# K. S. Rangasamy College of Technology

**(Autonomous)**

**CURRICULUM AND SYLLABI**

# of

# B.E. Mechatronics Engineering

**(For the batch admitted in 2022 - 2023)**

# R 2022

**Courses Accredited by NBA, Accredited by NAAC with ‘A++’ Grade,
Approved by AICTE, Affiliated to Anna University, Chennai.**

**KSR Kalvi Nagar, Tiruchengode – 637 215.
Namakkal District, Tamil Nadu, India.**

## DEPARTMENT OF MECHATRONICS ENGINEERING

### VISION

To become a pioneer in producing competent Mechatronics Engineers, researchers and entrepreneurs through quality education

### MISSION

- To produce competent and ethically bound Mechatronics professionals by imparting the technical knowledge and skills through quality teaching learning process
- To build an environment that is favourable for employability skills through collaborations with academia and industry
- To groom the students to focus on higher studies, research, entrepreneurship and be committed to the societal welfare and quality of life by creating an effective ecosystem

### PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Core competencies: Our graduates apply engineering knowledge to solve problems in Mechatronics and relevant fields.

PEO2: Employability: Our graduates demonstrate technical and professional skills to ethically address the industrial and societal needs.

PEO3: Higher Studies, Research and Entrepreneurship: Our graduates pursue higher studies, research and entrepreneurship in diverse fields.

### PROGRAM OUTCOMES (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design /development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for thepublic health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‘s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### PROGRAMME SPECIFIC OUTCOMES (PSOs):

Engineering Graduates will be able to:

PSO1: Specify, design and develop automation systems for the given engineering applications.

PSO2: Design and evaluate mechatronic systems using the state-of-the-art equipment and software tools.



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**MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) WITH PROGRAMMEOUTCOMES (POs)**

The B.E. Mechatronics Engineering Programme outcomes leading to the achievement of the objectives are summarized in the following Table.

| Programme Educational Objectives | Programme Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| PEO 1 | 3 | 1 | 3 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 3 | 1 |
| PEO 2 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 3 | 1 |
| PEO 3 | 3 | 2 | 3 | 2 | 2 | 1 | 1 | 1 | 3 | 2 | 3 | 1 |

**Contributions: 1- low, 2- medium, 3- high**
**MAPPING: MECHATRONICS ENGINEEIRNG (UG)**

| Year | Sem. | Course Name | PO | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| I | I | Professional English-I | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 |
| | | Matrices and Calculus | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - |
| | | Engineering Physics | 3 | 2 | - | - | - | - | - | - | - | - | - | - |
| | | Basic Electrical and Electronics Engineering | 2.6 | 2 | - | - | - | 2 | 2.3 | - | 3 | 2 | - | 2 |
| | | Engineering Mechanics | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 2 |
| | | Environmental Studies and Climate Change | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |
| | | Fabrication and Reverse Engineering Laboratory | 3 | 2 | 3 | - | - | 2 | 2 | - | 3 | - | - | 3 |
| | | Basic Electrical and Electronics Engineering Laboratory | 3 | 1.8 | - | - | - | - | - | 3 | 2 | 2 | 2 | - |
| | II | Professional English-II | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 |
| | | Integrals and Partial Differential Equations and Laplace Transform | 3 | 3 | - | - | 2 | - | - | - | - | - | - | - |
| | | Engineering Drawing | 3 | 2.8 | 3 | | 3 | | | 3 | | | | |
| | | C Programming | 1 | 3 | - | 2 | 3 | - | - | 2 | - | - | - | 2 |
| | | Chemistry for Mechanical Sciences | 3 | 2.2 | - | - | 2.5 | 1.5 | 1.7 | 1 | - | - | - | 2 |
| | | Heritage of Tamils | - | - | - | - | - | - | 3 | 3 | - | 2 | - | 3 |
| | | Physics & Chemistry Laboratory | 3 | 2 | - | - | - | - | 2 | - | - | - | 2 | - |
| | | C Programming Laboratory | 1 | 3 | - | 2 | 3 | - | - | 2 | - | - | - | 2 |
| | | Career Skill Development-I | - | - | - | - | - | - | - | - | - | - | - | - |
| II | III | Statistics and Numerical Methods | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - |
| | | Analog Devices and Digital Circuits | 3 | 1.6 | 1.6 | 1.6 | 1 | - | - | - | 1 | 1 | 1 | 2 |
| | | Sensors and Instrumentation | 3 | 2.4 | 1.7 | - | 2.3 | - | - | - | - | 2 | - | 2 |
| | | Manufacturing Technology | 3 | - | - | - | 2.2 | - | 3 | - | - | - | 2 | 3 |
| | | Mechanics of Solids | 3 | 3 | 3 | 1.8 | 3 | 2 | - | - | - | 2 | - | 2 |
| | | Universal Human Values | - | - | - | - | - | 3 | 3 | 3 | 2.8 | 3 | 2 | 3 |
| | | Analog Devices and Digital Circuits Laboratory | 2 | 2.75 | 1.7 | 2 | 2 | - | - | 1.3 | 2 | 1.7 | 1 | 1 |
| | | Manufacturing Technology Laboratory | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 2 | 2 |
| | | Career Skill Development-II | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 |



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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **II** | **IV** | Industrial Drives and Control | 3 | 2.6 | 3 | 2.6 | 2.8 | - | - | 1.8 | 1.2 | 1 | 1 | 1 |
| | | Fluid Mechanics and Thermodynamics | 3 | 3 | 2 | 2 | - | - | - | - | 1 | - | - | 1 |
| | | Metrology and Statistical Quality Control | 3 | 3 | 2 | 2 | - | - | - | - | 1 | - | - | 1 |
| | | Hydraulic and Pneumatic Control | 3 | 2 | 2 | 1.5 | 1.6 | 1 | 1 | - | 1 | - | - | - |
| | | Virtual Instrumentation and Applications | 3 | 3 | 1.8 | 2.2 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 2.5 |
| | | Industrial Drives and Control Laboratory | 2 | 2.75 | 1.7 | 2 | 2 | - | - | 1.3 | 2 | 1.75 | 1 | 1 |
| | | Applied Mechanics Laboratory | 3 | 2 | - | - | - | 2 | 3 | - | 2 | 2 | - | 2 |
| | | Career Skill Development-III | 2.6 | 2.6 | 2.6 | 2.8 | - | 2.4 | - | - | - | 2 | 3 | 3 |
| **III** | **V** | Microprocessors and Microcontrollers | 2.5 | 2.5 | 2.3 | 2.7 | 2.5 | 2 | 2 | 2.5 | 3 | 3 | 2 | 2.4 |
| | | System Design and Control | 3 | 3 | 2.8 | 2.6 | 1 | 1.2 | 1 | 2 | 1 | 2 | 1 | 2.2 |
| | | Kinematics and Dynamics of Machines | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 2 |
| | | Total Quality Management | 3 | 2.5 | - | - | 2.5 | 2.6 | 2.5 | 3 | 2.5 | 2.75 | - | 3 |
| | | Start-ups and Entrepreneurship | 2.8 | 2.6 | 3 | 2.4 | 2.2 | 2.5 | 1.7 | 1.7 | 1.3 | 2 | 2.2 | 2.4 |
| | | Microprocessors and Microcontrollers Laboratory | 3 | - | - | 3 | - | 3 | - | - | 3 | - | 2 | 3 |
| | | Metrology and Dynamics Laboratory | 3 | - | - | 3 | - | 3 | - | - | 3 | - | 2 | 3 |
| | | Design Thinking and Innovation Laboratory | - | - | - | - | - | - | - | - | - | - | - | - |
| | | Career Skill Development-IV | - | - | - | - | - | - | - | - | - | - | - | - |
| | **VI** | Industrial Automation Controllers | 3 | 2.8 | 2.4 | 2.2 | 2.4 | 2 | 3 | 3 | 3 | 3 | 2.3 | 2.3 |
| | | Machine Design | 1.6 | 2.4 | 1.6 | 2 | 1.8 | 1.7 | 2.3 | 2 | 3 | 1.7 | 1.7 | 2.2 |
| | | Computer Aided Design and Manufacturing | 2.2 | 2.6 | 2.6 | 2.2 | 2.8 | 2 | - | - | - | 2.4 | - | 2.6 |
| | | Computer Aided Manufacturing Laboratory | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 2 | 2 |
| | | Industrial Automation Laboratory | 3 | 2.8 | 2.4 | 2.2 | 3 | 2 | 3 | 3 | 3 | 3 | .3 | 2.3 |
| | | Design Thinking and Product Development laboratory | - | - | - | - | - | - | - | - | - | - | - | - |
| **IV** | **VII** | Robotics Engineering | 2.4 | 2 | 2.2 | 1.8 | 1.8 | - | - | - | - | - | 2.5 | 2.2 |
| | | Embedded System | 2.6 | 2.2 | 2.4 | 2.2 | 2.8 | 2 | 2.2 | 2.3 | 2.4 | 1.6 | 2 | 2 |
| | | Automation in Automobiles | 3 | 2 | 1 | 1 | - | 1 | - | - | - | - | - | 1 |
| | | Embedded System Laboratory | 3 | 2.6 | 2.8 | 2.5 | 3 | 1.5 | - | 2 | 1.5 | 3 | 2 | 2 |
| | | Robotics and Machine Vision Laboratory | 2.4 | 2.6 | 2 | 2 | 3 | 2 | 2.5 | 2 | 2 | 3 | 2.5 | 2.5 |
| | | Project Work - Phase I | 2.4 | 2.6 | 1.6 | 2 | 2 | 3 | 3 | | 3 | 2 | 2 | 1.4 |
| | **VIII** | Project Work - Phase II | 2.4 | 2.6 | 1.6 | 2 | 2 | 3 | 3 | | 3 | 2 | 2 | 1.4 |

w.e.f. 23/07/2022
Passed in the BoS Meeting Held on 20/07/2022
Approved in Academic Council Meeting held on 23/07/2022

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**Credit Distribution for B.E(MCT) Programme–2022 –2023 Batch**

| S. No. | Category | Credits Per Semester | | | | | | | | Total Credits | Percentage % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII | | |
| 1. | HS | 2 | 2 | - | - | 3 | - | - | - | **07** | **4.29** |
| 2. | BS | 7 | 9 | 4 | - | - | - | - | - | **20** | **12.27** |
| 3. | ES | 11 | 9 | - | - | - | - | - | - | **12** | **7.36** |
| 4. | PC | - | - | 18 | 21 | 15 | 15 | 13 | - | **90** | **55.22** |
| 5. | PE | - | - | - | - | 3 | 6 | 3 | 3 | **15** | **9.20** |
| 6. | OE | - | - | - | 3 | 3 | 3 | - | - | **09** | **5.52** |
| 7. | CG | - | - | - | - | - | - | 2 | 8 | **10** | **6.14** |
| 8. | MY | - | MY I | MY II | - | MY III | - | - | - | **-** | **-** |
| 9. | AC | - | - | - | - | - | - | AC I | - | **-** | **-** |
| 10. | GE* | - | 1* | 1* | - | 2* | - | - | - | 4* | **-** |
| Total | | **20** | **20** | **22** | **24** | **24** | **24** | **18** | **11** | **163** | **100** |

# General Elective- Extra credits is offered

HS – HUMANITIES AND SOCIAL SCIENCES
BS – BASIC SCIENCE
ES – ENGINEERING SCIENCES
PC – PROFESSIONAL CORE
PE – PROFESSIONAL ELECTIVES
OE – OPEN ELECTIVES
CG – CAREER GUIDANCE COURSES
MY – MANDATORY COURSES
AC – AUDIT COURSES
GE – GENERAL
ELECTIVE

Open Electives are courses offered by different departments that do not have any prerequisites and could be of interest to students of any branch



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**K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE -637215**
**(An Autonomous Institution affiliated to Anna University)**
**HUMANITIES AND SOCIAL SCIENCES (HS)**

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Pre-requisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 EN 001 | Professional English - I | HS | 3 | 1 | 0 | 2 | 2 | -NIL- |
| 2. | 60 EN 002 | Professional English - II | HS | 3 | 1 | 0 | 2 | 2 | -NIL- |
| 3. | 60 HS 003 | Total Quality Management | HS | 3 | 3 | 0 | 0 | 3 | -NIL- |
| 4. | 60 AB 00* | NCC/NSS/NSO/YRC/RRC/Fine Arts* | HS | 4 | 2 | 0 | 2 | 3* | -NIL- |

**BASIC SCIENCE (BS)**

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Pre-requisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 MA 001 | Matrices and Calculus | BS | 5 | 3 | 1 | 0 | 4 | -NIL- |
| 2. | 60 PH 001 | Engineering Physics | BS | 3 | 3 | 0 | 0 | 3 | -NIL- |
| 3. | 60 CH 001 | Chemistry for Mechanical Sciences | BS | 3 | 3 | 0 | 0 | 3 | -NIL- |
| 4. | 60 CP 0P1 | Physics and Chemistry Laboratory | BS | 4 | 0 | 0 | 4 | 2 | -NIL- |
| 5. | 60 MA 003 | Integrals, Partial Differential Equations and Laplace Transform | BS | 5 | 3 | 1 | 0 | 4 | -NIL- |
| 6. | 60 MA 007 | Statistics and Numerical Methods | BS | 5 | 3 | 1 | 0 | 4 | -NIL- |

**ENGINEERING SCIENCES (ES)**

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Pre-requisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 ME 0P1 | Fabrication and Reverse Engineering Laboratory | ES | 4 | 0 | 0 | 4 | 2 | -NIL- |
| 2. | 60 CS 001 | C Programming | ES | 3 | 3 | 0 | 0 | 3 | -NIL- |
| 3. | 60 EE 003 | Basic Electrical and Electronics Engineering | ES | 3 | 3 | 0 | 0 | 3 | -NIL- |
| 4. | 60 CS 0P1 | C Programming Laboratory | ES | 4 | 0 | 0 | 4 | 2 | -NIL- |
| 5. | 60 EE 0P1 | Basic Electrical and Electronics Engineering Laboratory | ES | 4 | 0 | 0 | 4 | 4 | -NIL- |



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## PROFESSIONAL CORE (PC)

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Pre-requisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 MC 301 | Analog Devices and Digital Circuits | PC | 3 | 3 | 0 | 0 | 3 | NIL |
| 2. | 60 MC 302 | Sensors and Instrumentation | PC | 5 | 3 | 0 | 2 | 4 | NIL |
| 3. | 60 MC 303 | Manufacturing Technology | PC | 3 | 3 | 0 | 0 | 3 | Engineering Physics |
| 4. | 60 MC 304 | Mechanics of Solids | PC | 5 | 3 | 1 | 0 | 4 | Applied Mechanics |
| 5. | 60 MC 3P1 | Analog Devices and Digital Circuits Laboratory | PC | 4 | 0 | 0 | 4 | 2 | Analog Devices and Digital Circuits |
| 6. | 60 MC 3P2 | Manufacturing Technology Laboratory | PC | 4 | 0 | 0 | 4 | 2 | Manufacturing Technology |
| 7. | 60 MC 401 | Industrial Drives and Control | PC | 3 | 3 | 0 | 0 | 3 | Basic Electrical and Electronics Engineering |
| 8. | 60 MC 402 | Fluid Mechanics and Thermodynamics | PC | 5 | 3 | 1 | 0 | 4 | Mechanics of Solids |
| 9. | 60 MC 403 | Metrology and Statistical Quality control | PC | 3 | 3 | 0 | 0 | 3 | NIL |
| 10. | 60 MC 404 | Hydraulic and Pneumatic Control | PC | 5 | 3 | 0 | 2 | 4 | Fluid Mechanics and Thermodynamics |
| 11. | 60 MC 405 | Virtual Instrumentation and Applications | PC | 4 | 2 | 0 | 2 | 3 | NIL |
| 12. | 60 MC 4P1 | Industrial Drives and Control Laboratory | PC | 4 | 0 | 0 | 4 | 2 | Industrial Drives and Control |
| 13. | 60 MC 4P2 | Applied Mechanics Laboratory | PC | 4 | 0 | 0 | 4 | 2 | Metrology and Statistical Quality Control |
| 14. | 60 MC 501 | Microprocessors and Microcontrollers | PC | 3 | 3 | 0 | 0 | 3 | Analog Devices and Digital Circuits |
| 15. | 60 MC 502 | System Design and Control | PC | 5 | 3 | 1 | 0 | 4 | NIL |
| 16. | 60 MC 503 | Theory of Machines | PC | 5 | 3 | 1 | 0 | 4 | NIL |
| 17. | 60 MC 5P1 | Microprocessors and Microcontrollers Laboratory | PC | 3 | 0 | 0 | 3 | 1.5 | Microprocessors and Microcontrollers |
| 18. | 60 MC 5P2 | Metrology and Dynamics Laboratory | PC | 3 | 0 | 0 | 3 | 1.5 | Metrology and Statistical Quality Control |
| 19. | 60 MC 5P3 | Design Thinking and Innovation Laboratory | PC | 2 | 0 | 0 | 2 | 1 | NIL |
| 20. | 60 MC 601 | Industrial Automation Controllers | PC | 3 | 3 | 0 | 0 | 3 | System Design and Control |
| 21. | 60 MC 602 | Machine Design | PC | 5 | 3 | 1 | 0 | 4 | Theory of Machines |
| 22. | 60 MC 603 | Computer Aided Design and Manufacturing | PC | 3 | 3 | 0 | 0 | 3 | NIL |
| 23. | 60 MC 6P1 | Computer Aided Manufacturing Laboratory | PC | 3 | 0 | 0 | 3 | 1.5 | Computer Aided Design and Manufacturing |
| 24. | 60 MC 6P2 | Industrial Automation Laboratory | PC | 3 | 0 | 0 | 3 | 1.5 | Industrial Automation Controllers |
| 25. | 60 MC 6P3 | Design Thinking and Product Development Laboratory | PC | 2 | 0 | 0 | 2 | 1 | NIL |
| 26. | 60 MC 701 | Robotics Engineering | PC | 3 | 3 | 0 | 0 | 3 | NIL |



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|---|---|---|---|---|---|---|---|---|---|
| 27. | 60 MC 702 | Embedded System | PC | 3 | 3 | 0 | 0 | 3 | Microprocessors and Microcontrollers |
| 28. | 60 MC 703 | Automation in Automobiles | PC | 3 | 3 | 0 | 0 | 3 | Industrial Automation Controllers |
| 29. | 60 MC 7P1 | Embedded System Laboratory | PC | 4 | 0 | 0 | 4 | 2 | Embedded System |
| 30. | 60 MC 7P2 | Robotics and Machine Vision Laboratory | PC | 4 | 0 | 0 | 4 | 2 | Robotics Engineering |

**PROFESSIONAL ELECTIVES (PE): Vertical**

| Elective | (Vertical I) Robotics | (Vertical II) Electric Vehicle | (Vertical III) Drone | (Vertical IV) Manufacturing | (Vertical V) Design and Analysis | (Vertical VI) Logistics and Supply Chain Management |
|---|---|---|---|---|---|---|
| **ELECTIVE I** | Mobile Robotics<br>Medical Robotics<br>AI for Robotics | Electric Vehicle | Aircraft Mechatronics | Applied Materials Technology | Design of Experiments | Automation in Process Industries |
| **ELECTIVE II** | Agricultural Robotics and Automation<br>Robot Kinematics and Dynamics | Design of Transmission Systems | Navigation and Communication Systems | Non Destructive Testing | Optimization Techniques | Supply Chain Management |
| **ELECTIVE III** | Robots and Systems in Smart Manufacturing<br>Applied and Industrial Robotics | Automotive Electronics | Design of UAV Systems | Non-conventional Machining Processes | Product Design and Costing | Ware House Management |
| **ELECTIVE IV** | Design of Robot Elements<br>Robotics Programming<br>Sensors and Machine Vision Systems | Mechatronics System | Drone Technology | Design for Manufacturing | Finite Element Analysis | Process Planning and Cost Estimation |
| **ELECTIVE V** | Robotic Welding Technology | Smart Mobility and Intelligent Vehicles | Aerodynamics of Drones | AI/ML for Manufacturing | Rapid Prototyping | Container Logistics |



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## PROFESSIONAL ELECTIVES (PE)

### Semester V Elective –I

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Pre-requisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 MC E11 | Mobile Robotics | PE | 3 | 3 | 0 | 0 | 3 | Robotics Engineering |
| 2. | 60 MC E12 | Electric Vehicle | PE | 3 | 3 | 0 | 0 | 3 | Industrial Drives and Control, Sensors and Instrumentation |
| 3. | 60 MC E13 | Aircraft Mechatronics | PE | 3 | 3 | 0 | 0 | 3 | Applied Mechanics |
| 4. | 60 MC E14 | Applied Materials Technology | PE | 3 | 3 | 0 | 0 | 3 | NIL |
| 5. | 60 MC E15 | Design of Experiments | PE | 3 | 3 | 0 | 0 | 3 | Statistics and Numerical Methods |
| 6. | 60 MC E16 | Automation in Process Industries | PE | 3 | 3 | 0 | 0 | 3 | Industrial Automation Controllers |
| 7. | 60 MC E17 | Medical Robotics | PE | 3 | 3 | 0 | 0 | 3 | - |
| 8. | 60 MC E18 | AI for Robotics | PE | 3 | 3 | 0 | 0 | 3 | - |

### Semester VI Elective –II

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Pre-requisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 MC E21 | Agricultural Robotics and Automation | PE | 3 | 3 | 0 | 0 | 3 | Robotics Engineering |
| 2. | 60 MC E22 | Design of Transmission Systems | PE | 3 | 3 | 0 | 0 | 3 | NIL |
| 3. | 60 MC E23 | Navigation and Communication Systems | PE | 3 | 3 | 0 | 0 | 3 | Sensors and Instrumentation |
| 4. | 60 MC E24 | Non Destructive Testing | PE | 3 | 3 | 0 | 0 | 3 | NIL |
| 5. | 60 MC E25 | Optimization Techniques | PE | 3 | 3 | 0 | 0 | 3 | NIL |
| 6. | 60 MC E26 | Supply Chain Management | PE | 3 | 3 | 0 | 0 | 3 | NIL |
| 7. | 60 MC E27 | Robot Kinematics and Dynamics | PE | 3 | 3 | 0 | 0 | 3 | - |

### Semester VI Elective –III

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Pre-requisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 MC E31 | Robots and Systems in Smart Manufacturing | PE | 3 | 3 | 0 | 0 | 3 | Robotics Engineering |
| 2. | 60 MC E32 | Automotive Electronics | PE | 3 | 3 | 0 | 0 | 3 | Sensors and Instrumentation |
| 3. | 60 MC E33 | Design of UAV Systems | PE | 3 | 3 | 0 | 0 | 3 | NIL |
| 4. | 60 MC E34 | Non-conventional Machining Processes | PE | 3 | 3 | 0 | 0 | 3 | NIL |
| 5. | 60 MC E35 | Product Design and Costing | PE | 3 | 3 | 0 | 0 | 3 | Manufacturing Technology |
| 6. | 60 MC E36 | Ware House Management | PE | 3 | 3 | 0 | 0 | 3 | NIL |
| 7. | 60 MC E37 | Applied and Industrial Robotics | PE | 3 | 3 | 0 | 0 | 3 | - |

### Semester VII Elective –IV

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Pre-requisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 MC E41 | Design of Robot Elements | PE | 4 | 2 | 0 | 2 | 3 | Robotics Engineering |
| 2. | 60 MC E42 | Mechatronics System | PE | 4 | 2 | 0 | 2 | 3 | Sensors and Instrumentation |
| 3. | 60 MC E43 | Drone Technology | PE | 4 | 2 | 0 | 2 | 3 | Sensors and Instrumentation |
| 4. | 60 MC E44 | Design for Manufacturing | PE | 4 | 2 | 0 | 2 | 3 | NIL |
| 5. | 60 MC E45 | Finite Element Analysis | PE | 4 | 2 | 0 | 2 | 3 | Matrices and Calculus |
| 6. | 60 MC E46 | Process Planning and Cost Estimation | PE | 4 | 2 | 0 | 2 | 3 | Manufacturing Technology |
| 7. | 60 MC E47 | Robotics Programming | PE | 3 | 3 | 0 | 0 | 3 | Sensors and Instrumentation |
| 8. | 60 MC E48 | Sensors and Machine Vision Systems | PE | 3 | 3 | 0 | 0 | 3 | Sensors and Instrumentation |

**Semester VIII Elective –V**

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Pre-requisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 MC E51 | Robotic Welding Technology | PE | 3 | 3 | 0 | 0 | 3 | Robotics Engineering |
| 2. | 60 MC E52 | Smart Mobility and Intelligent Vehicles | PE | 3 | 3 | 0 | 0 | 3 | NIL |
| 3. | 60 MC E53 | Aerodynamics of Drones | PE | 3 | 3 | 0 | 0 | 3 | NIL |
| 4. | 60 MC E54 | AI/ML for Manufacturing | PE | 3 | 3 | 0 | 0 | 3 | Manufacturing Technology |
| 5. | 60 MC E55 | Rapid Prototyping | PE | 3 | 3 | 0 | 0 | 3 | NIL |
| 6. | 60 MC E56 | Container Logistics | PE | 3 | 3 | 0 | 0 | 3 | NIL |

**Note: any of the elective courses shall be opted for Honour degree**

**MANDATORY COURSES (MY)**

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Pre-requisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 MY 001 | Environmental Studies and Climate Change | MY | 2 | 2 | 0 | 0 | 0 | Nil |
| 2. | 60 MY 002 | Universal Human Values | MY | 3 | 3 | 0 | 0 | 3* | Nil |
| 3. | 60 MY 003 | Start-ups and Entrepreneurship | MY | 2 | 2 | 0 | 0 | 2* | Nil |

**SEMESTER VII & SEMESTER VIII, AUDIT COURSES (AC)**

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Pre-requisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 AC 001 | Research Skill Development | AC | 1 | 1 | 0 | 0 | 0 | Nil |

**OPEN ELECTIVES I / II / III / IV (OE)**

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Pre-requisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 MC L03 | Applied Ergonomics | OE | 3 | 3 | 0 | 0 | 3 | Nil |
| 2. | 60 MC L04 | Introduction to Occupational Health | OE | 3 | 3 | 0 | 0 | 3 | Nil |
| 3. | 60 MC L05 | Digital Transformation in Manufacturing | OE | 3 | 3 | 0 | 0 | 3 | Nil |
| 4. | 60 MC L06 | Safety and Risk Analytics | OE | 3 | 3 | 0 | 0 | 3 | Nil |

**INTEGRATED COURSES (IC)**

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Pre-requisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 MC 302 | Sensors and Instrumentation | PC | 5 | 3 | 0 | 2 | 4 | NIL |
| 2. | 60 MC 404 | Hydraulic and Pneumatic control | PC | 5 | 3 | 0 | 2 | 4 | Fluid Mechanics and Thermodynamics |
| 3. | 60 MC 405 | Virtual Instrumentation and Applications | PC | 4 | 2 | 0 | 2 | 3 | NIL |
| 4. | 60 MC E41 | Design of Robot Elements | PE | 4 | 2 | 0 | 2 | 3 | Robotics Engineering |
| 5. | 60 MC E42 | Mechatronics System | PE | 4 | 2 | 0 | 2 | 3 | Sensors and Instrumentation |
| 6. | 60 MC E43 | Drone Technology | PE | 4 | 2 | 0 | 2 | 3 | NIL |
| 7. | 60 MC E44 | Design for Manufacturing | PE | 4 | 2 | 0 | 2 | 3 | NIL |
| 8. | 60 MC E45 | Finite Element Analysis | PE | 4 | 2 | 0 | 2 | 3 | NIL |
| 9. | 60 MC E46 | Process Planning and Cost Estimation | PE | 4 | 2 | 0 | 2 | 3 | NIL |

## CAREER GUIDANCE COURSES (CG)

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Pre-requisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 CG 0P1 | Career Skill Development I | CG | 2 | 0 | 0 | 2 | 1* | Basic knowledge of reading and writing in English |
| 2. | 60 CG 0P2 | Career Skill Development II | CG | 2 | 0 | 0 | 2 | 1* | Basic knowledge of reading and writing in English |
| 3. | 60 CG 0P3 | Career Skill Development III | CG | 2 | 0 | 0 | 2 | 1* | Career Skill Development – II |
| 4. | 60 CG 0P4 | Career Skill Development IV | CG | 2 | 0 | 0 | 2 | 1* | Career Skill Development – III |
| 5. | 60 CG 0P5 | Comprehension Test | CG | 2 | 0 | 0 | 2 | 1* | Career Skill Development I, II, III, IV |
| 6. | 60 MC 7P3 | Project Work - Phase I | CG | 4 | 0 | 0 | 4 | 2 | Nil |
| 7. | 60 MC 8P1 | Project Work - Phase II | CG | 4 | 0 | 0 | 4 | 8 | Nil |
| 8. | 60 CG 00* | Internship* | CG | 0 | 0 | 0 | 0 | 3* | Nil |

## GENERAL ELECTIVE (GE)

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Pre-requisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 GE 001 | Heritage of Tamils / தமிழர் மரபு (Common to all Branches ) | GE | 1 | 1 | 0 | 0 | 1* | Nil |
| 2. | 60 GE 002 | Tamils and Technology / தமிழரும் தொழில்நுட்பமும் (Common to all Branches ) | GE | 1 | 1 | 0 | 0 | 1* | Nil |

**K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215**

**(An Autonomous Institution affiliated to Anna University) COURSES OF STUDY**

**(For the candidates admitted in 2022-2023)**

## SEMESTER I

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| | | **Induction Programme** | **-** | **-** | **-** | **-** | **-** | **0** |
| | | **THEORY** | | | | | | |
| 1. | 60 EN 001 | Professional English-I | HS | 3 | 1 | 0 | 2 | 2 |
| 2. | 60 MA 001 | Matrices and Calculus | BS | 5 | 3 | 1 | 0 | 4 |
| 3. | 60 PH 001 | Engineering Physics | BS | 3 | 3 | 0 | 0 | 3 |
| 4. | 60 EE 001 | Basic Electrical and Electronics Engineering | ES | 3 | 3 | 0 | 0 | 3 |
| 5. | 60 ME 004 | Engineering Mechanics | ES | 5 | 3 | 1 | 0 | 4 |
| 6. | 60 MY 001 | Environmental Studies and Climate Change | MY | 2 | 2 | 0 | 0 | 0 |
| | | **PRACTICALS** | | | | | | |
| 7. | 60 ME 0P1 | Fabrication and Reverse Engineering Laboratory | ES | 4 | 0 | 0 | 4 | 2 |
| 8. | 60 EE 0P1 | Basic Electrical and Electronics Engineering Laboratory | ES | 4 | 0 | 0 | 4 | 2 |
| | | | **Total** | **29** | **15** | **02** | **10** | **20** |

**I to VII semester**

NCC% - Course can be waived with 3 credits in VII semester or offered as extra credits NSS/NSO/YRC/RRC/Fine Arts% 3 credits is not accounted for CGPA

Career Skill Development (CSD) - additional credit is offered not accounted for CGPA.

**I to VIII semester**

Internship - 1/2/3 additional credits is offered based on duration and not accounted for CGPA.

## SEMESTER II

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | 60 EN 002 | Professional English II | HS | 3 | 1 | 0 | 2 | 2 |
| 2. | 60 MA 003 | Integrals, Partial Differential Equations and Laplace Transform | BS | 5 | 3 | 1 | 0 | 4 |
| 3. | 60 MC 001 | Engineering Drawing | ES | 6 | 2 | 0 | 4 | 4 |
| 4. | 60 CS 001 | C Programming | ES | 3 | 3 | 0 | 0 | 3 |
| 5. | 60 CH 001 | Chemistry for Mechanical Sciences | BS | 3 | 3 | 0 | 0 | 3 |
| 6. | 60 GE 001 | Heritage of Tamils / (தமிழர் மரபு) | GE | 1 | 1 | 0 | 0 | 1& |
| **PRACTICALS** | | | | | | | | |
| 7. | 60 CP 0P1 | Physics and Chemistry Laboratory | BS | 4 | 0 | 0 | 4 | 2 |
| 8. | 60 CS 0P1 | C Programming Laboratory | ES | 4 | 0 | 0 | 4 | 2 |
| 9. | 60 CG 0P1 | Career Skill Development-I | CG | 2 | 0 | 0 | 2 | 1* |
| | | | **Total** | **31** | **13** | **1** | **16** | **20** |

Heritage of Tamils& additional 1 credit is offered and not account for CGPA.

## SEMESTER III

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | 60 MA 007 | Statistics and Numerical Methods | BS | 5 | 3 | 1 | 0 | 4 |
| 2. | 60 MC 301 | Analog Devices and Digital Circuits | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | 60 MC 302 | Sensors and Instrumentation | PC | 5 | 3 | 0 | 2 | 4 |
| 4. | 60 MC 303 | Manufacturing Technology | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | 60 MC 304 | Mechanics of Solids | PC | 5 | 3 | 1 | 0 | 4 |
| 6. | 60 MY 002 | Universal Human Values | MY | 3 | 3 | 0 | 0 | 3# |
| 7. | 60 GE 002 | Tamils and Technology/ (தமிழரும் தொழில்நுட்பமும்) | GE | 1 | 1 | 0 | 0 | 1& |
| **PRACTICALS** | | | | | | | | |
| 8. | 60 MC 3P1 | Analog Devices and Digital Circuits Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 9. | 60 MC 3P2 | Manufacturing Technology Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 10. | 60 CG 0P2 | Career Skill Development-II | CG | 2 | 0 | 0 | 2 | 1* |
| 11. | 60 CG 0P6 | Internship | CG | - | - | - | - | 1/2/3* |
| | | | **Total** | **35** | **19** | **2** | **12** | **22** |

UHV# additional 3 credit is offered and not accounted for CGPA

## SEMESTER IV

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | 60 MC 401 | Industrial Drives and Control | PC | 3 | 3 | 0 | 0 | 3 |
| 2. | 60 MC 402 | Fluid Mechanics and Thermodynamics | PC | 5 | 3 | 1 | 0 | 4 |
| 3. | 60 MC 403 | Metrology and Statistical Quality control | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | 60 MC 404 | Hydraulic and Pneumatic control | PC | 5 | 3 | 0 | 2 | 4 |
| 5. | 60 MC 405 | Virtual Instrumentation and Applications | PC | 4 | 2 | 0 | 2 | 3 |
| 6. | 60 OE L0* | Open Elective-I | OE | 3 | 3 | 0 | 0 | 3 |
| **PRACTICALS** | | | | | | | | |
| 7. | 60 MC 4P1 | Industrial Drives and Control Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 8. | 60 MC 4P2 | Applied Mechanics Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 9. | 60 CG 0P3 | Career Skill Development-III | CG | 2 | 0 | 0 | 2 | 1* |
| 10. | 60 CG 0P6 | Internship | CG | - | - | - | - | 1/2/3* |
| | | | **Total** | **33** | **17** | **1** | **14** | **24** |

## SEMESTER V

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | 60 MC 501 | Microprocessors and Microcontrollers | PC | 3 | 3 | 0 | 0 | 3 |
| 2. | 60 MC 502 | System Design and Control | PC | 5 | 3 | 1 | 0 | 4 |
| 3. | 60 MC 503 | Kinematics and Dynamics of Machines | PC | 5 | 3 | 1 | 0 | 4 |
| 4. | 60 HS 003 | Total Quality Management | HS | 3 | 3 | 0 | 0 | 3 |
| 5. | 60 MY 003 | Start-ups and Entrepreneurship | MY | 2 | 2 | 0 | 0 | 2* |
| 6. | 60 MC E1* | Professional Elective-I | PE | 3 | 3 | 0 | 0 | 3 |
| 7. | 60 OE L0* | Open Elective-II | OE | 3 | 3 | 0 | 0 | 3 |
| **PRACTICALS** | | | | | | | | |
| 8. | 60 MC 5P1 | Microprocessors and Microcontrollers Laboratory | PC | 3 | 0 | 0 | 3 | 1.5 |
| 9. | 60 MC 5P2 | Metrology and Dynamics Laboratory | PC | 3 | 0 | 0 | 3 | 1.5 |
| 10. | 60 MC 5P3 | Design Thinking and Innovation Laboratory | PC | 2 | 0 | 0 | 2 | 1 |
| 11. | 60 CG 0P4 | Career Skill Development-IV | CG | 2 | 0 | 0 | 2 | 1* |
| 12. | 60 CG 0P6 | Internship | CG | - | - | - | - | 1/2/3* |
| | | | **Total** | **34** | **20** | **2** | **10** | **24** |

## SEMESTER VI

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | 60 MC 601 | Industrial Automation Controllers | PC | 5 | 3 | 1 | 0 | 4 |
| 2. | 60 MC 602 | Machine Design | PC | 5 | 3 | 1 | 0 | 4 |
| 3. | 60 MC 603 | Computer Aided Design and Manufacturing | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | 60 MC E2* | Professional Elective-II | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | 60 MC E3* | Professional Elective-III | PE | 3 | 3 | 0 | 0 | 3 |
| 6. | 60 OE L0* | Open Elective-III | OE | 3 | 3 | 0 | 0 | 3 |
| **PRACTICALS** | | | | | | | | |
| 7. | 60 MC 6P1 | Computer Aided Manufacturing Laboratory | PC | 3 | 0 | 0 | 3 | 1.5 |
| 8. | 60 MC 6P2 | Industrial Automation Laboratory | PC | 3 | 0 | 0 | 3 | 1.5 |
| 9. | 60 MC 6P3 | Design Thinking and Product Development Laboratory | PC | 2 | 0 | 0 | 3 | 1 |
| 10. | 60 CG 0P5 | Comprehension Test | CG | 2 | 0 | 0 | 2 | 1* |
| 11. | 60 CG 0P6 | Internship | CG | - | - | - | - | 1/2/3* |
| | | | **Total** | **32** | **18** | **2** | **11** | **24** |

Comprehension Test* -one additional credit is offered and not accounted for CGPA calculation



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**SEMESTER VII**

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | 60 MC 701 | Robotics Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 2. | 60 MC 702 | Embedded System | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | 60 MC 703 | Automation in Automobiles | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | 60 MC E4* | Professional Elective-IV | PE | 4 | 2 | 0 | 2 | 3 |
| 5. | 60 AC 001 | Research Skill Development | AC | 1 | 1 | 0 | 0 | 0 |
| 6. | 60 AB 00* | NCC\NSS\NSO\YRC\RRC\Yoga\Fine Arts% | HS | 4 | 2 | 0 | 2 | 3% |
| **PRACTICALS** | | | | | | | | |
| 7. | 60 MC 7P1 | Embedded System Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 8. | 60 MC 7P2 | Robotics and Machine Vision Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 9. | 60 MC 7P3 | Project Work - Phase I | CG | 4 | 0 | 0 | 4 | 2 |
| 10. | 60 CG 0P6 | Internship | CG | - | - | - | - | 1/2/3* |
| | | | **Total** | **26** | **12** | **0** | **14** | **18** |

NCC% - Course can be waived with 3 credits in VII semester or offered as extra 3 credits.
NSS/NSO/YRC/RRC/Fine Arts% 3 extra credits not accounted for CGPA

**SEMESTER VIII**

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | 60 MC E5* | Professional Elective-V | PE | 3 | 3 | 0 | 0 | 3 |
| **PRACTICALS** | | | | | | | | |
| 2. | 60 MC 8P1 | Project Work - Phase II | CG | 16 | 0 | 0 | 16 | 8 |
| 3. | 60 CG 0P6 | Internship | CG | - | - | - | - | 1/2/3* |
| | | | **Total** | **19** | **3** | **0** | **16** | **11** |

**TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 163**

**Note**: HS- Humanities and Social Sciences including Management Courses, BS- Basic Science Courses, ES-Engineering Science Courses, PE-Professional Core Courses, PE-Professional Elective Courses, GE-General Elective Courses, OE- Open Elective Courses, CG - Career Enhancement Course, MY-Mandatory Courses



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**K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215**
(An Autonomous Institution affiliated to Anna University)
B.E. / B.Tech. Degree Programme
**SCHEME OF EXAMINATIONS**
(For the candidates admitted in 2022-2023)
FIRST SEMESTER

| S. No. | Course Code | Name of the Course | Duration of Internal Exam | Weightage of Marks | | | Minimum Marks for Pass in End Semester Exam | |
|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment* | End Semester Exam** | Max. Marks | End Semester Exam | Total |
| **THEORY** | | | | | | | | |
| 1 | 60 EN 001 | Professional English-I | 2 | 40 | 60 | 100 | 45 | 100 |
| 2 | 60 MA 001 | Matrices and Calculus | 2 | 40 | 60 | 100 | 45 | 100 |
| 3 | 60 PH 001 | Engineering Physics | 2 | 40 | 60 | 100 | 45 | 100 |
| 4 | 60 EE 001 | Basic Electrical and Electronics Engineering | 2 | 40 | 60 | 100 | 45 | 100 |
| 5 | 60 ME 004 | Engineering Mechanics | 2 | 40 | 60 | 100 | 45 | 100 |
| 6 | 60 MY 001 | Environmental Studies and Climate Change | 2 | 100 | - | 100 | - | 100 |
| **PRACTICAL** | | | | | | | | |
| 7 | 60 ME 0P1 | Fabrication and Reverse Engineering Laboratory | 3 | 60 | 40 | 100 | 45 | 100 |
| 8 | 60 EE 0P1 | Basic Electrical and Electronics Engineering Laboratory | 3 | 60 | 40 | 100 | 45 | 100 |

*** CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.**
**** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory End Semester Examination and 40 marks for practical End Semester Examination.**

w.e.f. 23/07/2022
Passed in the BoS Meeting Held on 20/07/2022
Approved in Academic Council Meeting held on 23/07/2022

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| 60 EN 001 | Professional English – I | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | HS | 1 | 0 | 2 | 2 |

## Objectives

- To help learners improve their vocabulary and to enable them to use words appropriately in different academic and professional contexts
- To help learners develop strategies that could be adopted while reading texts
- To help learners acquire the ability to speak effectively in English in real life and career related situations
- To equip students with effective speaking and listening skills in English
- To facilitate learners to enhance their writing skills with coherence and appropriate format effectively

## Pre-requisites

- Basic knowledge of reading and writing in English

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Compare and interpret complex academic texts | Understand |
| CO2 | Recall the denotative and connotative meanings of technical texts | Remember |
| CO3 | Interpret definitions, descriptions, narrations, and essays on various topics | Understand |
| CO4 | Express fluently and accurately in formal and informal communicative Contexts | Understand |
| CO5 | Summarize their opinions effectively in both oral and written medium of communication | Understand |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | - | - |
| CO2 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | - | - |
| CO3 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | - | - |
| CO4 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | - | - |
| CO5 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | - | - |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 10 | 10 | 20 | 20 |
| Understand | 50 | 50 | 80 | 80 |
| Apply | - | - | - | - |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | 100 |



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**Syllabus**

**K.S.Rangasamy College of Technology – Autonomous R2022**

**Common to All Branches**

**60 EN 001 - Professional English I**

| Semester | Hours/Week | | | Total Hours | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| I | 1 | 0 | 2 | 45 | 2 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to Fundamentals of Communication**<br>**Listening:** General information-specific details-conversation: introduction to classmates – audio / video (formal & informal).<br>**Speaking:** Self Introduction; Introducing a friend; conversation - politeness strategies.<br>**Reading:** Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails.<br>**Writing:** Writing letters – informal and formal – basics and format orientation<br>**Language Focus:** Present Tenses; word formation (affixes); synonyms, antonyms and contranyms, and phrasal verbs; abbreviations & acronyms (as used in technical contexts). | **[9]** |
| **Narration and Summation**<br>**Listening:** Podcast, anecdotes / stories / event narration; documentaries and interviews with celebrities.<br>**Speaking:** Narrating personal experiences / events; Interviewing a celebrity; reporting / and summarizing of documentaries / podcasts/ interviews.<br>**Reading:** Biographies, travelogues, newspaper reports, excerpts from literature, and travel & technical blogs.<br>**Writing:** Paragraph writing, short report on an event (field trip etc.).<br>**Language Focus**: Past tenses and prepositions; One-word substitution. | **[9]** |
| **Description of a process / product**<br>**Listening:** Listen to a product and process descriptions; advertisements about products or services<br>**Speaking**: Picture description; giving instruction to use the product; presenting a product.<br>**Reading**: Advertisements, gadget reviews and user manuals.<br>**Writing:** Definitions; instructions; and product /process description.<br>**Language Focus**: Imperatives; comparative adjectives; future tenses. Homonyms; and Homophones, discourse markers (connectives & sequence words) | **[9]** |
| **Classification and Recommendations**<br>**Listening:** TED Talks; scientific lectures; and educational videos.<br>**Speaking**: Small Talk; Mini presentations<br>**Reading**: Newspaper articles and Journal reports<br>**Writing:** Note-making / Note-taking; recommendations; Transferring information from non-verbal (chart, graph etc, to verbal mode)<br>**Language Focus**: Articles; Pronouns -Possessive & Relative pronouns; ; subject-verb agreement; collocations. | **[9]** |
| **Expression**<br>**Listening:** Debates/ discussions; different viewpoints on an issue; and panel discussions.<br>**Speaking**: Group discussions, debates & role plays.<br>**Reading**: Editorials; and opinion blogs.<br>**Writing**: Essay Writing (Descriptive or narrative).<br>**Language Focus**: Punctuation; Compound Nouns; simple, compound & complex sentences. cause& effect expressions. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | 'English for Engineers & Technologists' Orient Blackswan Private Ltd. Department of English, Anna University, 2020 |
| 2. | Norman Lewis, 'Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary Book', Penguin Random House India, 2020 |

**Reference(s):**

| | |
|---|---|
| 1. | Paul Emmerson and Nick Hamilton, 'Five Minute Activities for Business English', Cambridge University Press, New York, 2005 |
| 2. | Arthur Brookes and Peter Grundy,' Beginning to Write: Writing Activities for Elementary and Intermediate Learners', Cambridge University Press, New York, 2003 |
| 3. | Michael McCarthy and Felicity O Dell, 'English Vocabulary in Use: Upper Intermediate', Cambridge University Press, N.York, 2012 |
| 4. | Lakshmi Narayanan, 'A Course Book on Technical English'Scitech Publications (India) Pvt. Ltd. 2020 |

*SDG 4 – Quality Education



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| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Introduction to Fundamentals of Communication** | |
| 1.1 | Listening for general information and Specific details | 1 |
| 1.2 | Self-introduction | 1 |
| 1.3 | Narrating personal experiences | 1 |
| 1.4 | Reading relevant to technical contexts and emails | 1 |
| 1.5 | Writing letters – informal | 1 |
| 1.6 | Writing letters – formal | 1 |
| 1.7 | Present tenses | 1 |
| 1.8 | Synonyms, antonyms and contranyms, and affixes | 1 |
| 1.9 | Phrasal verbs; abbreviations & acronyms | 1 |
| **2.0** | **Narration and Summation** | |
| 2.1 | Listening to podcasts, documentaries and interviews with celebrities | 1 |
| 2.2 | Narrating personal experiences | 1 |
| 2.3 | Summarizing of documentaries | 1 |
| 2.4 | Reading travelogues, and excerpts from literature | 1 |
| 2.5 | Paragraph writing | 1 |
| 2.6 | Short report on an event (field trip etc.). | 1 |
| 2.7 | Past tenses | 1 |
| 2.8 | Prepositions | 1 |
| 2.9 | One-word substitution | 1 |
| **3.0** | **Description of a process / product** | |
| 3.1 | Listen to a product and process descriptions | 1 |
| 3.2 | Picture description | 1 |
| 3.3 | Giving instruction to use the product | 1 |
| 3.4 | Reading Advertisements, gadget reviews and user manuals | 1 |
| 3.5 | Writing Definitions and instructions | 1 |
| 3.6 | Future Tenses | 1 |
| 3.7 | Homonyms and Homophones | 1 |
| 3.8 | Imperatives | 1 |
| 3.9 | Comparative adjectives, and discourse markers | 1 |
| **4.0** | **Classification and Recommendations** | |
| 4.1 | Listening to TED Talks and educational videos | 2 |
| 4.2 | Listening to scientific lectures | 1 |
| 4.3 | Small Talk and mini presentations | 2 |
| 4.4 | Reading newspaper articles and journal reports | 2 |
| 4.5 | Note-making / Note-taking | 1 |
| 4.6 | Recommendations | 1 |
| 4.7 | Transferring information from non-verbal | 1 |
| 4.8 | Articles and Pronouns | 2 |
| 4.9 | Subject-verb agreement and collocations | |
| **5.0** | **Expression** | |
| 5.1 | Listening to debates and panel discussions | 1 |
| 5.2 | Group discussions | 2 |
| 5.3 | Role plays | 1 |
| 5.4 | Reading editorials and opinion blogs | 1 |
| 5.5 | Essay Writing (Descriptive or narrative) | 1 |
| 5.6 | Punctuation and cause & effect expressions. | 1 |
| 5.7 | Compound Nouns | 1 |
| 5.8 | Simple, compound & complex sentences | 1 |

**Course Designer(s)**

1. Dr.A.Palaniappan - palaniappan@ksrct.ac.in

| 60 MA 001 | Matrices and Calculus | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | BS | 3 | 1 | 0 | 4 |

## Objectives

- To familiarize the basic concepts in Cayley-Hamilton theorem and orthogonal transformation
- To get exposed to the fundamentals of differentiation
- To acquire skills to understand the concepts involved in Jacobians and maxima and minima
- To solve various linear differential equations and method of variation of parameters
- To learn various techniques and methods in solving definite and indefinite integrals

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Apply the concepts of Cayley-hamilton theorem and orthogonal transformation to the matrix | Apply |
| CO2 | Apply the concepts of differentiation in solving various Engineering Problems | Apply |
| CO3 | Obtain Jacobians and maxima and minima of functions of two variables | Apply |
| CO4 | Employ various methods in solving differential equations | Apply |
| CO5 | Apply different techniques to evaluate definite and indefinite integrals | Apply |

## Mapping with Programme Outcomes

| COs | Pos | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - | - | 3 |
| CO2 | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - | - | 3 |
| CO3 | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - | - | 3 |
| CO4 | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - | - | 3 |
| CO5 | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - | - | 3 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 10 | 10 | 10 | 10 |
| Understand | 10 | 10 | 20 | 20 |
| Apply | 40 | 40 | 70 | 70 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Common to MECH, ECE, EEE, CSE, MCT, CIVIL, IT, TXT, BT, FT, AI&DS, AI&ML | | | | | | | | |
| 60 MA 001 - Matrices and Calculus | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| I | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 |

| | |
|---|---|
| **Matrices**<br>Characteristic equation - Eigen values and Eigen vectors of a real matrix - Properties of Eigen values and Eigen vectors - Cayley-Hamilton theorem - Orthogonal transformation of a symmetric matrix to diagonal form - Reduction of quadratic form to canonical form by an Orthogonal transformation - Nature of quadratic form - Applications: Stretching of an elastic membrane<br>**Hands-on: Matrix Operations - Addition, Multiplication, Transpose, Inverse and Rank** | **[9]** |
| **Differentiation**<br>Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Successive Differentiation - Leibnitz's theorem **- Applications: Maxima and Minima of functions of one variable* Hands-on: Determine the solution of system of linear equations** | **[9]** |
| **Functions of Several Variables**<br>Partial differentiation - Homogeneous functions and Euler's theorem - Jacobians - Taylor's series for functions of two variables - **Applications: Maxima and minima of functions of two variables - Constrained maxima and minima: Lagrange's Method of Undetermined Multipliers***<br>**Hands-on: Compute the Eigen values and Eigen vectors of a Matrix** | **[9]** |
| **Differential Equations**<br>Linear differential equations of second and higher order with constant coefficients - R.H.S is of the form $e^{\alpha x}$, $sin\ \alpha\ x$, $cos\ \alpha\ x$, $x^n$, $n > 0$ - Differential equations with variable coefficients: Cauchy's and Legendre's form of linear equations - Method of variation of parameters **Hands-on: Solve the first and second order ordinary differential equations** | **[9]** |
| **Integration**<br>Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications: Hydrostatic force and pressure, moments and centres of mass<br>**Hands-on: Compute the Maxima and Minima of a function of one variable** | **[9]** |
| **Total Hours: 45 + 5 (Hands-on) + 10 (Tutorial)** | **60** |

**Text Book(s):**

| | |
|---|---|
| 1. | Grewal B.S, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2017. |
| 2. | Kreyszig Erwin, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons (Asia) Limited, New Delhi, 2016. |

**Reference(s):**

| | |
|---|---|
| 1. | Dass H.K, "Higher Engineering Mathematics", 3rd (Revised) Edition, S.Chand & Company Ltd, New Delhi, 2014. |
| 2. | Veerarajan T, "Engineering Mathematics", for Semesters I and II, 1st Edition, Tata McGraw Hill Publishing Co., New Delhi, 2019. |
| 3. | Kandasamy P, Thilagavathy K and Gunavathy K, "Engineering Mathematics - I", S.Chand & Company Ltd, New Delhi, 2017. |
| 4. | Bali N P and Manish Goyal," A text book of Engineering Mathematics",10th Edition, Laxmi Publications (P) Ltd, 2016. |

*SDG: 4 – Quality Education

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Matrices** | |
| 1.1 | Characteristic equation | 1 |
| 1.2 | Eigen values and Eigen vectors of a real matrix | 1 |
| 1.3 | Properties of Eigen values and Eigen vectors | 1 |
| 1.4 | Cayley-Hamilton theorem | 1 |
| 1.5 | Orthogonal transformation of a symmetric matrix to diagonal form | 1 |
| 1.6 | Nature of quadratic form | 1 |
| 1.7 | Reduction of quadratic form to canonical form by Orthogonal transformation | 2 |
| 1.8 | Stretching of an elastic membrane | 1 |
| 1.9 | Tutorial | 2 |
| 1.10 | Hands-on | 1 |
| **2.0** | **Differentiation** | |
| 2.1 | Representation of functions | 1 |
| 2.2 | Limit of a function and Continuity | 1 |
| 2.3 | Differentiation rules (sum, product, quotient, chain rules) | 2 |
| 2.4 | Successive differentiation | 1 |
| 2.5 | Leibnitz's theorem | 2 |
| 2.6 | Maxima and minima of functions of one variable | 2 |
| 2.7 | Tutorial | 2 |
| 2.8 | Hands-on | 1 |
| **3.0** | **Functions of Several Variables** | |
| 3.1 | Partial differentiation | 1 |
| 3.2 | Homogeneous functions and Euler's theorem | 1 |
| 3.3 | Jacobians | 2 |
| 3.4 | Taylor's series for functions of two variables | 1 |
| 3.5 | Maxima and minima of functions of two variables | 2 |
| 3.6 | Lagrange's Method of Undetermined Multipliers | 2 |
| 3.7 | Tutorial | 2 |
| 3.8 | Hands-on | 1 |
| **4.0** | **Differential Equations** | |
| 4.1 | Linear differential equations of second and higher order with constant co-efficient | 1 |
| 4.2 | R.H.S is of the form $e^{\alpha x}$, $\sin \alpha x$, $\cos \alpha x$, $x^n, n > 0$ | 2 |
| 4.3 | Differential equations with variable coefficients: Cauchy's form of linear equations | 2 |
| 4.4 | Differential equations with variable coefficients: Legendre's form of linear equations | 2 |
| 4.5 | Method of variation of parameters | 2 |
| 4.6 | Tutorial | 2 |
| 4.7 | Hands-on | 1 |
| **5.0** | **Integration** | |
| 5.1 | Definite and Indefinite integrals | 2 |
| 5.2 | Substitution rule | 1 |
| 5.3 | Techniques of Integration: Integration by parts | 1 |
| 5.4 | Integration of rational functions by partial fraction | 1 |
| 5.5 | Integration of irrational functions | 1 |
| 5.6 | Improper integrals | 1 |
| 5.7 | Hydrostatic force. | 1 |
| 5.8 | Pressure, moments and centres of mass. | 1 |
| 5.9 | Tutorial | 2 |
| 5.10 | Hands-on | 1 |

**Course Designer(s)**


1. Dr.C.Chandran - cchandran@ksrct.ac.in
2. Mr.G.Mohan - mohang@ksrct.ac.in

| 60 PH 001 | Engineering Physics | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | BS | 3 | 0 | 0 | 3 |

## Objectives

- To make the students to understand the basics of crystallography, crystal growth and its importance in studying materials properties.
- To establish a sound, grasp of knowledge on optics, laser and its applications
- To understand the dielectric properties of materials including magnetic materials, applications of dielectrics and magnetic materials
- To introduce advanced materials and nano technology for various modern engineering applications
- To instil the knowledge on next generation energy device and its applications

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Realize the basics of crystallography and its importance for varied materials properties | Remember |
| CO2 | Acquire the fundamentals of optics, laser technology and its applications in various fields | Apply |
| CO3 | Appraise the knowledge on magnetic properties of materials and their applications in sensors | Understand |
| CO4 | Infer the properties of advanced materials and nano materials for potential applications | Understand |
| CO5 | Recognize the next generation energy device and its applications in electric vehicles | Understand |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | - | - | - | - | - | - | 2 | - | 2 | - | - | - | - |
| CO2 | 3 | - | - | - | - | - | - | 2 | - | 2 | - | - | - | - |
| CO3 | 3 | - | - | - | - | - | - | 2 | - | 2 | - | - | - | - |
| CO4 | 3 | - | - | - | - | - | - | 2 | - | 2 | - | - | - | - |
| CO5 | 3 | - | - | - | - | - | - | 2 | - | 2 | - | 2 | - | - |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 10 | 14 | 16 | 16 |
| Understand | 46 | 46 | 80 | 80 |
| Apply | 04 | - | 04 | 04 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Common to MECH, MCT | | | | | | | | |
| 60 PH 001 – Engineering Physics | | | | | | | | |
| Semester | Hours/Week | | | Total Hours | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| I | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| ***Crystal Physics**<br>Lattice - Unit cell – crystal systems and Bravais lattice - Crystal planes and Miller indices - d spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - Coordination number - Packing factor for HCP structure - Crystal growth techniques– solution (Slow solvent evaporation and slow cooling)- melt (Bridgman and Czochralski) - Imperfections in crystals. | **[9]** |
| ***Optics and Laser Technology**<br>**Optics:** Reflection, refraction and diffraction of light waves - interference - Application of interference in thin films: Newton's ring and Air wedge experiment - Overview of linear and nonlinear optics. **Laser:** Theory of laser - characteristics - Einstein's coefficients - population inversion - Nd-YAG laser, $CO_2$ laser - Applications of lasers in industry: Drilling, welding, cutting micro machining, measurement of long distances and IR Thermography | **[9]** |
| ***Magnetic and Dielectric Materials**<br>**Magnetic Materials:** Origin of magnetic moment - Bohr magnetron - Classification of magnetic materials - Domain theory - Hysteresis - soft and hard magnetic materials - Applications - Giant Magneto Resistance(GMR). **Dielectric Materials:** Polarization - Electronic, ionic, orientational and space charge - Frequency and Temperature dependence of polarization- Breakdown mechanisms - Applications of dielectrics in<br>Capacitor and Transformer. | **[9]** |
| ***Advanced Materials and Nanotechnology**<br>**Advanced Materials:** Metallic glasses - preparation, properties and applications - Shape memory alloys (SMA) -characteristics, properties of NiTi alloy applications.<br>**Nano Technology:** Properties- Top-down process: Ball Milling method - Bottom-up process: Vapour Phase Deposition - Carbon Nano Tube (CNT): Properties, preparation by electric arc method, Applications of carbon nano tube:Mechanical reinforcement & Sensors. | **[9]** |
| ****Next Generation Energy Device**<br>Introduction - Capacitor-Battery-Comparison – Supercapacitor (SC)- Role of active materials, electrodes, electrolyte and separator in SC - Types of SC – Principle, construction and working of Electric double layer capacitor (EDLC), Pseudocapacitor and hybrid capacitor- Advantages and disadvantages of SC – Construction, working, and performance of hybrid (supercapacitor/ battery) device and its application in electric vehicles. | **[9]** |
| **Total Hours** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | M. N. Avadhanulu, P. G. Kshirsagar, TVS Arun Murthy "A Text Book of Engineering Physics", S Chand Publications, New Delhi, 2022. |
| 2. | H. K. Malik, A. K. Singh "Engineering Physics" McGraw Hill Education Private Limited, New Delhi. |
| 3. | D. R. Joshi "Engineering Physics" McGraw Hill Education Private Limited, New Delhi. 2010 |

**Reference(s):**

| | |
|---|---|
| 1. | S.O. Pillai "A Text Book of Engineering Physics" New Age International (P) Limited, New Delhi, 2014B. R. Puri, L.R. Sharma, and S. P. Madan. Principles of Physical Chemistry: Vishal Publishing Company. Gumber Market, Old Railway Road, Jalandhar. |
| 2. | B. R. Puri, L.R. Sharma, and S. P. Madan. Principles of Physical Chemistry: Vishal Publishing Company. Gumber Market, Old Railway Road, Jalandhar, 2018. |
| 3. | B. B. Laud "Lasers and Non-Linear Optics" New Age International Publications, New Delhi, 2015B.S. Bahl, G.D. Tuli, Arun Bahl. Essentials of Physical Chemistry. S.Chand and Company, Ltd. New Delhi. |
| 4. | S. Rajagopal, R. Pulapparambil Vallikkattil, M. Mohamed Ibrahim, D.G.Velev, Electrode Materials for Supercapacitors in Hybrid Electric Vehicles: Challenges and Current Progress. Condens. Matter 2022, 7, 6. https://doi.org/10.3390/ condmat7010006 |

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** SDG:7 - Affordable, reliable, sustainable and modern energy for all



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| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Crystal Physics** | |
| 1.1 | Introduction to Lattice ,Unit cell | 1 |
| 1.2 | Crystal systems and Bravais lattice | 2 |
| 1.3 | Crystal planes and Miller indices | 1 |
| 1.4 | D spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - Coordination number - Packing factor for HCP structure | 2 |
| 1.5 | Crystal growth techniques – solution (Slow solvent evaporation and slow cooling | 1 |
| 1.6 | Melt growth technique(Bridgman and Czochralski) | 1 |
| 1.7 | Imperfections in crystals | 1 |
| **2.0** | **Optics and Laser Technology** | |
| 2.1 | **Optics:** Reflection, refraction and diffraction of light waves - | 1 |
| 2.2 | Interference -Application of interference in thin films: | 1 |
| 2.3 | Newton’s ring and Air wedge experiment | 1 |
| 2.4 | Overview of linear and nonlinear optics. | 1 |
| 2.5 | **Laser:** Theory of laser - characteristics. | 1 |
| 2.6 | Einstein’s coefficients- Population inversion | 1 |
| 2.7 | Nd-YAG laser, $CO_2$ laser | 1 |
| 2.8 | Applications of lasers in industry: Drilling, welding, cutting micro machining, | 1 |
| 2.9 | Measurement of long distances and IR Thermography. | 1 |
| **3.0** | **Magnetic and Dielectric Materials** | |
| 3.1 | **Magnetic Materials:** Origin of magnetic moment - Bohr magnetron | 1 |
| 3.2 | Classification of magnetic materials | 1 |
| 3.3 | Domaintheory - Hysteresis | 1 |
| 3.4 | Soft and hard magnetic materials - Applications | 1 |
| 3.5 | Giant Magneto Resistance(GMR) | 1 |
| 3.6 | **Dielectric Materials:** Polarization - Electronic, ionic, orientational and space charge | 1 |
| 3.7 | Frequency and Temperature dependence ofpolarization | 1 |
| 3.8 | Breakdown mechanisms | 1 |
| 3.9 | Applications of dielectrics in Capacitor and Transformer. | 1 |
| **4.0** | **Advanced Materials and Nanotechnology**. | |
| 4.1 | **Advanced Materials:** Metallic glasses - preparation, properties and applications | 2 |
| 4.2 | Shape memory alloys (SMA) -characteristics, properties of NiTi alloy applications | 2 |
| 4.3 | **Nano Technology:** Properties- Top-down process: Ball Milling method | 2 |
| 4.4 | Bottom-up process: Vapour Phase Deposition | 1 |
| 4.5 | Carbon Nano Tube (CNT): Properties, preparation by electric arc method, Applications of carbon nano tube . | 1 |
| 4.6 | Mechanical reinforcement & Sensors | 1 |
| **5.0** | **Next Generation Energy Device** | |
| 5.1 | Introduction - Capacitor-Battery-Comparison | 1 |
| 5.2 | Supercapacitor (SC) | 1 |
| 5.3 | Role of active materials, electrodes, electrolyte and separator in SC | 1 |
| 5.4 | Types of SC – Principle, construction and working of Electric double layer capacitor (EDLC) | 1 |
| 5.5 | Principle, construction and working of Pseudocapacitor | 1 |
| 5.6 | Principle, construction and working of hybrid capacitor | 1 |
| 5.7 | Advantages and disadvantages of SC | 1 |
| 5.8 | Construction, working, and performance of hybrid (supercapacitor/battery)device | 1 |
| 5.9 | Its application in electric vehicles | 1 |

**Course Designer(s)**


1. Dr. V. Vasudevan - vasudevanv@ksrct.ac.in
2. Dr. M. Malarvizhi - malarvizhi@ksrct.ac.in
3. Dr. P. Suthanthira Kumar - suthanthirakumar@ksrct.ac.in

| 60 EE 001 | Basic Electrical and Electronics Engineering | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | ES | 3 | 0 | 0 | 3 |

## Objectives

- To familiarize the basic concept on electrical circuits and its various parameters
- To facilitate the various types of electrical machines and their uses
- To gain knowledge on Electrical safety
- To provide exposure on the functions of various semiconductor devices
- To familiarize the use of various measuring instruments

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Apply the basic laws of electric circuits to calculate the unknown quantities. | Apply |
| CO2 | Acquire knowledge on different electrical machines and select suitable machines for industrial applications. | Apply |
| CO3 | Express the significance of various components of low voltage electrical installations and create awareness on electrical safety. | Understand |
| CO4 | Demonstrate the operation and characteristics of various semiconductor devices. | Understand |
| CO5 | Interpret the operating principles of measuring instruments and choose suitable instrument for measuring the parameters. | Understand |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | | - | - | - | - | - | - | - | - | - | | - | - |
| CO2 | 3 | 2 | - | - | - | - | 2 | - | - | - | - | 2 | 2 | - |
| CO3 | 3 | 2 | - | - | - | 2 | - | - | - | - | - | 2 | 2 | - |
| CO4 | 2 | 2 | - | - | - | - | 2 | - | - | 2 | - | 2 | 2 | - |
| CO5 | 2 | 2 | - | - | - | - | 3 | - | 3 | 2 | - | 2 | 2 | - |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 20 | 20 | 30 | 20 |
| Understand | 20 | 40 | 30 | 40 |
| Apply | 20 | - | 40 | 40 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | 100 |



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**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Common to CSE, IT, AIDS, AIML, MECH, MCT, BT, FT and CIVIL Branches | | | | | | | | |
| 60 EE 001 - Basic Electrical and Electronics Engineering | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| I / II | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Electrical Circuits**<br>DC Circuits: Circuit Components: Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws–Simple problems.<br>Introduction to AC Circuits and Parameters: Waveforms, Average value and RMS Value of Sinusoidal Waveform real power, reactive power and apparent power, power factor – Steady state analysis of RLC series circuits- Simple problems. Introduction to three phase AC circuits | **[9]** |
| **Electrical Machines***<br>Construction and Working principle - Separately and Self-excited DC Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor. | **[9]** |
| **Electrical Installations***<br>Domestic wiring, types of wires and cables, earthing, protective devices- switch fuse unit- Miniature Circuit Breaker-Moulded Case Circuit Breaker- Earth Leakage Circuit Breaker, Batteries and types, UPS,Safety precautions and First Aid. | **[9]** |
| **Analog Electronics***<br>Introduction to Semiconductor Materials– PN Junction Diodes, Zener Diode – Characteristics and Applications – Bipolar Junction Transistor-Biasing and Configuration (NPN) - **Regulated power supply unit, switched mode power supply*.** | **[9]** |
| **Measurements and Instrumentation***<br>Functional elements of an instrument, Standards and calibration, Operating Principle, types -Moving Coil and Moving Iron meters, Operating principles and Types of Wattmeter, Energy Meter, Instrument Transformers-**CT and PT, DSO**- Block diagram- **Data acquisition***. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020. |
| 2. | A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015. |

**Reference(s):**

| | |
|---|---|
| 1. | Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019. |
| 2. | Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017. |
| 3. | Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002. |
| 4. | H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010. |

*SDG 9 – Industry Innovation and Infrastructure

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Electrical Circuits** | |
| 1.1 | Circuit Components: Resistor, Inductor, Capacitor | 1 |
| 1.2 | Ohm's Law - Kirchhoff's Laws | 1 |
| 1.3 | Ohm's Law - Kirchhoff's Laws - Problems | 2 |
| 1.4 | Introduction to AC Circuits and Parameters: Waveforms, Average value and RMS Value of Sinusoidal Waveform | 2 |
| 1.5 | Real power, reactive power and apparent power, power factor | 1 |
| 1.6 | Steady state analysis of RLC series circuits | 1 |
| 1.7 | RLC series circuits - Problems | 1 |
| 1.8 | Introduction to three phase system | 1 |
| **2.0** | **Electrical Machines** | |
| 2.1 | Construction and Working principle of DC Generator | 1 |
| 2.2 | Types and Applications of Separately and Self excited DC Generators | 1 |
| 2.3 | EMF equation of DC Generator | 1 |
| 2.4 | Working Principle of DC motors | 1 |
| 2.5 | Torque Equation | 1 |
| 2.6 | Types and Applications | 1 |
| 2.7 | Construction, Working principle and Applications of Transformer | 1 |
| 2.8 | Construction, Working principle and Applications of Three phase Alternator | 1 |
| 2.9 | Construction, Working principle and Applications of Synchronous motor | 1 |
| 2.10 | Construction, Working principle and Applications of Three Phase Induction Motor | 1 |
| **3.0** | **Electrical Installations** | |
| 3.1 | Domestic wiring, types of wires and cables | 1 |
| 3.2 | Earthing, protective devices | 2 |
| 3.3 | Switch fuse unit- Miniature Circuit Breaker | 1 |
| 3.4 | Molded Case Circuit Breaker- Earth Leakage Circuit Breaker | 1 |
| 3.5 | Batteries and types | 2 |
| 3.6 | UPS | 1 |
| 3.7 | Safety precautions and First Aid | 1 |
| **4.0** | **Analog Electronics** | |
| 4.1 | Introduction to Semiconductor Materials | 1 |
| 4.2 | Characteristics and Applications of PN Junction Diodes | 1 |
| 4.3 | Characteristics and Applications of Zener Diode | 1 |
| 4.4 | Bipolar Junction Transistor | 1 |
| 4.5 | Biasing & Configuration (NPN) | 2 |
| 4.6 | Regulated power supply unit | 1 |
| 4.7 | Switched mode power supply | 1 |
| **5.0** | **Measurements and Instrumentation** | |
| 5.1 | Functional elements of an instrument | 1 |
| 5.2 | Standards and calibration | 1 |
| 5.3 | Moving Coil meters - Operating Principle, types | 1 |
| 5.4 | Moving Iron meters - Operating Principle, types | 1 |
| 5.5 | Operating principles and Types of Wattmeter | 1 |
| 5.6 | Energy Meter | 1 |
| 5.7 | Instrument Transformers – CT& PT | 1 |
| 5.8 | DSO- Block diagram- Data acquisition | 1 |

**Course Designer(s)**


1. Mr.S.Srinivasan - srinivasan@ksrct.ac.in
2. Ms.R.Radhamani - radhamani@ksrct.ac.in
3. Ms.S.Jaividhya - jaividhya@ksrct.ac.in
4. Dr.S.Gomathi - gomathi@ksrct.ac.in
5. Mr.T.Prabhu - prabhut@ksrct.ac.in




CHAIRMAN
Board Of Studies/
Mechatronics Engineering

| 60 ME 004 | Engineering Mechanics | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | ES | 3 | 1 | 0 | 4 |

## Objectives

- To learn a process for analysis of static objects, concepts of force, moment, and mechanical equilibrium in two and three dimensions.
- To learn the equilibrium of rigid bodies such as frames, trusses, beams.
- To identify the properties of surfaces and solids by using different theorem.
- To learn the principle of frictional forces at the contact surfaces and impart basic concept of dynamics of particles.
- To acquire the concept of elements of rigid body dynamics

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Use scalar and vector analytical techniques for analysing forces in statically determinate structures. | Apply |
| CO2 | Apply basic knowledge of scientific concepts to solve real-world problems. | Apply |
| CO3 | Calculate the properties of surfaces and solids using various theorems. | Apply |
| CO4 | Determine the effect of frictional forces and the dynamic forces exerted in the particle | Apply |
| CO5 | Analysis of rigid body dynamics and calculation of member forces in the rigid body | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | 2 | - | - |
| CO2 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | 2 | - | - |
| CO3 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | 2 | - | - |
| CO4 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | 2 | - | - |
| CO5 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | 2 | - | - |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 10 | 10 | 20 | 20 |
| Understand | 20 | 20 | 30 | 30 |
| Apply | 30 | 30 | 50 | 50 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **B.E – Mechatronics Engineering** | | | | | | | | | |
| **60 ME 004 - Engineering Mechanics** | | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | | |
| | L | T | P | | C | CA | ES | Total | |
| I | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 | |

| | |
|---|---|
| **Basics and Statics of Particles**<br>Introduction -Units and Dimensions-Laws of Mechanics–Principle of transmissibility-Lame's theorem, Parallelogram and triangular Law of forces–Vectors–Vectorial representation of forces and moments | **[12]** |
| **Vector operations**<br>Addition, subtraction, dot product, cross product-Coplanar Forces–Resolution and Composition of forces–Equilibrium of a particle–Forces in space-Equilibrium of a particle in space-Equivalent systems of forces-Single equivalent force. | **[12]** |
| **Equilibrium of Rigid Bodies**<br>Free body diagram–Types of supports and their reactions–requirements of stable equilibrium–Static determinacy, Moments and Couples–Moment of a force about a point and about an axis–Vectorial representation of moments and couples–Varignon's theorem- Equilibrium of Rigid bodies in two dimensions. | **[12]** |
| **Properties of Surfaces and Solids**<br>Determination of Areas and Volumes-Centroid, Moment of Inertia of plane area (Rectangle, circle, triangle using Integration Method; T section, I section, Angle section, Hollow section using standard formula) - Parallel axis theorem and perpendicular axis theorem- Polar moment of inertia -Mass moment of inertia of thin rectangular section.<br>**Friction**<br>Frictional force–Laws of Coloumb friction–Simple contact friction–Ladder friction-Rolling resistance–Ratio of tension in belt. | **[12]** |
| **Dynamics of Particles**<br>Displacement, Velocity, acceleration and their relationship–Relative motion -Projectile motion in horizontal plane– Newton's law–Work Energy Equation – Impulse and Momentum.<br>**Elements of Rigid Body Dynamics**<br>Translation and Rotation of Rigid Bodies: Velocity and acceleration–General Plane motion: Crank and Connecting rod mechanism. | **[12]** |
| **Total Hours:** | **60** |

**Text Book(s):**

| | |
|---|---|
| 1. | Rajasekaran, S., Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., 3rd Edition, 2017. |
| 2. | Beer, F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", Statics and Dynamics, McGraw-Hill International, 11th Edition, 2016. |

**Reference(s):**

| | |
|---|---|
| 1. | Jayakumar, V. and Kumar, M, "Engineering Mechanics", PHI Learning Private Ltd, New Delhi, 2012 |
| 2. | Hibbeller, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., |
| 3. | Bansal R.K," Engineering Mechanics" Laxmi Publications (P) Ltd, 2011. |
| 4. | Irving H. Shames, Engineering Mechanics: Statics and Dynamics", Pearson Education Asia Pvt. Ltd, 4th Edition, 2003. |

*SDG 9 – Industry Innovation and Infrastructure
**SDG 3 – Good Health and Well Being
***SDG 7 – Affordable and Clean Energy

**Course Contents and Lecture Schedule**

| S.No | Topic | No.of Hours |
|---|---|---|
| **1** | **Basics and Statics of Particles** | |
| 1.1 | Introduction, Units and Dimensions, Laws of Mechanics | 1 |
| 1.2 | Principle of transmissibility, Lame's theorem, | 1 |
| 1.3 | Parallelogram and triangular Law of forces | 1 |
| 1.4 | Tutorial | 2 |
| 1.5 | Vectors, Vectorial representation of forces and moments | 1 |
| 1.6 | Vector operations, Coplanar Forces–Resolution and Composition of forces | 2 |
| 1.7 | Equilibrium of a particle, Forces in space | 1 |
| 1.8 | Equivalent systems of forces-Single equivalent force. | 1 |
| 1.9 | Tutorial | 2 |
| **2** | **Equilibrium of Rigid Bodies** | |
| 2.1 | Free body diagram, Types of supports and their reactions | 1 |
| 2.2 | Requirements of stable equilibrium, Static determinacy | 1 |
| 2.3 | Moments and Couples–Moment of a force about a point and about an axis | 1 |
| 2.4 | Vectorial representation of moments and couples | 2 |
| 2.5 | Tutorial | 1 |
| 2.6 | Varignon's theorem | 2 |
| 2.7 | Equilibrium of Rigid bodies in two dimensions | 1 |
| 2.8 | Tutorial | 1 |
| **3** | **Properties of Surfaces and Solids** | |
| 3.1 | Determination of Areas and Volumes-Centroid | 1 |
| 3.2 | Moment of Inertia of plane area (Rectangle, circle, triangle using Integration Method) | 1 |
| 3.3 | Tutorial | 1 |
| 3.4 | Moment of Inertia of plane area(T section, I section, Angle section) | 2 |
| 3.5 | Moment of Inertia of plane area(Hollow section) | 1 |
| 3.6 | Parallel axis theorem and perpendicular axis theorem | 2 |
| 3.7 | Polar moment of inertia | 1 |
| 3.8 | Mass moment of inertia of thin rectangular section. | 1 |
| 3.9 | Tutorial | 2 |
| **4** | **Friction & Dynamics of Particles** | |
| 4.1 | Frictional force, Laws of Coloumb friction, Simple contact friction | 1 |
| 4.2 | Ladder friction | 1 |
| 4.3 | Rolling resistance–Ratio of tension in belt | 1 |
| 4.4 | Tutorial | 2 |
| 4.5 | Displacement, Velocity, acceleration and their relationship, Relative motion | 1 |
| 4.6 | Projectile motion in horizontal plane | 2 |
| 4.7 | Newton's law | 1 |
| 4.8 | Work Energy Equation | 1 |
| 4.9 | Impulse and Momentum | 2 |
| 4.10 | Tutorial | 2 |
| **5** | **Elements of Rigid Body Dynamics** | |
| 5.1 | Translation and Rotation of Rigid Bodies | 1 |
| 5.2 | Translation and Rotation of Rigid Bodies - Velocity | 2 |
| 5.3 | Translation and Rotation of Rigid Bodies - acceleration | 2 |
| 5.4 | Tutorial | 2 |
| 5.5 | General Plane motion | 1 |
| 5.6 | General Plane motion - Crank and Connecting rod mechanism | 2 |
| 5.7 | Tutorial | 2 |

| 60 MY 001 | Environmental Studies and Climate Change | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | BS | 2 | 0 | 0 | 0 |

## Objectives

- To understand the impact climate changes in ecosystem and biodiversity.
- To analyze the impacts of pollution, control and legislation.
- To explain the importance of sustainable development practices.
- To explore the significance of organic farming.
- To identify the Geo-spatial tools for resource management.

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Interpret the impacts of pollution on climate change | Understand |
| CO2 | Categorize the wastes and its management. | Analyze |
| CO3 | Identify the different types of sustainable practices | Apply |
| CO4 | Classify the organic farming techniques | Apply |
| CO5 | Categorize the Geo-spatial tools for resource management | Analyze |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | - | - | - | - | 3 | - | - | - | - | 2 | - | - |
| CO2 | 3 | 2 | - | - | - | 3 | 3 | 2 | - | - | - | 2 | - | - |
| CO3 | 3 | 2 | - | - | - | 3 | 3 | 2 | - | - | - | 2 | - | - |
| CO4 | 3 | 2 | - | - | - | 2 | 3 | - | - | - | - | 2 | - | - |
| CO5 | 3 | 2 | - | - | 3 | - | 2 | - | - | - | - | 2 | - | - |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests | | Quiz | | Seminar presentation |
|---|---|---|---|---|---|
| | Case Study | Activity Report | Quiz 1 | Quiz 2 | |
| Remember | 10 | 10 | 5 | 5 | 10 |
| Understand | 30 | 20 | 10 | 10 | 15 |
| Apply | - | 30 | - | 5 | 15 |
| Analyse | 20 | - | 5 | - | 10 |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |
| **Total** | **60** | **60** | **20** | **20** | **50** |

**Syllabus**

**K.S.Rangasamy College of Technology – Autonomous R2022**

**Common to all Branches**

**60 MY 001 - Environmental Studies and Climate Change**

| Semester | Hours/Week | | | Total Hours | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| I / II | 2 | 0 | 0 | 30 | 0 | 100 | 0 | 100 |

| | |
|---|---|
| **Pollution and its Impact on Climate Change*** <br> Pollution: Sources and Impacts of Air Pollution – Greenhouse Effect- Global Warming-Climate Change - Ozone Layer Depletion - Acid Rain. Carbon Footprint - Climate Change on Various Sectors – Agriculture, Forestry and Ecosystem – Climate Change Mitigation and Adaptation. Action Plan on Climate Change. IPCC, UNFCCC, Kyoto Protocol, Montreal Protocol on Climatic Changes. | **[6]** |
| **Integrated Waste Management**** <br> Waste - Types and Classification. Principles of Waste Management (5R Approach) - Swachh Bharat Abhiyan – Commercial Waste, Plastic Waste, Domestic Waste, E -Waste - Biomedical Waste - RiskManagement: Collection, Segregation, Treatment and Disposal Methods. Waste Water Treatment- Activate Sludge Process. | **[6]** |
| **Sustainable Development Practices***** <br> Sustainable Development Goals (Sdgs) **–** Green Computing- Carbon Trading - Green Building – Eco- Friendly Plastic – Alternate Energy: Hydrogen – Bio-Fuels – Solar Energy – Wind – Hydroelectric Power. Water Scarcity- Watershed Management, Ground Water <br> Recharge and Rainwater Harvesting. | **[6]** |
| **Environment and Agriculture****** <br> Organic Farming – Bio-Pesticides- Composting, Bio Composting, Vermi- Composting, Roof Gardening and Irrigation. Waste Land Reclamation. Climate Resilient Agriculture. Green Auditing | **[6]** |
| **Geo-Science in Natural Resource Management** <br> Data Base Software in Environment Information- Digital Image Processing Applications in Forecasting. GPS - Remote Sensing and Geographical Information System (GIS) - World Wide Web (WWW) - Environmental Information System (ENVIS). | **[6]** |
| **Total Hours:** | **30** |

**Text Book(s):**

| | |
|---|---|
| 1. | Anubha Kaushik, C P Kaushik. Perspectives in Environmental Studies, New Age International publishers;6th Edition 2018. |

**Reference(s):**

| | |
|---|---|
| 1. | Tyler G. Miller Environmental Science 14th Edition Cengage Publications, Delhi, 2013 |
| 2. | Gilbert M.Masters and Wendell P. Ela,"Environmental Engineering And Science", PHI Learning PrivateLimited, 3rd Edition, 2015 |
| 3. | Erach Bharucha. Textbook of Environmental Studies for Undergraduate Courses, Universities Press, 2000 |

*SDG: 13 – Climate Action
**SDG: 4 – Clean Water and Sanitation
***SDG: 6 - Affordable and Clean Energy
****SDG: 3 – Good Health and WSell-being



CHAIRMAN
Board Of Studies/
Mechatronics Engineering

## Course Contents and Lecture Schedule

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Pollution and its Impact on Climate Change** | |
| 1.1 | Pollution: Sources and Impacts of Air Pollution – Greenhouse Effect-Global Warming- Climate Change - Ozone Layer Depletion - Acid Rain | 2 |
| 1.2 | Climate Change on Various Sectors: Agriculture, Forestry and Ecosystem. – Climate Change Mitigation and Adaptation | 1 |
| 1.3 | Action Plan on Climate Change - IPCC, UNFCCC, Kyoto Protocol, Montreal Protocol on Climatic Changes | 1 |
| **2.0** | **Integrated Waste Management** | |
| 2.1 | Waste - Types and Classification. Principles of Waste Management (5R approach) - Swachh Bharat Abhiyan | 1 |
| 2.2 | Commercial Waste, Plastic Waste, Domestic Waste, E-Waste and Biomedical Waste | 1 |
| 2.3 | Risk Management: Collection, Segregation, Treatment and Disposal Methods. | 1 |
| **3.0** | **Sustainable Development Practices** | |
| 3.1 | Sustainable Development Goals (SDGs) – Green Computing- Carbon Trading -Green Building – Eco- Friendly Plastic | 1 |
| 3.2 | Alternate Energy: Hydrogen – Bio-Fuels – Solar Energy – Wind – Hydroelectric Power | 2 |
| 3.3 | Water Scarcity- Watershed Management, Ground Water Recharge and Rainwater Harvesting | 1 |
| **4.0** | **Environment and Agriculture** | |
| 4.1 | Organic Farming – Bio-Pesticides | 1 |
| 4.2 | Composting, Bio Composting, Vermi-Composting | 1 |
| 4.3 | Roof Gardening and Irrigation | 1 |
| 4.4 | Waste Land Reclamation. Climate Resilient Agriculture, Green Auditing | 1 |
| **5.0** | **Geo-Science in Natural Resource Management** | |
| 5.1 | Data Base Software in Environment Information, Digital Image Processing Applications in Forecasting | 2 |
| 5.2 | GPS, Remote Sensing and Geographical Information System (GIS) | 1 |
| 5.3 | World Wide Web (WWW), Environmental Information System (ENVIS) | 1 |

## Course Designer(s)


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3. Dr.S.Meenachi - meenachi@ksrct.ac.in
4. Ms.D.Kirthiga - kiruthiga@ksrct.ac.in

| 60 ME 0P1 | Fabrication and Reverse Engineering Laboratory | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | ES | 0 | 0 | 4 | 2 |

## Objectives

- To acquire skills in operating hand tools and instruments.
- To provide hands-on training on Carpentry, Sheet metal, Fitting and Welding.
- To provide hands-on training on household wiring and electronic circuits.
- To offer real time activity on plumbing connections in domestic applications.
- To provide hands-on activities on dismantling, and assembling the Home Appliance, Center lathe operations, computer's internal components and peripherals.

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Perform power tools operations. | Apply |
| CO2 | Make a wooden model using carpentry Process | Apply |
| CO3 | Make a model using sheet metal, filing and joining a MS Plate | Apply |
| CO4 | Repair and Maintenances of water lines for home applications | Apply |
| CO5 | Trouble shoots the electrical and electronic circuits, Electrical Machines and realizes the reputation of house wiring, home Appliance, computer internal components and peripherals. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 3 | - | - | 2 | 2 | - | 3 | - | - | 3 | - | 3 |
| CO2 | 3 | 2 | 3 | - | - | 2 | 2 | - | 3 | - | - | 3 | - | 3 |
| CO3 | 3 | 2 | 3 | - | - | 2 | 2 | - | 3 | - | - | 3 | - | 3 |
| CO4 | 3 | 2 | 3 | - | - | 2 | 2 | - | 3 | - | - | 3 | - | 3 |
| CO5 | 3 | 2 | 3 | - | - | 2 | 2 | - | 3 | - | - | 3 | - | 3 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Lab Experiments Assessment (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) | |
|---|---|---|---|---|---|
| | Lab | Activity | | | |
| Remember | - | - | - | - | - |
| Understand | 25 | 12 | 50 | - | 50 |
| Apply | 25 | 13 | 50 | - | 50 |
| Analyse | - | - | - | - | - |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |
| Total | 50 | 25 | 100 | - | 100 |

**Syllabus**

**Performs of Power Tools***
Drilling in Different Walls and Materials Fitting of Hand Shower Mount, Shirt Hanger, Towel Hanger and Pipe with Clamps.
**Carpentry Process***
Design and Development of Wooden Model using the Carpentry Process T / Cross Joint / Different Joints
**Sheet Metal and Filling Process***
Design and Development of Metal Model - Make a Tray Components using Sheet Metal Process and Mating of Square joint in MS Plate Using the Filling Process
**Welding Process***
Fabrication of Models with MS Plate Using Arc Welding- Lap Joint, Butt Joint, T Joint
**Plumbing Process***
Repair and Maintenances of Pipe Fitting for Home Applications Study of Plumbing Tools, Assembly of G.I. Pipes/ PVC and Pipe Fittings, Cutting of Threads in G.I. Pipes by Thread Cutting Dies.
**Residential house wiring***
Design and Excusion of Residential House Wiring with and Without UPS- 1 BHK - 2 BHK. Design and Fabrication of Domestic LED Lamps - Circuit Designing (Calculation of Components)
**Electronic Circuit wiring***
PCB Fabrication — Soldering - Assembling of Audio Amplifiers- Connecting USB/Bluetooth MP3 Player Board - Connecting Volume Controllers - Connecting Bass & Treble Filter Boards - Connecting Surround and Sub-Woofer Filter Board
**Assembling and dismantling of Electronics Machines***
Iron Box, Induction Stove, Water Heater, Mixer, Table Fan, Ceiling Fan
**Study Exercises**
Demonstration of Centre Lathe Operations Facing, Turning, and Drilling and its Components. Assemble and dismantle of Vacuum Cleaner / Refrigerator and its Components
**Computer Hardware Study Exercises**
Identify Internal Components of Computer - Assemble and Dismantle Desktop Computer Systems

*SDG 9 – Industry Innovation and Infrastructure

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Common to All Branches | | | | | | | | |
| 60 ME 0P1 - Fabrication and Reverse Engineering Laboratory | | | | | | | | |
| Semester | Hours/Week | | | Total Hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |

**List of Experiments:**

1. **Fitting of Wall mounting Parts using Power Tools**
   a) Drilling in Different Walls and Materials
   b) Fitting of Hand Shower Mount, Shirt Hanger, Towel Hanger and Pipe with Clamps.
2. **Making of Wooden model using the Carpentry Process**
   a) T / Cross Joint
   b) Mortise and Tenon Joint / Different Joints
3. **Making of Metal Model**
   a) Making of Components Using Sheet Metal Process
   b) Making of Components Using the Filling Process
4. **Fabrication of Welded Model**
5. **Repair and Maintenance of Pipe Fitting for Home Applications**
   a) Assembly of GI Pipes/PVC and Pipe Fitting
   b) Cutting of Threads in GI Pipes by Thread Cutting Dies
6. **Assembling and Dismantling of**
   a) Iron Box
   b) Induction Stove
   c) Water Heater
   d) Mixer
   e) Table Fan
   f) Ceiling Fan
7. **Design and Execution of Residential House Wiring**
   a) 1 BHK

b) 2 BHK

**8. Design and Execution of Residential House Wiring with UPS.**

a) 1 BHK

b) BHK

**9. Design and Fabrication of Domestic LED lamps**

a) Circuit Designing (Calculation of Components)

b) PCB Fabrication

c) Soldering

**10. Assembling of Audio Amplifiers**

a) Connecting USB/Bluetooth MP3 Player Board

b) Connecting Volume Controllers

c) Connecting Bass & Treble Filter Boards

d) Connecting Surround and Sub-Woofer Filter Board

**Study Exercises**

1. Demonstration of Centre Lathe and its Operations Like Facing, Turning, and Drilling.
2. Dismantle and Assemble of Vacuum Cleaner / Refrigerator.
3. Study of Components of Computer. Dismantle and Assemble of Desktop Computer Systems

**Course Designer(s)**

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2. Dr. D Sri Vidya - srividhya@ksrct.ac.in
3. Mr. K.Raguvaran – raguvaran@ksrct.ac.in

| 60 EE 0P1 | Basic Electrical and Electronics Engineering Laboratory | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | ES | 0 | 0 | 4 | 2 |

## Objectives

- To acquire knowledge in conducting basic electrical laws
- To gain knowledge on three phase power measurement
- To train the students in conducting load tests on electrical machines
- To gain practical experience in characterizing electronic devices
- To gain practical experience in using measuring devices

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Practice experimental methods to verify the Ohm's and Kirchhoff's Laws. | Apply |
| CO2 | Perform the three-phase power measurement. | Apply |
| CO3 | Demonstrate the load characteristics of electrical machines. | Apply |
| CO4 | Describe the characteristics of basic electronic devices. | Understand |
| CO5 | Use the appropriate measuring devices to measure the electrical parameters. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | - | - | - | - | - | 3 | 2 | - | - | - | - | - |
| CO2 | 3 | 2 | - | - | - | - | - | 3 | 2 | - | 2 | - | - | - |
| CO3 | 3 | 2 | - | - | - | - | - | 3 | 2 | - | 2 | - | 2 | 2 |
| CO4 | 3 | 2 | - | - | - | - | - | 3 | 2 | 2 | 2 | - | 2 | 2 |
| CO5 | 3 | 1 | - | - | - | - | - | 3 | 2 | 2 | 2 | - | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Lab Experiments Assessment (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) | |
|---|---|---|---|---|---|
| | Lab | Activity | | | |
| Remember | - | - | - | - | - |
| Understand | 25 | 12 | 50 | - | 50 |
| Apply | 25 | 13 | 50 | - | 50 |
| Analyse | - | - | - | - | - |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |
| Total | 50 | 25 | 100 | - | 100 |

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Common to Civil, Mech, MCT and FT Branches** | | | | | | | | |
| **60 EE 0P1 - Basic Electrical and Electronics Engineering Laboratory** | | | | | | | | |
| Semester | Hours/W eek | | | Total Hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| I | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |

**List of Experiments:**

1. Verification of Ohm's and Kirchhoff's Laws.
2. Measurement of Three Phase Power.
3. Load test on DC Shunt Motor.
4. Load test on Self Excited DC Generator.
5. Load test on Single phase Transformer.
6. Load test on Induction Motor.
7. Characteristics of PN and Zener Diodes.
8. Characteristics of BJT (CE).
9. Calibration of Single-Phase Energy Meter*.
10. Mini Project

*SDG 9 – Industry Innovation and Infrastructure

**Course Designer(s)**


1. Mr.S.Srinivasan - srinivasan@ksrct.ac.in
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3. Ms.S.Jaividhya - jaividhya@ksrct.ac.in
4. Dr.S.Gomathi - gomathi@ksrct.ac.in
5. Mr.T.Prabhu - prabhut@ksrct.ac.in

**K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215**
(An Autonomous Institution affiliated to Anna University)
B.E. / B.Tech. Degree Programme
**SCHEME OF EXAMINATIONS**
(For the candidates admitted in 2022-2023)
SECOND SEMESTER

| S. No. | Course Code | Name of the Course | Duration of Internal Exam | Weightage of Marks | | | Minimum Marks for Pass in End Semester Exam | |
|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment* | End Semester Exam** | Max. Marks | End Semester Exam | Total |
| **THEORY** | | | | | | | | |
| 1 | 60 EN 002 | Professional English II | 2 | 40 | 60 | 100 | 45 | 100 |
| 2 | 60 MA 003 | Integrals, Partial Differential Equations and Laplace Transform | 2 | 40 | 60 | 100 | 45 | 100 |
| 3 | 60 ME 001 | Engineering Drawing | 2 | 50 | 50 | 100 | 45 | 100 |
| 4 | 60 CS 001 | C Programming | 2 | 40 | 60 | 100 | 45 | 100 |
| 5 | 60 CH 001 | Chemistry for Mechanical Sciences | 2 | 40 | 60 | 100 | 45 | 100 |
| 6 | 60 GE 001 | Heritage of Tamils / □□□□□□□ □□□□ | 2 | 100 | 0 | 100 | 0 | 100 |
| **PRACTICAL** | | | | | | | | |
| 8 | 60 CP 0P1 | Physics & Chemistry Laboratory | 3 | 60 | 40 | 100 | 45 | 100 |
| 9 | 60 CS 0P1 | C Programming Laboratory | 3 | 60 | 40 | 100 | 45 | 100 |
| 10 | 60 CG 0P1 | Career Skill Development-I | 3 | 100 | - | 100 | - | 100 |

*** CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.**
**** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory courses, 50 marks for theory cum practical courses and 40 marks for Practical End Semester Examination.**

w.e.f. 07/01/2023
Passed in the BoS Meeting Held on 23/12/2022
Approved in Academic Council Meeting held on 07/01/2023

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| 60 EN 002 | Professional English II | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | HS | 1 | 0 | 2 | 2 |

## Objectives

- To help learners improve their vocabulary and enable them to use words appropriately in different academic and professional contexts.
- To help learners develop strategies that could be adopted while reading texts.
- To help learners acquire the ability to speak and write effectively in English in real life and career related situations.
- Improve listening, observational skills, and problem-solving capabilities
- Develop message generating and delivery skills.

## Pre-requisites

- Basic knowledge of reading and writing in English and should have completed Professional English I.

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Compare and contrast products and ideas in technical texts. | Understand |
| CO2 | Illustrate cause and effects in events, industrial processes through technical texts | Understand |
| CO3 | Infer problems in order to arrive at feasible solutions and communicate them orally and in the written format. | Understand |
| CO4 | Relate events and the processes of technical and industrial nature. | Remember |
| CO5 | Demonstrate their opinions in a planned and logical manner, and draft effective résumés in context of job search. | Understand |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | 3 | 2 |
| CO2 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | 3 | 2 |
| CO3 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | 2 | 2 |
| CO4 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| CO5 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 10 | 10 | 20 | 20 |
| Understand | 50 | 50 | 80 | 80 |
| Apply | - | - | - | - |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | 100 |

Syllabus

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Common to All Branches** | | | | | | | | |
| **60 EN 002 Professional English II** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| II | 1 | 0 | 2 | 45 | 2 | 40 | 60 | 100 |

| | |
|---|---|
| **Making Comparisons**<br>**Listening:** Evaluative Listening: Advertisements, Product Descriptions, - Audio / video; filling a graphic organiser (choosing a product or service by comparison)<br>**Speaking:** Marketing a product, persuasive speech techniques.<br>**Reading:** Reading advertisements, user manuals and brochures.<br>**Writing:** Professional emails, Email etiquette - compare and contrast essay.<br>**Language Focus:** mixed tenses, prepositional phrases, same words used in different contexts and discourse markers | **[9]** |
| **Expressing Causal Relations in Speaking and Writing**<br>**Listening:** Listening to longer technical talks and completing– gap filling exercises. Listening technical information from podcasts – Listening to process/event descriptions to identify cause & effects.<br>**Speaking:** Describing and discussing the reasons of accidents or disasters based on news reports.<br>**Reading:** longer technical texts– cause and effect essays, and letters / emails of complaint,<br>**Writing:** Writing responses to complaints<br>**Language Focus:** Active Passive Voice transformations, Infinitive and Gerunds – Word Formation (Noun-Verb-Adj-Adv), Adverbs. | **[9]** |
| **Problem Solving**<br>**Listening:** Listening to / watching movie scenes/ documentaries depicting a technical problem and suggesting solutions.<br>**Speaking:** Group Discussion (based on case studies), - techniques and Strategies.<br>**Reading:** Case Studies, excerpts from literary texts, news reports etc.<br>**Writing:** Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay<br>**Language Focus:** Error correction; If conditional sentences - Compound Words, Sentence Completion. | **[9]** |
| **Reporting of Events and Research**<br>**Listening:** Listening Comprehension based on new report and documentaries – **Speaking:** Interviewing, presenting oral reports, Mini presentations on select topics. **Reading:** Newspaper articles.<br>**Writing:** Recommendations, Transcoding, Accident Report, Precis writing and Summarising<br>**Language Focus:** Reported Speech – Modals - Conjunctions- use of Prepositions | **[9]** |
| **The Ability to put Ideas or Information Coherently**<br>**Listening:** Listening to TED Talks, Presentations, Formal job interviews, (analysis of the interview performance).<br>**Speaking:** Participating in role plays, virtual interviews, making presentations with visual aids<br>**Reading:** excerpts of interview with professionals<br>**Writing:** Job / Internship application – Cover letter & Résumé<br>**Language Focus:** Numerical Adjectives, question types: Wh/ Yes or No/ and Tags; Relative Clauses - Idioms. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | 'English for Engineers & Technologists' Orient Blackswan Private Ltd. Department of English, Anna University, 2020 |
| 2. | Norman Lewis, 'Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary Book', Penguin Random House India, 2020 |

**Reference(s):**

| | |
|---|---|
| 1. | Raman. Meenakshi, Sharma. Sangeeta, 'Professional English'. Oxford university press. New Delhi. 2019 |
| 2. | Arthur Brookes and Peter Grundy,' Beginning to Write: Writing Activities for Elementary and Intermediate Learners', Cambridge University Press, New York, 2003 |
| 3. | Prof. R.C. Sharma & Krishna Mohan, 'Business Correspondence and Report Writing', Tata McGraw Hill & Co. Ltd., New Delhi, 2001 |
| 4. | V.N. Arora and Laxmi Chandra, 'Improve Your Writing', Oxford University Press, New Delhi, 2001 |

* SDG 4 – Quality Education

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Making Comparisons** | |
| 1.1 | Evaluative Listening | 1 |
| 1.2 | Product Descriptions and filling a graphic organiser | 1 |
| 1.3 | Marketing a product by using persuasive techniques | 2 |
| 1.4 | Reading advertisements, user manuals and brochures | 1 |
| 1.5 | Writing professional emails | 1 |
| 1.6 | Compare and contrast essay | 1 |
| 1.7 | Mixed tenses and prepositional phrases | 1 |
| 1.8 | Same words used in different contexts | 1 |
| **2.0** | **Expressing Causal Relations in Speaking and Writing** | |
| 2.1 | Listening to longer technical talks | 1 |
| 2.2 | Listening to process/event descriptions | 1 |
| 2.3 | Describing and discussing the reasons of accidents or disasters | 1 |
| 2.4 | Reading longer technical texts– cause and effect essays | 1 |
| 2.5 | Writing responses to complaints | 1 |
| 2.6 | Active Passive Voice transformations | 2 |
| 2.7 | Infinitive and Gerunds | 1 |
| 2.8 | Word Formation (Noun-Verb-Adj-Adv), Adverbs. | 1 |
| **3.0** | **Problem Solving** | |
| 3.1 | Listening to documentaries and suggesting solutions | 1 |
| 3.2 | Group Discussion (based on case studies) | 2 |
| 3.3 | Reading Case Studies, excerpts from literary texts and news reports | 1 |
| 3.4 | Letter to the Editor | 1 |
| 3.5 | Checklists | 1 |
| 3.6 | Problem solution and argumentative essays | 1 |
| 3.7 | Error correction and Sentence Completion | 1 |
| 3.8 | If conditional sentences | 1 |
| **4.0** | **Reporting of Events and Research** | |
| 4.1 | Listening Comprehension | 1 |
| 4.2 | Interviewing and presenting oral reports | 1 |
| 4.3 | Mini presentations on select topics | 1 |
| 4.4 | Reading newspaper articles | 1 |
| 4.5 | Recommendations | 1 |
| 4.6 | Transcoding | 1 |
| 4.7 | Precis writing and Summarising | 1 |
| 4.8 | Reported Speech, Modals | 1 |
| 4.9 | Conjunctions | |
| **5.0** | **The Ability to put Ideas or Information Coherently** | |
| 5.1 | Listening to Formal job interviews | 1 |
| 5.2 | Role plays | 2 |
| 5.3 | Virtual interviews | 1 |
| 5.4 | Reading Company profiles | 1 |
| 5.5 | Writing Statement of Purpose (SoPs) | 1 |
| 5.6 | Writing Résumé | 1 |
| 5.7 | Numerical Adjectives and Relative Clauses - Idioms | 1 |
| 5.8 | Question types: Wh/ Yes or No/ and Tags | 1 |

**Course Designer(s)**

1. Dr.A.Palaniappan - palaniappan@ksrct.ac.in

| 60 MA 003 | **Integrals, Partial Differential Equations and Laplace Transform** | **Category** | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|---|---|
| | | **BS** | **3** | **1** | **0** | **4** |

## Objectives

- To acquire the knowledge about multiple integrals.
- To familiarize the basic concepts of vector calculus.
- To get exposed to the fundamentals of analytic functions.
- To solve various types of partial differential equations.
- To familiarize the concepts of Laplace transform.

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Interpret the basic concepts of double and triple integrals. | Apply |
| CO2 | Interpret the basic concepts of vector calculus. | Apply |
| CO3 | Construct the analytic functions and evaluate complex integrals. | Apply |
| CO4 | Compute the solution of partial differential equations using different methods. | Apply |
| CO5 | Apply Laplace transform techniques for solving differential equations. | Apply |

## Mapping with Programme Outcomes

| **COs** | **POs** | | | | | | | | | | | | **PSOs** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** |
| CO1 | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - | - | 3 |
| CO2 | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - | - | 3 |
| CO3 | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - | - | 3 |
| CO4 | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - | - | 3 |
| CO5 | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - | - | 3 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| **Bloom's Category** | **Continuous Assessment Tests (Marks)** | | **Model Examination (Marks)** | **End Sem Examination (Marks)** |
|---|---|---|---|---|
| | **1** | **2** | | |
| Remember | 10 | 10 | 10 | 10 |
| Understand | 10 | 10 | 20 | 20 |
| Apply | 40 | 40 | 70 | 70 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | 100 |



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**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Common to MECH, ECE, EEE, CSE, MCT, CIVIL, IT, TXT, BT, FT** | | | | | | | | |
| **60 MA 003 – Integrals, Partial Differential Equations and Laplace Transform** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| II | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 |

| | |
|---|---|
| **Multiple Integrals**<br>Double integration – Cartesian and polar co-ordinates – Change of order of integration – Area as double integral – Triple integration in Cartesian co-ordinates – Change of variables - Cartesian to polar co-ordinates and Cartesian to Cylindrical co-ordinates.<br>**Hands - on:** Evaluating double integrals, triple integrals, area as double integrals and volume as triple integrals | **[9]** |
| **Vector Calculus***<br>Introduction - Gradient of a scalar point function –Directional derivative – Angle of intersection of two surfaces – Divergence and curl (excluding vector identities) – Solenoidal and irrotational vectors – Application: Green’s theorem in the plane – Gauss divergence theorem - Stokes’ theorem (statement only).<br>**Hands - on:** Evaluating Gradient, divergence and curls. | **[9]** |
| **Analytic Functions and Integrals**<br>Analytic function – Necessary and Sufficient conditions (statement only)-Properties – Harmonic function – Construction of an analytic function – Cauchy’s Integral theorem (statement only) – Cauchy’s integral formula – Classification of singularities – Application: Cauchy’s residue theorem.<br>**Hands - on:** Plotting and visualizing functions of single variable, two and three variables. | **[9]** |
| **Partial Differential Equations***<br>Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions – Non-Linear partial differential equations of first order – Lagrange’s linear equations – Application: Homogeneous Linear partial differential equations with constant coefficients.<br>**Hands - on:** Calculate homogeneous linear partial differential equations. | **[9]** |
| **Laplace Transform**<br>Conditions for existence – Transforms of elementary functions – Basic properties - Derivatives and integrals of transforms - Initial and final value theorem – Transform of periodic functions. Inverse Laplace transform – Convolution theorem (excluding proof) – Application: Solution of second order ordinary differential equations with constant co-efficients.<br>**Hands - on:** Evaluating laplace, Inverse laplace transforms and solve differential equations. | **[9]** |
| **Total Hours: 45 + 5(Hands on) + 10(Tutorial)** | **60** |

| **Text Book(s):** | |
|---|---|
| 1. | Grewal B.S, “Higher Engineering Mathematics”, 44th Edition, Khanna Publishers, Delhi, 2017. |
| 2. | Kreyszig Erwin, “Advanced Engineering Mathematics”, 10th Edition, John Wiley and Sons (Asia) Limited, New Delhi, 2016. |
| **Reference(s):** | |
| 1. | Dass H.K, “Higher Engineering Mathematics”, 3rd (Revised) Edition, S.Chand & Company Ltd, New Delhi, 2014. |
| 2. | Veerarajan T, “Engineering Mathematics”, for Semesters I & II, 1st Edition, Tata McGraw Hill Publishing Co., New Delhi, 2019. |
| 3. | Kandasamy P, Thilagavathy K and Gunavathy K, “Engineering Mathematics - I”, S.Chand & Company Ltd, New Delhi, 2017 |
| 4. | Bali N P and Manish Goyal, ”A text book of Engineering Mathematics”,10th Edition, Laxmi Publications (P) Ltd, 2016. |

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| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Multiple Integrals** | |
| 1.1 | Double integration | 1 |
| 1.2 | Cartesian and polar coordinates | 1 |
| 1.3 | Change of order of integration | 1 |
| 1.4 | Area as double integral | 1 |
| 1.5 | Triple integration in Cartesian coordinates | 1 |
| 1.6 | Change of variables | 2 |
| 1.7 | Cartesian to polar coordinates | 1 |
| 1.8 | Cartesian to Cylindrical coordinates | 1 |
| 1.9 | Tutorial | 2 |
| 1.10 | Hands on | 1 |
| **2.0** | **Vector Calculus** | |
| 2.1 | Introduction: Gradient of a scalar point function | 1 |
| 2.2 | Directional derivative | 1 |
| 2.3 | Angle of intersection of two surfaces | 1 |
| 2.4 | Divergence and curl (excluding vector identities) | 1 |
| 2.5 | Solenoidal and irrotational vectors | 1 |
| 2.6 | Application: Green's theorem in the plane | 1 |
| 2.7 | Gauss divergence theorem | 2 |
| 2.8 | Stokes' theorem (statement only) | 1 |
| 2.9 | Tutorial | 2 |
| 2.10 | Hands on | 1 |
| **3.0** | **Analytic Functions And Integrals** | |
| 3.1 | Analytic function | 1 |
| 3.2 | Necessary and Sufficient conditions (statement only) | 1 |
| 3.3 | Properties | 1 |
| 3.4 | Harmonic function | 1 |
| 3.5 | Construction of an analytic function | 1 |
| 3.6 | Cauchy's Integral theorem (statement only), Cauchy's integral formula | 2 |
| 3.7 | Classification of singularities | 1 |
| 3.8 | Applications : Cauchy's residue theorem. | 1 |
| 3.9 | Tutorial | 2 |
| 3.10 | Hands on | 1 |
| **4.0** | **Partial Differential Equations** | |
| 4.1 | Formation of partial differential equations by eliminating arbitrary constants | 1 |
| 4.2 | Formation of partial differential equations by eliminating arbitrary functions | 2 |
| 4.3 | Non- linear partial differential equations of first order | 3 |
| 4.4 | Lagrange's linear equations | 1 |
| 4.5 | Application: Homogeneous Linear partial differential equations with constant coefficients. | 2 |
| 4.6 | Tutorial | 2 |
| 4.7 | Hands on | 1 |
| **5.0** | **Laplace Transform** | |
| 5.1 | Conditions for existence | 1 |
| 5.2 | Transforms of elementary functions | 1 |



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| | | |
|---|---|---|
| 5.3 | Basic properties | 1 |
| 5.5 | Derivatives and integrals of transforms, Initial and final value theorem | 1 |
| 5.6 | Transform of periodic functions | 1 |
| 5.7 | Inverse Laplace transform | 1 |
| 5.8 | Convolution theorem (excluding proof) | 1 |
| 5.9 | Application: Solution of second order ordinary differential equation with constant co-efficient. | 2 |
| 5.10 | Tutorial | 2 |
| 5.11 | Hands on | 1 |

**Course Designer(s)**


1. Dr.C.Chandran - cchandran@ksrct.ac.in
2. Dr.K.Prabakaran - prabakaran@ksrct.ac.in




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| 60 ME 001 | Engineering Drawing | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | ES | 2 | 0 | 4 | 4 |

## Objectives

- To convey to acquire various concepts of dimensioning, conventions and standards.
- To impart the graphic skills for converting pictorial views of solids in to orthographic views.
- To learn the concept in projection of solids.
- To draws the section of solids and to know development of different types of surfaces.
- To learn the concept in isometric projection.

## Pre-requisites

- Basic knowledge of Higher Secondary Mathematics, Binary Operations & Mathematical Logic.

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Use the drafting instruments for construct the conic sections | Apply |
| CO2 | Convert the pictorial views of solids in to orthographic views | Apply |
| CO3 | Draw the projections of regular solids | Apply |
| CO4 | Draw the true shape of sections and develop the lateral surfaces of right solids. | Apply |
| CO5 | Sketch the three-dimensional view of solids for given orthographic views and 2D drawing using drafting software. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | 3 |
| CO3 | 3 | 3 | 3 | - | 3 | - | - | 3 | - | - | - | - | 3 | 3 |
| CO4 | 3 | 3 | 3 | - | 3 | - | - | 3 | - | - | - | - | 3 | 3 |
| CO5 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 10 | 10 | 20 | 20 |
| Understand | 20 | 20 | 30 | 30 |
| Apply | 30 | 30 | 50 | 50 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E – Mechatronics Engineering** | | | | | | | | |
| **60 ME 001- Engineering Drawing** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| II | 2 | 0 | 4 | 90 | 4 | 50 | 50 | 100 |

| | |
|---|---|
| **Introduction to Engineering Drawing and Plane Curves**<br>Use of drawing instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning – Drawing sheet layouts - Title block – Line types – Scales: plain, diagonal and vernier scales. Construction of ellipse, parabola and hyperbola (Eccentricity method) - Construction of rectangular hyperbola - Construction of cycloids, epicycloids and hypocycloids | **[6+12]** |
| **Orthographic Projection**<br>Introduction to orthographic projections – Planes of projection – Projection of points and lines inclined to both planes – Projection of planes (Inclined to one plane and parallel to other – Inclined to both planes) - Conversions of pictorial views to orthographic views | **[6+12]** |
| **Projection of Solids**<br>Projections of simple solids: prism, pyramid, cylinder and cone (Axis of solid inclined to both HP and VP). | **[6+12]** |
| **Sections of solids and Development of surfaces**<br>Sections of solids :Prism, Cylinder, Pyramid, Cone – Auxiliary Views - Draw the sectional orthographic views of geometrical solids, objects from industry - Development of surfaces of Right solids – Prism, Pyramid, Cylinder and Cone | **[6+12]** |
| **Isometric Projection and Introduction to AutoCAD**<br>Principles of isometric projection – Isometric scale – Isometric projections of simple solids: Prism, pyramid, cylinder and cone - Isometric projections of frustum and truncated solids - Combination of two solid objects in simple vertical positions. | **[6+12]** |
| **Total Hours(Lecture=30 Hours + Practice=60 Hours)** | **90** |

**Text Book(s):**

| | |
|---|---|
| 1. | Bhatt N.D., “Engineering Drawing”, Charotar Publishing House Pvt. Ltd., 53rd Edition, Gujarat, 2019 |
| 2. | Basant Agarwal and C.M.Agarwal., “Engineering Drawing”, McGraw Hill Education, 2013. |

**Reference(s):**

| | |
|---|---|
| 1. | Shah M.B., Rana B.C., and V.K.Jadon., “Engineering Drawing”, Pearson Education, 2011. |
| 2. | Natarajan K.V., “A Text Book of “Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2014. |
| 3. | Venugopal K., “Engineering Graphics”, New Age International (P) Limited, 2014. |
| 4. | Dhawan, R.K., “A Text Book of Engineering Drawing” 3rd Revised Edition, S. Chand Publishing, New Delhi, 2012. |

*SDG 9 – Industry Innovation and Infrastructure



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| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1** | **Introduction to Engineering Drawing and Plane Curves** | |
| 1.1 | Use of drawing instruments | 1 |
| 1.2 | BIS conventions and specifications – Size, layout and folding of drawing sheets | 1 |
| 1.3 | Lettering and dimensioning -Drawing sheet layouts - Title block - Line types | 2 |
| 1.4 | Scales: plain, diagonal and vernier scales | 2 |
| 1.5 | Construction of ellipse | 1 |
| 1.6 | Construction of parabola | 2 |
| 1.7 | Construction hyperbola by eccentricity method | 1 |
| 1.8 | Practice class for ellipse, parabola and hyberbola | 2 |
| 1.9 | Construction of rectangular hyperbola | 2 |
| 1.10 | Construction of cycloids | 1 |
| 1.11 | Construction of epicycloids and hypocycloids | 2 |
| 1.12 | Practice class for cycloids and hypocycloids | 1 |
| **2** | **Orthographic Projection** | |
| 2.1 | Introduction to orthographic projections | 2 |
| 2.2 | Planes of projection | 2 |
| 2.3 | Projection of points | 1 |
| 2.4 | Projection of lines inclined to both planes | 2 |
| 2.5 | Projection of planes | 2 |
| 2.6 | Projection of planes Inclined to both planes | 2 |
| 2.7 | Conversions of pictorial views to orthographic views | 3 |
| 2.8 | Practice class for pictorial views to orthographic views | 2 |
| 2.9 | Practice class for pictorial views to orthographic views | 2 |
| **3** | **Projection of Solids** | |
| 3.1 | Projections of simple solids: prism | 2 |
| 3.2 | Projections of simple solids: cylinder | 3 |
| 3.3 | Projections of simple solids: pyramid | 3 |
| 3.4 | Projections of simple solids: Cone | 2 |
| 3.5 | Practice class for Projection of Solids | 3 |
| 3.6 | Axis of solid inclined to both HP and VP | 5 |
| **4** | **Sections of solids and Development of surfaces** | |
| 4.1 | Section of solids for Prism | 2 |
| 4.2 | Section of solids for Cylinder | 2 |
| 4.3 | Section of solids for Pyramid | 2 |
| 4.4 | Section of solids for Cone | 2 |
| 4.7 | Auxiliary Views - Draw the sectional orthographic views of geometrical solids | 2 |
| 4.8 | Draw the sectional orthographic views of objects from industry | 2 |
| 4.9 | Development of surfaces of Right solids Prism | 2 |
| 4.10 | Development of surfaces of Right solids Pyramid | 2 |
| 4.11 | Development of surfaces of Right solids Cylinder and Cone | 2 |
| **5** | **Isometric Projection and Introduction to AutoCAD** | |
| 5.1 | Principles of isometric projection | 2 |
| 5.2 | Isometric scale | 2 |
| 5.3 | Isometric projections of simple solids: Prism | 2 |

| | | |
|---|---|---|
| 5.4 | Isometric projections of simple solids: Pyramid | 2 |
| 5.5 | Isometric projections of simple solids: Cylinder | 2 |
| 5.6 | Isometric projections of simple solids: Cone | 2 |
| 5.7 | Isometric projections of frustum | 2 |
| 5.8 | Isometric projections of truncated solids | 2 |
| 5.9 | Combination of two solid objects in simple vertical positions | 2 |

**Course Designer(s)**

1. Dr.G.Venkatachalam-venkatachalam@ksrct.ac.in

| 60 CS 001 | C Programming | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | ES | 3 | 0 | 0 | 3 |

## Objectives

- To learn most fundamental element of the C language and to examine the execution of branching, looping statements,
- To examine the concepts of arrays, its characteristics and types and strings.
- To understand the concept of functions, pointers and the techniques of putting them to use
- To apply the knowledge of structures and unions to solve basic problems in C language
- To enhance the knowledge in file handling functions for storage and retrieval of data

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Construct the fundamental building blocks of structured Programming in C | Apply |
| CO2 | Implement the different operations on arrays and strings | Apply |
| CO3 | Develop simple real world applications utilizing functions, recursion and pointers. | Apply |
| CO4 | Demonstrate the concepts of structures ,unions ,user defined data types and preprocessor | Apply |
| CO5 | Interpret the file concepts using proper standard library functions for a given application | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | - | 3 | - | - | - | 2 | 2 | - | 2 | 3 | 3 |
| CO2 | 3 | 3 | 3 | - | 3 | - | - | - | 2 | 2 | - | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | - | 3 | - | - | - | 2 | 2 | - | 2 | 3 | 3 |
| CO4 | 3 | 3 | 3 | - | 3 | - | - | - | 2 | 2 | - | 2 | 3 | 3 |
| CO5 | 3 | 3 | 3 | - | 3 | - | - | - | 2 | 2 | - | 2 | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 10 | 10 | 20 | 20 |
| Understand | 10 | 10 | 20 | 20 |
| Apply | 40 | 40 | 60 | 60 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | 100 |



CHAIRMAN
Board Of Studies/
Mechatronics Engineering

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Common to all Branches** | | | | | | | | |
| **60 CS 001 – C Programming** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| II | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Basics of C, I/O, Branching and Loops***<br>Structure of a C Program – Data types – Keywords - Variables – Type Qualifiers - Constants – Operators–expressions and precedence- Console I/O– Unformatted and Formatted Console I/O - Conditional Branching and Loops-Writing and evaluation of conditionals and consequent branching | **[9]** |
| **Arrays and Strings***<br>Arrays: One Dimensional Arrays - Two Dimensional Arrays — Matrix Manipulation - Character arrays – Strings: String Manipulation with and without String Handling Functions. | **[7]** |
| **Functions and Pointers***<br>Functions: Scope of a Function – Library Functions and User defined functions - Function Prototypes –Call by value and Call by reference – Function Categorization- Arguments to main function—Recursion and application - Passing Arrays to Functions– Storage class Specifiers.<br>Introduction to Pointer Variables - The Pointer Operators - Pointer Expressions - Pointers and Arrays - Generating a Pointer to an Array - Indexing Pointers– Function and pointers - Dynamic memory allocation. | **[11]** |
| **Structures, Unions, Enumerations, Typedef and Preprocessors***<br>Structures - Introduction to Structures and Initialization - Arrays of Structures- Arrays and Structures, Nested Structures - Passing Structures to Functions - Structure Pointers - Unions – Bit Fields - Enumerations - typedef –The preprocessor and commands. | **[9]** |
| **File Handling***<br>File: Streams –Reading and Writing Characters - Reading and Writing Strings - File System functions – File Manipulation-Sequential access - Random Access Files – Command Line arguments. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Herbert Schildt, “The Complete Reference C”, Fourth Edition, Tata McGraw Hill Edition, 2010. |
| 2. | Byron Gottfried, “Programming with C”, Third Edition, McGraw Hill Education, 2014. |

**Reference(s):**

| | |
|---|---|
| 1. | Balagurusamy E, “Programming in ANSI C”, Seventh Edition, Tata McGraw Hill Edition, New Delhi, 2016. |
| 2. | Brian W. Kernighan and Dennis M. Ritchie, “C Programming Language”, Prentice-Hall. |
| 3. | ReemaThareja, “Computer Fundamentals and Programming in C”, Second Edition, Oxford Higher Education, 2016. |
| 4. | King K N, “C Programming: A Modern Approach”, Second Edition, W.W.Norton, New York, 2008. |

*SDG:4- Quality Education

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Basics of C, I/O, Branching and Loops** | |
| 1.1 | Structure of a C Program, Keywords | 1 |
| 1.2 | Data types, Type Qualifiers | 1 |
| 1.3 | Variables and Constants | 1 |
| 1.4 | Operators–expressions and precedence | 1 |
| 1.5 | Console I/O– Unformatted and Formatted Console I/O | 1 |
| 1.6 | Conditional Branching | 1 |
| 1.7 | Iteration and loops | 2 |
| 1.8 | Writing and evaluation of conditionals and consequent branching | 1 |
| **2.0** | **Arrays and Strings** | |
| 2.1 | One Dimensional Array | 1 |
| 2.2 | Two-Dimensional Array and Matrix Manipulation | 1 |
| 2.3 | Character arrays and Strings Basics | 1 |
| 2.4 | String Manipulation without String Handling Functions | 2 |
| 2.5 | String Manipulation with String Handling Functions | 2 |
| **3.0** | **Functions and Pointers** | |
| 3.1 | Scope of a Function – Library Functions, User defined functions and Function Prototypes | 1 |
| 3.2 | Function Call by value and Function Call by reference,Function Categorization | 2 |
| 3.3 | Arguments to main function | 1 |
| 3.4 | Recursion and application | 1 |
| 3.5 | Passing Arrays to Functions | 1 |
| 3.6 | Storage class Specifiers | 1 |
| 3.7 | Introduction to Pointer Variables - The Pointer Operators - Pointer Expressions | 1 |
| 3.8 | Pointers and Arrays - Generating a Pointer to an Array - Indexing Pointers | 1 |
| 3.9 | Function and pointers | 1 |
| 3.10 | Dynamic memory allocation | 1 |
| **4.0** | **Structures, Unions, Enumerations, Typedef and Preprocessors** | |
| 4.1 | Introduction to Structures and Initialization | 1 |
| 4.2 | Arrays and Structures, Arrays of Structures | 1 |
| 4.3 | Structures within Structures, Passing Structures to Functions | 2 |
| 4.4 | Structure Pointers | 1 |
| 4.5 | Unions and Bit Fields. | 1 |
| 4.6 | Enumerations - typedef | 1 |
| 4.7 | Preprocessor commands | 2 |
| **5.0** | **File Handling** | |
| 5.1 | File Streams –Reading and Writing Characters - Reading and Writing Strings | 2 |
| 5.2 | File System functions and File Manipulation | 2 |
| 5.3 | Sequential access | 2 |
| 5.4 | Random Access Files | 2 |
| 5.5 | Command Line arguments and files | 1 |

**Course Designer(s)**

1. Dr.P.Kaladevi - kaladevi@ksrct.ac.in

| 60 CH 001 | Chemistry for Mechanical Sciences | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | BS | 3 | 0 | 0 | 3 |

## Objectives

- To help the learners to analyse the hardness of water and its removal
- To study the concepts of electrochemistry and corrosion control.
- To learn about the types of engineering materials.
- To explain the characteristics and application of chemical sensors
- To study the types of batteries and fuel cells.

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Identify the types of hardness of water and its removal. | Apply |
| CO2 | Interpret the applications of electrochemistry, corrosion and its control | Apply |
| CO3 | Summarize the application of protective coatings. | Understand |
| CO4 | Categorize the types of sensors for various applications. | Apply |
| CO5 | Illustrate the significance of the types of batteries and fuel cells. | Understand |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| CO2 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | 3 |
| CO3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| CO4 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | 3 |
| CO5 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | - |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 20 | 20 | 20 | 20 |
| Understand | 30 | 30 | 60 | 60 |
| Apply | 10 | 10 | 20 | 20 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | 100 |

**Syllabus**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
| **(Common to Mechanical and Mechatronics)** | | | | | | | | |
| **60 CH 001 – Chemistry for Mechanical Sciences** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| I/II | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Water Technology*** <br> Introduction – Commercial and Industrial uses of Water - Hardness - Types – Estimation of Hardness by EDTA Method- Internal Conditioning (Colloidal, Phosphate, Calgon and Carbonate Conditioning Methods) – External Conditioning (Zeolite Process, Demineralization Process) - Desalination Methods (Reverse Osmosis and Electro Dialysis) - Flash Evaporation. | [9] |
| **Electrochemistry and Corrosion***** <br> Electrode Potential - Nernst Equation - Derivation and Problems - Reversible and Irreversible Cells - Types of Electrodes and Its Applications - Reference Electrodes - pH, Conductometric and Potentiometric Titrations. Electrochemical Corrosion, Corrosion due to Dissimilar Metal Cells (Galvanic Cells), Corrosion due to Differential Aeration - Factors Influencing Corrosion - Corrosion Control: Cathodic Protection (Sacrificial Anodic Protection, Impressed Current Cathodic Protection). | [9] |
| **Protective Coatings ***** <br> Protective Coatings: Classification - Metallic Coating: Electroplating – Electroless Plating - Diffusion Coating. Paint: Types and Characteristics of Paints - Constituents - Drying Process. Varnishes: Characteristics - Constituents. Enamels and Lacquers (Natural Resins). Electro Polishing of Mild Steel- Electrochemical Machining – Electrophoretic Painting in Automotive Industry, Technology of Electro Priming – Electrochemical Etching for Conductors and Semiconductors – Electroforming – Electro Winning of Aluminium – Anodizing of Aluminium. | [9] |
| **Chemical Sensors ***** <br> Sensors – Chemical Sensors – Characteristics – Elements and Characterization - Potentiometric Sensors -Amperometric Sensors – Sensors Based on Electrochemical Methods – Electrochemical Biosensors – Optical Biosensors: Enzyme Sensors – Bio Affinity <br> Sensors - DNA Sensors. Chemical Sensors as Detectors and Indicators: Indicators for Titration Processes – Separation Methods. Nano Technology in Chemical Sensors. | [9] |
| **Energy Storage Devices **, *** &** **** <br> Reversible and Irreversible Cells – Batteries - Types of Batteries. Fabrication and Working of Alkaline Battery - Lead-Acid Battery-Ni-Cd-Lithium Ion Batteries – Fuel Cells: Hydrogen-Oxygen Fuel Cell - Microbial Fuel Cell (Mfc). Organic Solar Cells-Working Principle and Applications Organic Transistors- Construction-Working Principle and Applications in Electronic Industries. | [9] |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Palanna O.G., “Engineering Chemistry”, Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 2017. |
| 2. | Jain P.C. and Monica Jain, “A Textbook of Engineering Chemistry”, Dhanpat Raj Publications, New Delhi, 16th edition, 2015. |

**Reference(s):**

| | |
|---|---|
| 1. | Jain. P.C. and Monica Jain, “Engineering Chemistry”, Dhanpatrai publishing co. New Delhi, 14th Edition, 2015. |
| 2. | Pletcher D and Walsh F C, “Industrial Electrochemistry”, Chapman and Hall, 2nd Edition, New York, 1990. |
| 3. | Roussak O.V. and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013. |
| 4. | Shikha Agarwal, “Engineering Chemistry-Fundamentals and Applications”, Cambridge University Press, Delhi, 2nd Edition, 2019. |

*SDG 6 Improve Clean Water and Sanitation
**SDG 7 Affordable and clean energy
***SDG 9 Industry, innovation and infrastructure
****SDG 12 Responsible consumption and production

w.e.f. 07/01/2023
Passed in the BoS Meeting Held on 23/12/2022
Approved in Academic Council Meeting held on 07/01/2023

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Mechatronics Engineering

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Water Technology** | |
| 1.1 | Introduction – Commercial and Industrial Uses of Water | 1 |
| 1.2 | Hardness – Types | 1 |
| 1.3 | Estimation of Hardness of Ater by EDTA Method | 1 |
| 1.4 | Internal Conditioning (Colloidal, Phosphate, Calgon and Carbonate) | 1 |
| 1.5 | External Conditioning (Zoelite Process & Demineralization Process) | 1 |
| 1.6 | Desalination Methods (Reverse Osmosis and Electrodialysis) | 1 |
| 1.7 | Flash Evaporation | 1 |
| **2.0** | **Electrochemistry And Corrosion** | |
| 2.1 | Electrode Potential - Nernst Equation - Derivation and Problems | 1 |
| 2.2 | Reversible and Irreversible Cells | 1 |
| 2.3 | Types of Electrodes and its Applications | 2 |
| 2.4 | Reference Electrodes – Ph | 1 |
| 2.5 | Conductometric and Potentiometric Titrations | 1 |
| 2.6 | Electrochemical Corrosion, Corrosion Due to Dissimilar Metal Cells (Galvanic Cells), | 1 |
| 2.7 | Corrosion due to Differential Aeration - Factors Influencing Corrosion | 2 |
| 2.8 | Corrosion Control: Cathodic Protection (Sacrificial Anodic Protection, Impressed Current Cathodic Protection). | 1 |
| **3.0** | **Protective Coatings** | |
| 3.1 | Protective Coatings: Classification | 1 |
| 3.2 | Metallic Coating: Electroplating – Electroless Plating - Diffusion Coating. | 1 |
| 3.3 | Paint: Types and Characteristics of Paints - Constituents - Drying Process. | 1 |
| 3.4 | Varnishes: Characteristics - Constituents. Enamels and Lacquers (Natural Resins). | 1 |
| 3.5 | Electro Polishing of Mild Steel- Electrochemical Machining – Electro Phoretic Painting in Automotive Industry, | 2 |
| 3.6 | Technology of Electro Priming – Electrochemical Etching for Conductors and Semiconductors | 2 |
| 3.7 | Electroforming – Electro Winning of Aluminium – Anodizing of Aluminium. | 1 |
| **4.0** | **Chemical Sensors** | |
| 4.1 | Sensors – Chemical Sensors – Characteristics | 1 |
| 4.2 | Elements and Characterization | 1 |
| 4.3 | Potentiometric Sensors, Amperometric Sensors | 1 |
| 4.4 | Sensors Based on Electrochemical Methods | 1 |
| 4.5 | Electrochemical Biosensors | 1 |
| 4.6 | Optical Biosensors : Enzyme Sensors – Bio Affinity Sensors | 1 |
| 4.7 | DNA Sensors. Chemical Sensors as Detectors and Indicators | 1 |
| 4.8 | Indicators for Titration Processes | 1 |
| 4.9 | Separation Methods. Nano technology in Chemical Sensors. | 2 |
| **5.0** | **Energy Storage Devices** | |
| 5.1 | Reversible and Irreversible Cells – Batteries - Types of Batteries. | 2 |
| 5.2 | Fabrication and Working of Alkaline Battery | 1 |
| 5.3 | Lead-Acid Battery | 1 |
| 5.4 | Ni-Cd-Lithium Ion Batteries | 1 |
| 5.5 | Fuel Cells: Hydrogen-Oxygen Fuel Cell | 1 |
| 5.6 | Microbial Fuel Cell (MFC). | 1 |
| 5.7 | Organic Solar Cells-Working Principle and Applications Organic Transistors | 1 |
| 5.8 | Construction-Working Principle and Applications in Electronic Industries. | 1 |

**Course Designer(s)**

1. Dr.T.A.Sukantha
2. Dr.B.Srividhya
3. Dr.K.Prabha
4. Dr.S.Meenachi
5. Mr.K.Tamilarasu
6. Ms.D.Kirthiga

| 60 GE 001 | Heritage of Tamils | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | GE | 1 | 0 | 0 | 1 |

## Objectives

- To learn the extensive literature of classical Tamil.
- To review the fine arts heritage of Tamil culture.
- To realize the contribution of Tamils in Indian freedom struggle

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Recognize the extensive literature of Tamil and its classical nature. | Understand |
| CO2 | Apprehend the heritage of sculpture, painting and musical instruments of ancient people. | Understand |
| CO3 | Review on folk and martial arts of Tamil people. | Understand |
| CO4 | Insight thinai concepts, trade and victory of Chozha dynasty. | Understand |
| CO5 | Realize the contribution of Tamil in Indian freedom struggle, self-esteem movement and siddha medicine. | Understand |

## Mapping with Programme Outcomes

| COs | Pos | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | - | - | - | - | - | 2 | - | 3 | 2 | - | - | 1 | - | - |
| CO2 | - | - | - | - | - | 1 | 1 | 1 | - | - | - | 3 | - | - |
| CO3 | - | - | - | - | - | 2 | - | 3 | 3 | 2 | - | 2 | - | - |
| CO4 | 2 | - | - | - | - | 1 | 1 | 2 | 1 | 2 | - | 1 | - | - |
| CO5 | - | | - | - | - | - | - | 3 | 2 | 2 | - | 2 | - | - |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 20 | 20 | 34 | - |
| Understand | 40 | 40 | 66 | - |
| Apply | - | - | - | - |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | - |

**Syllabus**

| K.S.Rangasamy College of Technology - Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 60 GE 001- Heritage of Tamils | | | | | | | | |
| Common to all Departments | | | | | | | | |
| Semester | Hours/W eek | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 1 | 0 | 0 | 15 | 1# | 100 | 0 | 100 |

| | |
|---|---|
| **Language, Literature, Life Skills & Ethics*** Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan-Life, Responsibility, Self-exploration, Attitude, Self-confidence, Goals, Relationships, Leadership, Gender equality | **[3]** |
| **Heritage - Rock Art Paintings to Modern Art – Sculpture*** Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making -Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils. | **[3]** |
| **Folk and Martial Arts*** Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils. | **[3]** |
| **Thinai Concept of Tamils*** Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas. | **[3]** |
| **Contribution of Tamils to Indian National Movement and Indian Culture*** Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books. | **[3]** |
| **Total Hours** | 15 |

| Text Book(s) cum Reference Book(s) | |
|---|---|
| 1. | **முனைவர் கே. கே. பிள்ளை, தமிழக வரலாறு - மக்களும் பண்பாடும், தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்,** 18th Ed ,2022. |
| 2. | **முனைவர் இல. சுந்தரம், கணினித்தமிழ்,விகடன் பிரசுரம்,** 2nd Ed,2021 |
| 3. | **முனைவர் இரா.சிவானந்தம், மு.சேரன், கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம், தொல்லியல் துறை வெளியீடு,** 6th Ed,2020. |
| 4. | **முனைவர் இரா.சிவானந்தம் , முனைவர் ஜெ.பாஸ்கர், பொருநை - ஆற்றங்கரை நாகரிகம், தொல்லியல் துறை வெளியீடு,** 1st Ed ,2022 |
| 5. | **ஈரோடு கதிர், உயர்தல் உரிமை, சிக்ஸ் ப்ளஸ் ஒன் ட்ரெயினிங் அகாடமி,** 1st Ed,2024 |
| 6. | Dr.K.K.Pillay, Social Life of Tamils, TNTB & ESC and RMRL – (In print). |
| 7. | Dr.S.Singaravel, Social Life of the Tamils - The Classical Period, International Institute of Tamil Studies, 1st, 2001. |
| 8. | Dr.S.V.Subaramanian, Dr.K.D. Thirunavukkarasu, Historical Heritage of the Tamils, International Institute of Tamil Studies, 2nd, 2010 |
| 9. | Dr.M.Valarmathi, The Contributions of the Tamils to Indian Culture, International Institute of Tamil Studies, |
| 10. | Dr.R.Sivanantham, Keeladi - Sangam City Civilization on the banks of river Vaigai, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, |
| 11. | Dr.K.K.Pillay, Studies in the History of India with Special Reference to Tamil Nadu, K.K. Pillay( Published by the Author. |
| 12. | Dr.R.Sivanantham, Dr.J.Baskar, Porunai Civilization, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation. |
| 13 | R.Balakrishnan, Journey of Civilization Indus to Vaigai, Roja Muthiah Research Library,3rd Ed, 2022 |

*SDG 4 – Quality Education

# For Heritage of Tamils, additional 1 credit is offered and not accounted for CGPA.

| K.S.Rangasamy College of Technology–Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 60 GE 001- தமிழர் மரபு (அனைத்து துறைகளும் பொதுவானது) | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 1 | 0 | 0 | 15 | 1# | 100 | 0 | 100 |

| | |
|---|---|
| மொழி, இலக்கியம், வாழ்க்கைத் திறன்கள் மற்றும் நெறிமுறைகள்: * இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ் காப்பியங்கள் - தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு. வாழ்வியல், பொறுப்புணர்வு, சுய ஆய்வு, மனோபாவம், தன்னம்பிக்கை, இலக்குகள், உறவுகள், தலைமைப்பண்பு, பாலின சமநிலை. | [3] |
| மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை- சிற்பக் கலை. * நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு. | [3] |
| நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுள்: * தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து சிலம்பாட்டம், வளரி, புளியாட்டம், தமிழர்களின் விளையாட்டுகள். | [3] |
| தமிழர்களின் திணைக் கோட்பாடுகள்: * தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி . | [3] |
| இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: * இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ் புத்தகங்களின் அச்சு வரலாறு. | [3] |
| **Total Hours** | 15 |

**Text Book(s):**

| | |
|---|---|
| 1. | முனைவர் கே. கே. பிள்ளை, தமிழக வரலாறு - மக்களும் பண்பாடும், தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம், 18th Ed ,2022. |
| 2. | முனைவர் இல. சுந்தரம், கணினித்தமிழ்,விகடன் பிரசுரம், 2nd Ed,2021 |
| 3. | முனைவர் இரா.சிவானந்தம், மு.சேரன், கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம், தொல்லியல் துறை வெளியீடு, 6th Ed,2020. |
| 4. | முனைவர் இரா.சிவானந்தம் , முனைவர் ஜெ.பாஸ்கர், பொருநை - ஆற்றங்கரை நாகரிகம், தொல்லியல் துறை வெளியீடு, 1st Ed ,2022 |
| 5. | ஈரோடு கதிர், உயர்தல் உரிமை, சிக்ஸ் ப்ளஸ் ஒன் ட்ரெயினிங் அகாடமி, 1st Ed,2024 |
| 6. | Dr.K.K.Pillay, Social Life of Tamils, TNTB & ESC and RMRL – (In print). |
| 7. | Dr.S.Singaravel, Social Life of the Tamils - The Classical Period, International Institute of Tamil Studies, 1st, 2001. |
| 8. | Dr.S.V.Subaramanian, Dr.K.D. Thirunavukkarasu, Historical Heritage of the Tamils, International Institute of Tamil Studies, 2nd, 2010 |
| 9. | Dr.M.Valarmathi, The Contributions of the Tamils to Indian Culture, International Institute of Tamil Studies, |



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Mechatronics Engineering

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|---|---|
| 10. | Dr.R.Sivanantham, Keeladi - Sangam City Civilization on the banks of river Vaigai, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, |
| 11. | Dr.K.K.Pillay, Studies in the History of India with Special Reference to Tamil Nadu, K.K. Pillay( Published by the Author. |
| 12. | Dr.R.Sivanantham, Dr.J.Baskar, Porunai Civilization, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation. |
| 13 | R.Balakrishnan, Journey of Civilization Indus to Vaigai, Roja Muthiah Research Library,3rd Ed ,2022 |

*SDG 4 – Quality Education

# For Heritage of Tamils, additional 1 credit is offered and not accounted for CGPA.

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | மொழி மற்றும் இலக்கியம் | |
| 1.1 | இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் | 1 |
| 1.2 | திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள் - தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் | 1 |
| 1.3 | சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு. | 1 |
| **2.0** | மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை–சிற்பக் கலை | |
| 2.1 | நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் | 1 |
| 2.2 | தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை | 1 |
| 2.3 | இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு. | 1 |
| **3.0** | நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் | |
| 3.1 | தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து | 1 |
| 3.2 | ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி | 1 |
| 3.3 | புலியாட்டம், தமிழர்களின் விளையாட்டுகள். | 1 |
| **4.0** | தமிழர்களின் திணைக் கோட்பாடுகள் | |
| 4.1 | தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் | 1 |
| 4.2 | தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் | 1 |
| 4.3 | சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி. | 1 |
| **5.0** | இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு | |
| 5.1 | இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் | 1 |
| 5.2 | சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு | 1 |
| 5.3 | கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு. | 1 |



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| 60 CP 0P1 | Physics and Chemistry Laboratory | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | BS | 0 | 0 | 4 | 2 |

**Objectives**

- To infer the practical knowledge by applying the experimental methods to correlate with the Physics theory.
- To demonstrate an ability to make physical measurements and understand the limits of precision in measurements
- To analyze the behavior and characteristics of various materials for its optimum utilization
- Test the knowledge of theoretical concepts and develop the experimental skills of the learners.
- To facilitate data interpretation and expose the learners to various industrial and environmental applications.

**Pre-requisites**

- Nil

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Apply the concept of stress, strain and elastic limit for a given sample to find their properties | Apply |
| CO2 | Recognize the concept of quantum Physics & magnetic properties by experimental verification | Apply |
| CO3 | Recall the knowledge of properties of light and fiber optic cable | Apply |
| CO4 | Apply the concepts of chemistry and develop analytical skills for applications in engineering to determine the rate of corrosion | Apply |
| CO5 | Analyze the pH, electrode potential, conductance sample solutions | Analyze |

**Mapping with Programme Outcomes**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | - | - | - | - | - | - | 2 | 2 | - | - | - | - | - |
| CO2 | 3 | - | - | - | - | - | - | 2 | 2 | - | - | - | - | - |
| CO3 | 3 | - | - | - | - | - | - | 2 | 2 | - | - | - | - | - |
| CO4 | 3 | - | - | - | - | - | - | 2 | 2 | - | - | - | - | - |
| CO5 | 3 | - | - | - | - | - | - | 2 | 2 | - | - | - | - | - |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

**Assessment Pattern**

| Bloom's Category | Lab Experiments Assessment (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | Lab | Activity | | |
| Remember | 10 | - | 10 | 10 |
| Understand | 30 | 30 | 30 | 30 |
| Apply | 40 | 40 | 40 | 40 |
| Analyse | 20 | 30 | 20 | 20 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 100 | 100 | 100 | 100 |

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Common to CIVIL, MECH & MCT** | | | | | | | | |
| **60 CP 0P1 – Physics and Chemistry Laboratory** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hrs** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| I / II | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |

**List of Experiments (Physics):**

1. Determination of Young's modulus of a given material - Uniform bending
2. Determination of rigidity modulus of a wire - Torsional pendulum
3. Determination of Planck's constant
4. Magnetic field along the axis of current carrying coil – Stewart and Gee
5. (a) Laser- Determination of the wave length of the laser using grating
   (b) Optical fibre -Determination of Numerical Aperture and acceptance angle

* SDG: 4- Quality Education

**List of Experiments (Chemistry):**

1. Estimation of hardness of water sample by complexometric method.
2. Determination of Dissolved Oxygen in water sample by Winkler's method
3. Determination of corrosion by weight loss method
4. Estimation of HCl by pH meter.
5. Estimation of mixture of acids by conductivity meter.

**Case Studies/Activity Report**

1. Case study on Dissolved Oxygen in various water samples.
2. Activity report for determination of HCl using conductometric titration

***SDG 6: Improve Clean Water and Sanitation**
***SDG 9: Industry, Innovation, and Infrastructure**
***SDG 8: Decent Work and Economic Growth**

| **Lab Manual** | |
|---|---|
| 1. | "Engineering Physics Lab Manual", Department of Physics, KSRCT. |
| 2. | "Chemistry Lab Manual Volume I & II", Department of Chemistry, KSRCT. |

* SDG: 4- Quality Education

**Course Designer(s) - Physics**

1. Dr. V. Vasudevan - vasudevanv@ksrct.ac.in
2. Mr. S. Vanchinathan - vanchinathan@ksrct.ac.in
3. Dr. P. Suthanthira Kumar - suthanthirakumar@ksrct.ac.in

**Course Designer(s) - Chemistry**

1. Dr.T.A.Sukantha - sukantha@ksrct.ac.in
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3. Dr.S.Meenachi - meenachi@ksrct.ac.in



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| 60 CS 0P1 | C Programming Laboratory | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | ES | 0 | 0 | 4 | 2 |

## Objectives

- To enable the students to apply the concepts of C to solve simple problems
- To use selection and iterative statements in C programs
- To apply the knowledge of library functions in C programming
- To implement the concepts of arrays, functions, structures and pointers in C
- To implement the file handling operations through C

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Implement computational problems using selection and iterative Statements | Apply |
| CO2 | Demonstrate C program to manage collection of related data. | Apply |
| CO3 | Design and Implement different ways of passing arguments to functions, Recursion and implement pointers concepts. | Apply |
| CO4 | Develop a C program to manage collection of different data using structures, Union, user-defined data types and preprocessor directives. | Apply |
| CO5 | Demonstrate C program to store and retrieve data using file concepts. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | - | 3 | - | - | - | 2 | 2 | - | 2 | 3 | 3 |
| CO2 | 3 | 3 | 3 | - | 3 | - | - | - | 2 | 2 | - | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | - | 3 | - | - | - | 2 | 2 | - | 2 | 3 | 3 |
| CO4 | 3 | 3 | 3 | - | 3 | - | - | - | 2 | 2 | - | 2 | 3 | 3 |
| CO5 | 3 | 3 | 3 | - | 3 | - | - | - | 2 | 2 | - | 2 | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Lab Experiments Assessment (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) | |
|---|---|---|---|---|---|
| | Lab | Activity | | | |
| Remember | - | - | - | - | - |
| Understand | - | 12 | - | - | - |
| Apply | 50 | 13 | 100 | | 100 |
| Analyse | - | - | - | | - |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |
| Total | 50 | 25 | 100 | - | 100 |

w.e.f. 07/01/2023
Passed in the BoS Meeting Held on 23/12/2022
Approved in Academic Council Meeting held on 07/01/2023

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| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 CS 0P1 – C Programming Laboratory** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hrs** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| II | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |

**List of Experiments:**

1. Implementation of Simple computational problems using various formulas.
2. Implementation of Problems involving Selection statements.
3. Implementation of Iterative problems e.g., sum of series.
4. Implementation of 1D Array manipulation.
5. Implementation of 2D Array manipulation.
6. Implementation of String operations.
7. Implementation of Simple functions and different ways of passing arguments to functions and Recursive Functions.
8. Implementation of Pointers
9. Implementation of structures and Union.
10. Implementation of Bit Fields, Typedef and Enumeration.
11. Implementation of Preprocessor directives.
12. Implementation of File operations

* SDG:4- Quality Education

**Course Designer(s)**

1. Dr.P.Kaladevi - kaladevi@ksrct.ac.in



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| 60 CG 0P1 | Career Skill Development I | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | CG | 0 | 0 | 2 | 1* |

## Objectives

- To help learners improve their vocabulary and to enable them to use words appropriately in different academic and professional contexts
- To help learners develop strategies that could be adopted while reading texts
- To help learners acquire the ability to speak effectively in English in real life and career related situations
- To equip students with effective speaking and listening skills in English
- To facilitate learners to enhance their writing skills with coherence and appropriate format effectively

## Pre-requisites

- Basic knowledge of reading and writing in English.

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Listen and comprehend complex academic texts | Understand |
| CO2 | Read and infer the denotative and connotative meanings of technical texts | Analyze |
| CO3 | Write definitions, descriptions, narrations, and essays on various topics | Apply |
| CO4 | Speak fluently and accurately in formal and informal communicative contexts | Apply |
| CO5 | Appraise the verbal ability skills in the career development and professional Contexts | Analyze |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | - | - |
| CO2 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | - | 2 |
| CO3 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | 2 | 2 |
| CO4 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | - | - |
| CO5 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Common to All Branches** | | | | | | | | |
| **60 CG 0P1 -Career Skill Development I** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| II | 0 | 0 | 2 | 30 | 1* | 100 | 00 | 100 |

| | |
|---|---|
| **Listening**<br>Listening for General Information-Specific Details - Audio / Video (Formal & Informal) - Listen to Podcasts/ TED Talks/ Anecdotes / Stories / Event Narration / Documentaries and Interviews with Celebrities - Listen to a Product and Process Descriptions, Advertisements About Products or Services. | **[6]** |
| **Speaking**<br>Self-Introduction; Introducing a Friend; Conversation - Politeness Strategies - Narrating Personal Experiences / Events; Interviewing a Celebrity; Reporting / and Summarizing of Documentaries / Podcasts/ Interviews - Picture Description; Giving Instruction to use the Product; Presenting a Product - Small Talk; Mini Presentations - Group Discussions, Debates & Role Plays. | **[6]** |
| **Reading**<br>Loud Reading Vs Silent Reading, Skimming & Scanning of Passages, Reading Brochures (Technical Context), Social Media Messages Relevant to Technical Contexts and Emails - Biographies, Travelogues, Newspaper Reports and Travel & Technical Blogs - Advertisements, Gadget Reviews and User Manuals - Newspaper Articles and Journal Reports - Editorials; and Opinion Blogs | **[6]** |
| **Writing**<br>Writing Letters – Informal and Formal – Basics and Format Orientation - Paragraph Texting, Short Report on an Event (Field Trip Etc.) - Definitions; Instructions; and Product /Process Description - Note-Making / Note-Taking; Recommendations; Transferring Information from Non-Verbal (Charts, Graphs to Verbal Mode) - Essay Texting | **[6]** |
| **Verbal Ability I**<br>Reading Comprehension (MCQs) – Cloze Test - Sequencing of Sentences – Summarizing and Paraphrase – Error Detection – Spelling Test – Sentence Improvement - Preposition | **[6]** |
| **Total Hours:** | **30** |

**Reference(s):**


| | |
|---|---|
| 1. | 'English for Engineers & Technologists' Orient Blackswan Private Ltd. Department of English, Anna University, 2020 |
| 2. | Norman Lewis, 'Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary Book', Penguin Random House India, 2020 |
| 3. | Michael McCarthy and Felicity O Dell, 'English Vocabulary in Use: Upper Intermediate', Cambridge University Press, N.York, 2012 |
| 4. | Lakshmi Narayanan, 'A Course Book on Technical English' Scitech Publications (India) Pvt. Ltd. 2020 |


*SDG- 04- Quality Education

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Listening** | |
| 1.1 | Listening for General Information and Specific Details | 1 |
| 1.2 | Listening to Podcasts, Documentaries and Interviews with Celebrities | 1 |
| 1.3 | Narrating Personal Experiences | 1 |
| 1.4 | Readingrelevant to Technical Contexts and Emails | 1 |
| 1.5 | Listen to a Product and Process Descriptions | 1 |
| **2.0** | **Speaking** | |
| 2.1 | Self-Introduction | 1 |
| 2.2 | Summarizing of Documentaries& Picture Narration | 1 |
| 2.3 | Small Talk; Mini Presentations | 1 |
| 2.4 | Group Discussions, Debates & Role Plays. | 1 |
| 2.5 | Group Discussions | 1 |
| **3.0** | **Reading** | |
| 3.1 | Loud Reading Vs Silent Reading, Skimming & Scanning of Passages | 1 |
| 3.2 | Reading Social Media Messages Relevant to Technical Contexts | 1 |
| 3.3 | Reading Newspaper Reports and Travel & Technical Blogs | 1 |
| 3.4 | Reading Advertisements, Gadget Reviews and User Manuals | 1 |
| 3.5 | Reading Newspaper Articles and Journal Reports | 1 |
| **4.0** | **Writing** | |
| 4.1 | Writing Letters – Informal and Formal | 1 |
| 4.2 | Paragraph Texting | 1 |
| 4.3 | Definitions and Instructions | 1 |
| 4.4 | Note-Making / Note-Taking | 1 |
| 4.5 | Essay Texting | 1 |
| **5.0** | **Verbal Ability** | |
| 5.1 | Reading Comprehension (MCQs) and Cloze Test | 1 |
| 5.2 | Sequencing of Sentences | 1 |
| 5.3 | Paraphrasing and Summarizing | 1 |
| 5.4 | Error Detection and Spelling Test | 1 |
| 5.5 | Prepositions | 1 |

**Course Designer(s)**

1. Dr.A.Palaniappan- palaniappan@ksrct.ac.in



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**K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215**
(An Autonomous Institution affiliated to Anna University)
B.E. / B.Tech. Degree Programme
**SCHEME OF EXAMINATIONS**
(For the candidates admitted in 2022-2023)
THIRD SEMESTER

| S. No. | Course Code | Name of the Course | Duration of Internal Exam | Weightage of Marks | | | Minimum Marks for Pass in End Semester Exam | |
|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment* | End Semester Exam** | Max. Marks | End Semester Exam | Total |
| **THEORY** | | | | | | | | |
| 1 | 60 MA 007 | Statistics and Numerical Methods | 2 | 40 | 60 | 100 | 45 | 100 |
| 2 | 60 MC 301 | Analog Devices and Digital Circuits | 2 | 40 | 60 | 100 | 45 | 100 |
| 3 | 60 MC 302 | Sensors and Instrumentation | 2 | 50 | 50 | 100 | 45 | 100 |
| 4 | 60 MC 303 | Manufacturing Technology | 2 | 40 | 60 | 100 | 45 | 100 |
| 5 | 60 MC 304 | Mechanics of Solids | 2 | 40 | 60 | 100 | 45 | 100 |
| 6 | 60 MY 002 | Universal Human Values | 2 | 100 | 0 | 100 | 0 | 100 |
| 7 | 60 GE 002 | Tamils and Technology / தமிழரும் தொழில்நுட்பமும் | 2 | 100 | 0 | 100 | 0 | 100 |
| **PRACTICAL** | | | | | | | | |
| 8 | 60 MC 3P1 | Analog Devices and Digital Circuits Laboratory | 3 | 60 | 40 | 100 | 45 | 100 |
| 9 | 60 MC 3P2 | Manufacturing Technology Laboratory | 3 | 60 | 40 | 100 | 45 | 100 |
| 10 | 60 CG 0P2 | Career Skill Development-II | 3 | 100 | - | 100 | - | 100 |
| 11 | 60 CG 0P6 | Internship | - | 100 | - | 100 | - | 100 |

*** CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.**
**** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory courses, 50 marks for theory cum practical courses and 40 marks for Practical End Semester Examination.**

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Mechatronics Engineering

| 60 MA 007 | Statistics and Numerical Methods | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | BS | 3 | 1 | 0 | 4 |

## Objectives

- To familiarize the basic concepts of probability and random variables.
- To familiarize various distributions and testing of hypothesis.
- To learn basics of descriptive statistics.
- To get exposed to various techniques to solve equations numerically.
- To know the concepts of interpolation and numerical integration

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Interpret the basic concepts of probability and random variables. | Apply |
| CO2 | Apply Student's t test, F test and Chi-square test for testing the statistical hypothesis. | Apply |
| CO3 | Compute measures of central tendency, measures of dispersion and correlation coefficient. | Apply |
| CO4 | Employ various iteration techniques for solving algebraic, transcendental and system of linear equations. | Apply |
| CO5 | Apply different techniques to find the intermediate values and to evaluate single definite integrals. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - | - | 3 |
| CO2 | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - | - | 3 |
| CO3 | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - | - | 3 |
| CO4 | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - | - | 3 |
| CO5 | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - | - | 3 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 10 | 10 | 10 | 10 |
| Understand | 10 | 10 | 20 | 20 |
| Apply | 40 | 40 | 70 | 70 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | 100 |



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**Syllabus**

**K.S.Rangasamy College of Technology – Autonomous R2022**

**Common to CIVIL, MECH & MCT**

**60 MA 007 – Statistics and Numerical Methods**

| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 |

| | |
|---|---|
| **Probability and Random Variables**<br>Axioms of probability - Conditional probability - Baye's theorem - Random variable - Expectation - Probability mass function - Probability density function - Moment generating function.<br>**Hands - on: Calculate** expectation for discrete random variable. | **[9]** |
| Standard Distributions and **Testing of Hypothesis***<br>Binomial distribution - Poisson distribution – Type I and Type II errors - Test of significance of small samples - Student's 't' test - Single mean - Difference of means - F-test - Chi-square test - Goodness of fit - Independence of attributes.<br>**Hands - on:** Apply Student's t - test, F- test and Chi-square test to real dataset. | **[9]** |
| **Empirical Statistics**<br>**Measures of central tendency***: Mean, Median, Mode - Measures of dispersion: Range - Quartile deviation - Standard deviation - Measures of skewness: Bowley's co-efficient of skewness - Pearson's co-efficient of skewness- Correlation.<br>**Hands - on:** Calculate mean, median, mode and range for discrete frequency distribution. | **[9]** |
| **Solutions of Equations and Eigen Value Problem**<br>Algebraic and Transcendental equations - Newton Raphson method – Regula Falsi method - Gauss elimination method - Gauss Jordan method - Iterative methods: Gauss Jacobi method - Gauss Seidel method - Eigen value of a matrix by Power method.<br>**Hands - on:** Visualize the iterative methods for solving linear system of equations | **[9]** |
| **Interpolation and Numerical Integration**<br>**Lagrange's and Newton's divided difference interpolation (unequal intervals)**** - **Newton's forward and backward interpolation (equal intervals)**** - Two point and three point Gaussian quadrature - Trapezoidal, Simpson's 1/3 and 3/8 rule (single integral).<br>**Hands - on:** Numerical integration by Trapezoidal and Simpson's rules | **[9]** |
| **Total Hours: (Lecture - 45; Tutorial - 15)** | **60** |

**Text Book(s):**

| | |
|---|---|
| 1. | Gupta S. P., "Statistical Methods", 46th Revised Edition, Sultan Chand & Son, New Delhi, 2021. |
| 2. | Faires, J. D. and Burden, R., "Numerical Methods", 4th Edition, Brookes / Cole (Thomson Publications), New Delhi, 2011. |

**Reference(s):**

| | |
|---|---|
| 1. | Kapoor V. K., and Gupta S. C., "Fundamentals of Mathematical Statistics'', 12th Edition, Sultan Chand & sons, New Delhi, 2020. |
| 2. | Johnson, R. A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", 8th Edition, Pearson Education, Asia, 2023. |
| 3. | Grewal, B. S., and Grewal, J. S., "Numerical Methods in Engineering and Science", 10th Edition, Khanna Publishers, New Delhi, 2015. |
| 4. | Kandasamy P., Thilagavathy K. and Gunavathi K., "Numerical Methods", 3rd Edition, S.Chand & Company Ltd, New Delhi, 2003. |

*SDG:4 Quality Education,

**SDG:9 Industry, Innovation, and Infrastructure

w.e.f. 07/01/2023
Passed in the BoS Meeting Held on 23/12/2022
Approved in Academic Council Meeting held on 07/01/2023

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**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Probability and Random Variables** | |
| 1.1 | Axioms of probability | 1 |
| 1.2 | Conditional probability | 1 |
| 1.3 | Baye’s theorem | 1 |
| 1.4 | Random variable | 2 |
| 1.5 | Expectation | 1 |
| 1.6 | Probability mass function | 1 |
| 1.7 | Probability density function | 1 |
| 1.8 | Moment generating function | 1 |
| 1.9 | Tutorial | 2 |
| 1.10 | Hands on | 1 |
| **2.0** | **Standard Distributions and Testing of Hypothesis** | |
| 2.1 | Binomial Distribution | 1 |
| 2.2 | Poisson Distribution | 1 |
| 2.3 | Fit a Binomial and Poisson Distribution | 1 |
| 2.4 | T test | 1 |
| 2.5 | F test | 2 |
| 2.6 | Chi- square test | 1 |
| 2.7 | Test for Independency | 1 |
| 2.8 | Goodness of fit. | 1 |
| 2.9 | Tutorial | 2 |
| 2.10 | Hands on | 1 |
| **3.0** | **Empirical Statistics** | |
| 3.1 | Mean, Median and Mode | 2 |
| 3.2 | Range, Quartile deviation | 1 |
| 3.3 | Standard deviation | 1 |
| 3.4 | Pearson’s co-efficient ofskewness | 1 |
| 3.5 | Bowley’s co-efficient ofskewness | 1 |
| 3.6 | Measures of skewness | 1 |
| 3.7 | Correlation | 2 |
| 3.8 | Tutorial | 2 |
| 3.9 | Hands on | 1 |
| **4.0** | **System of Equations and Eigen Value Problem** | |
| 4.1 | Newton Raphson method | 1 |
| 4.2 | Gauss elimination method | 2 |
| 4.3 | Gauss Jordan method | 1 |
| 4.4 | Gauss Jacobi method | 1 |
| 4.5 | Gauss Seidel method | 1 |
| 4.6 | Matrix inversion by Gauss Jordan method | 1 |
| 4.7 | Eigen values of a matrix by power method | 2 |
| 4.8 | Tutorial | 2 |
| 4.9 | Hands on | 1 |
| **5.0** | **Interpolation and numerical integration** | |
| 5.1 | Lagrange’s interpolations | 1 |
| 5.2 | Newton’s divided difference interpolations | 2 |
| 5.3 | Newton’s forward and backward difference interpolations | 2 |
| 5.4 | Two and three point Gaussian quadratures | 2 |
| 5.5 | Single integration using Trapezoidal andSimpson’s1/3and3/8rules | 2 |
| 5.6 | Tutorial | 2 |
| 5.7 | Hands on | 1 |

**Course Designer(s)**


1. Dr.C.Chandran - cchandran@ksrct.ac.in

| 60 MC 301 | Analog Devices and Digital Circuits | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

## Objectives

- To procure the fundamental knowledge in semiconductor diodes and applications
- To impart the fundamental knowledge in the areas of transistors and amplifiers.
- To equip learners with Boolean algebra and design of combinational logic circuits.
- To acquaint learners with fundamentals and design of sequential circuits
- To educate learners with the basics of memory devices and implement combinational circuits

## Pre-requisites

- Basic Electrical and Electronics Engineering

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Describe the concepts and characteristics of Semiconductor Diodes | Understand |
| CO2 | Describe the characteristics of transistor and amplifiers | Understand |
| CO3 | Practice the Boolean techniques and design combinational circuits. | Apply |
| CO4 | Design Synchronous sequential circuit using flipflops. | Analyze |
| CO5 | Construct combinational logic functions using programmable logic Devices | Analyze |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 1 | 2 | 2 | 1 | - | - | - | - | 1 | 1 | 2 | 3 | 3 |
| CO2 | 3 | 2 | 2 | 1 | 1 | - | - | - | - | 1 | - | 2 | 3 | 3 |
| CO3 | 3 | 2 | 2 | 2 | 1 | - | - | - | 1 | 1 | - | 2 | 3 | 3 |
| CO4 | 3 | 2 | 1 | 1 | 1 | - | - | - | 1 | 1 | - | 2 | 3 | 3 |
| CO5 | 3 | 1 | 1 | 2 | 1 | - | - | - | 1 | 1 | 1 | 2 | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 30 | - | 20 | 20 |
| Understand | 30 | 20 | 30 | 30 |
| Apply | - | 20 | 30 | 30 |
| Analyse | - | 20 | 20 | 20 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | 100 |



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**Syllabus**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC 301 – Analog Devices and Digital Circuits** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Semiconductor Diodes and Applications**<br>Intrinsic and Extrinsic semiconductors - drift and diffusion current - Formation of PN junction – VI characteristics of diode – Static and dynamic resistance. Zener diode – Photo diode – Light emitting diode – Laser diode – Optocoupler- Clipperand Clamper - Voltage regulator and multipliers | **[9]** |
| **Transistor and Operational Amplifiers**<br>Construction & operation of BJT - Transistor characteristics - CE, CB and CC configuration - Construction & operation of JFET and MOSFET – FET characteristics - Ideal Op-Amp characteristics – Open loop, Closed loop configurations- Inverting & non-inverting amplifier – voltage follower - Summing amplifier- Comparators -Schmitt Trigger — Instrumentation Amplifier. | **[9]** |
| **Boolean Algebra and Combinational Circuits**<br>Boolean postulates and laws - Minimization of Boolean expressions - Karnaugh map minimization - Quine-McCluskeymethod of minimization.<br>Combinational circuits: Design procedure – Half adder – Full Adder – Half subtractor – Full subtractor – BCD adder – Multiplexer – Demultiplexer – encoder – decoder– parity checker – parity generators – Simulation of Combinational Circuits. | **[9]** |
| **Sequential Circuits**<br>Latches, Flip-flops – SR, JK, D, T and Master-Slave – Characteristic equation – Edge triggering – Level Triggering – Realization of one flip flop using other flip flops – Synchronous and Asynchronous Up/Down counters – Modulo–n counter-Registers. | **[9]** |
| **Memory and Programmable Logic Devices**<br>Classification of memories: ROM – PROM – EPROM – EEPROM – RAM – Write operation – Read operation – Static RAM Cell - Dynamic RAM cell –Programmable Logic Devices – Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) – Implementation of combinational logic circuits using PROM, PLA and PAL. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Thomas L. Floyd, "Electronic Devices", Prentice Hall of India Pvt. Ltd.,/ Pearson Education Pvt. Ltd., New Delhi,10th Edition, 2017. |
| 2. | Satish K Karna, "Digital Electronics", Vikas Publishing House Pvt. Ltd, New Delhi, 2nd Edition, 2017 |

**Reference(s):**

| | |
|---|---|
| 1. | David A.Bell, "Electronic Devices and Circuits", Oxford University Press, New Delhi, 5th Edition 2013. |
| 2. | Salivahanan S and Arivazhagan S, "Digital Circuits and Design", Vikas Publishing House Pvt. Ltd, New Delhi, 4th Edition, 2013. |
| 3. | Bishnu Charan Sarkar and Suvra Sarkar, "Analog Electronics Devices and Circuits", Damodar Group, WestBengal , 2019. |
| 4. | B.L. Theraja, A.K. Theraja, "A Text Book of Electrical Technology, Electronic Devices and Circuits", S. ChandReprint, 2013 |

*SDG 9 – Industry Innovation and Infrastructure



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| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Semiconductor Diodes and Applications** | |
| 1.1 | Intrinsic and Extrinsic semiconductors | 1 |
| 1.2 | Drift and diffusion current | 1 |
| 1.3 | Formation of PN junction | 1 |
| 1.4 | VI characteristics of diode | 1 |
| 1.5 | Static and dynamic resistance | 1 |
| 1.6 | Zener diode – photo diode – light emitting diode | 2 |
| 1.7 | Laser diode – optocoupler | 2 |
| 1.8 | Clipperand Clamper - voltage regulator and multipliers | 2 |
| **2.0** | **Transistor and Operational Amplifiers** | |
| 2.1 | Construction & operation of BJT | 1 |
| 2.2 | Transistor characteristics | 1 |
| 2.3 | CE, CB and CC configuration | 1 |
| 2.4 | Construction & operationof JFET and MOSFET – FET characteristics | 1 |
| 2.5 | Ideal Op-Amp characteristics - Open loop , Closed loop configurations | 1 |
| 2.6 | Inverting & non-inverting amplifier – | 1 |
| 2.7 | Voltage follower | 1 |
| 2.8 | Summing amplifier. | 1 |
| 2.9 | Comparators -Schmitt Trigger. | 1 |
| 2.10 | Instrumentation Amplifier. | 1 |
| **3.0** | **Boolean Algebra and Combinational Circuits**<br>Boolean postulates and laws | |
| 3.1 | Minimization of Boolean expressions - Karnaugh map minimization | 1 |
| 3.2 | Quine-McCluskeymethod of minimization | 2 |
| 3.3 | Combinational circuits: Design procedure – Half adder – Full Adder | 1 |
| 3.4 | Half subtractor – Full subtractor | 1 |
| 3.5 | BCD adder | 2 |
| 3.6 | Multiplexer – Demultiplexer | 1 |
| 3.7 | Encoder – decoder | 1 |
| 3.8 | Code Converters | 1 |
| **4.0** | **Synchronous devices** | |
| 4.1 | Latches, Flip-flops | 1 |
| 4.2 | SR, JK | 1 |
| 4.3 | D, T | 1 |
| 4.4 | Master-Slave | 1 |
| 4.5 | Characteristic equation – Edge triggering – Level Triggering | 2 |
| 4.6 | Realization of one flip flop using other flip flops | 1 |
| 4.7 | Synchronous and Asynchronous Up/Down counters - Modulo–n counter | 1 |
| 4.8 | Registers | |
| **5.0** | Realization of one flip flop using other flip flops | |
| 5.1 | Synchronous and Asynchronous Up/Down counters - Modulo–n counter | 1 |
| 5.2 | Registers | |
| 5.3 | **Memory and Programmable Logic Devices** | |
| 5.4 | Classification of memories: ROM – PROM – EPROM – EEPROM – RAM – Write operation – Read operation | 1 |
| 5.5 | Static RAM Cell - Dynamic RAM cell | 1 |
| 5.6 | Programmable Logic Devices | 1 |
| 5.7 | Programmable Logic Array (PLA) | 1 |

**Course Designer(s)**

1. Mrs V Indumathi- indumathi@ksrct.ac.in

w.e.f. 07/01/2023
Passed in the BoS Meeting Held on 23/12/2022
Approved in Academic Council Meeting held on 07/01/2023

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| 60 MC 302 | Sensors and Instrumentation | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 2 | 4 |

## Objectives

- To create a conceptual understanding of the basic principles of sensors, actuators, and their operations
- To analyze the real-world problems and provide solutions using sensors and actuators
- To promote awareness regarding recent developments in the fields of sensors and actuators
- To introduce about advancements in sensor technology.
- To educate the advance trends and application of sensors.

## Pre-requisites

- Basics of Electrical and Electronics Engineering, Analog Devices and Digital Circuits

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Classify different Sensors & Actuators based on various physical phenomena and differentiate their performance characteristics | Understand |
| CO2 | Interpret the working principles of thermal and optical sensor | Understand |
| CO3 | Infer the functional principles of Electromagnetic and Mechanical Sensors | Understand |
| CO4 | Illustrate the working and characteristics of Acoustic and Chemical Sensors | Apply |
| CO5 | Select the relevant sensors to design real-time data acquisition from ambience via case studies | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | 3 | 3 | - | 1 | 2 | 1 | 1 | 1 | 1 | 3 | 2 |
| CO2 | 3 | 3 | 3 | 1 | 1 | 1 | - | 2 | 2 | 1 | - | 1 | 3 | 2 |
| CO3 | 3 | 2 | 3 | 3 | 3 | - | - | 3 | 1 | 1 | 1 | 1 | 3 | 3 |
| CO4 | 3 | 1 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | - | 1 | 1 | 3 | 2 |
| CO5 | 3 | 2 | 3 | 2 | 3 | - | - | 1 | 1 | 1 | 1 | 1 | 3 | 2 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 30 | 20 | 30 | 30 |
| Understand | 30 | 25 | 40 | 40 |
| Apply | - | 15 | 30 | 30 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | 100 |



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**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC 302 -Sensors and Instrumentation** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 2 | 75 | 4 | 50 | 50 | 100 |

| | |
|---|---|
| **Basics of Sensors**<br>The five senses: vision, hearing, smell, taste, and touch – Definitions: Sensors & Actuators – Overview of Sensor classifications – Performance characteristics of Sensors : Transfer Function, Range, Span, Input and Output Full Scale, Resolution, and Dynamic Range - Calibration & Reliability | [9] |
| **Temperature and optical Sensors****<br>Thermoresistive sensors: Thermistors, Resistance temperature, and silicon resistive sensors – Thermoelectric sensors -Principles of Optics: Optical units – Quantum effects – Quantum-based Optical sensors – Photoelectric sensors – Charge coupled device (CCD) based – Thermal-based<br>Optical sensors – Active infrared (AFIR) sensors – Optical Actuators – Case study: Liquid Level Indicator using Optical Sensor**s** | [9] |
| **Electromagnetic and Mechanical Sensors***<br>Principles of Electric and Magnetic fields: Basic units – The Electric field: Capacitive Sensors – Magnetic sensors – Magnetoresistance – Magnetostrictive – Magnetometers<br>Force Sensors: Strain Gauges, Semiconductor Strain Gauges & Tactile Sensors – Accelerometers: Capacitive Accelerometers, Strain Gauge Accelerometers & Magnetic Accelerometers – Pressure Sensors: Mechanical, Piezoresistive, Capacitive & Magnetic – Velocity sensing | [9] |
| **Acoustic and Chemical Sensors****<br>Elastic waves and their properties – Microphones: Carbon, Magnetic, Ribbon and Capacitive Microphones – Piezoelectric effect – Piezoelectric Sensors – Acoustic sensors: Loudspeakers, Headphones and Buzzers - Magnetic and Piezoelectric – Ultrasonic sensors and actuators<br>Chemical units and Definitions – Electrochemical sensors: Metal Oxide Sensors and Solid Electrolyte Sensors – Potentiometric smart sensors: Glass Membranes, Soluble Inorganic Salt Membrane and Polymer - Immobilized Ionophore Membranes sensors – Thermochemical, Optical, Mass humidity gas sensors | [9] |
| **Recent sensor Applications**<br>Breathe analyzer using temperature Sensor -Liquid Level Indicator using Optical Sensor**s-**Speed sensing and odometer in a car using smart sensors-Tire-pressure monitoring system using smart sensors - Ultrasonic parking system -Water quality monitoring –Agriculture based moisture sensors. | [9] |
| **Practicals:**<br>**Simulation Using LabVIEW**<br>1. Design and implementation of Breath analyzer using temperature sensors<br>2. Liquid Level Indicator using optical Sensor**s**<br>3. Demonstrate a simple parking system using ultrasonic sensors | [30] |
| **Total Hours: (Lecture – 45:Practical - 30)** | **75** |

**Text Book(s):**

| | |
|---|---|
| 1. | Nathan Ida, "Sensors, Actuators and their Interfaces - A Multidisciplinary Introduction", 2020, 2nd Edition, IET, United Kingdom. |
| 2. | Renganathan S., "Transducer Engineering", Allied Publishers (P) Ltd., 2015 |

**Reference(s):**

| | |
|---|---|
| 1. | Murthy, D.V.S., Transducers and Instrumentation, 2nd Edition, Prentice Hall of India Pvt. Ltd., NewDelhi, 2010. |
| 2. | Jacob Fraden, "Handbook of Modern Sensors Physics, Designs, and Applications", 2016, 5th Edition, Springer, Switzerland. |
| 3. | Subhas Chandra Mukhopadhyay, Octavian Adrian Postolache, Krishanthi P. Jayasundera, Akshya K. Swain, "Sensors for Everyday Life Environmental and Food Engineering", 2017, Volume 23, Springer, Switzerland. |
| 4. | Jacob Fraden ,"Handbook of modern Sensors,"Volume 32,2016,Springer. |

*SDG 8 – Decent Work and Economic Growth

**SDG 9 – Industry Innovation and Infrastructure

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Basics of Sensors** | |
| 1.1 | The five senses: vision, hearing, smell, taste, and touch | 2 |
| 1.2 | Definitions: Sensors & Actuators | 2 |
| 1.3 | Overview of Sensor classifications | 2 |
| 1.4 | Performance characteristics of Sensors : Transfer Function, Range, Span, Input and Output Full Scale | 2 |
| 1.5 | Resolution, and Dynamic Range - Calibration & Reliability | 1 |
| **2.0** | **Temperature and optical Sensors** | |
| 2.1 | Thermoresistive sensors: Thermistors, Resistance temperature, silicon resistive sensors – Thermoelectric sensors | 2 |
| 2.2 | Principles of Optics: Optical units | 1 |
| 2.3 | Quantum effects – Quantum-based Optical sensors Photoelectric sensors | 2 |
| 2.4 | Photoelectric sensors – Charge coupled device (CCD) based – Thermal-based Optical sensors | 2 |
| 2.5 | Active infrared (AFIR) sensors – Optical Actuators – Case study: Liquid Level Indicator using Optical Sensors | 2 |
| **3.0** | **Electromagnetic and Mechanical Sensors** | |
| 3.1 | Principles of Electric and Magnetic fields | 1 |
| 3.2 | Basic units – The Electric field | 1 |
| 3.3 | Capacitive Sensors | 1 |
| 3.4 | Magnetic sensors , Magnetostrictive , Magnetometers | 1 |
| 3.5 | Force Sensors: Strain Gauges | 1 |
| 3.6 | Semiconductor Strain Gauges & Tactile Sensors | 1 |
| 3.7 | Magnetic Accelerometers | 1 |
| 3.8 | Pressure Sensors: Mechanical, Piezoresistive | 1 |
| 3.9 | Capacitive & Magnetic – Velocity sensing | 1 |
| **4.0** | **Acoustic and Chemical Sensors** | |
| 4.1 | Elastic waves and their properties | 1 |
| 4.2 | Microphones: Carbon, Magnetic, Ribbon and Capacitive Microphones | 1 |
| 4.3 | Piezoelectric effect , Piezoelectric Sensors | 1 |
| 4.4 | Acoustic sensors: Loudspeakers, Headphones and Buzzers | 1 |
| 4.5 | Magnetic and Piezoelectric – Ultrasonic sensors and actuators | 1 |
| 4.6 | Chemical units and Definitions - Electrochemical sensors | 1 |
| 4.7 | Potentiometric smart sensors: Glass Membranes, Soluble Inorganic | 1 |
| 4.8 | Immobilized Ionophore Membranes sensors | 1 |
| 4.9 | Thermochemical, Optical, Mass humidity gas sensors. | 1 |
| **5.0** | **Recent sensor Applications** | |
| 5.1 | Breathe analyzer using temperature | 1 |
| 5.2 | Liquid Level Indicator using Optical Sensors | 1 |
| 5.3 | Speed sensing and odometer in a car using smart sensors | 2 |
| 5.4 | Tire-pressure monitoring system using smart sensors | 1 |
| 5.5 | Ultrasonic parking system -Water quality monitoring | 1 |
| 5.6 | Water quality monitoring | 1 |
| 5.7 | Agriculture based moisture sensors | 2 |

**Course Designer(s)**

1. Dr.M.Ravi – ravi@ksrct.ac.in

| 60 MC 303 | Manufacturing Technology | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

## Objectives

- To enlighten the learners about the concepts of casting and powder metallurgy techniques.
- To impart the fundamental knowledge in the area of metal joining.
- To endow with an overview of metal forming processes.
- To understand the working of conventional machine tools and CNC Machines
- To gain adequate knowledge in the metal finishing processes.

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Recognize the concepts of casting and powder metallurgy process. | Remember |
| CO2 | Understand the working of welding processes. | Understand |
| CO3 | Describe the various types of forming processes. | Understand |
| CO4 | Demonstrate and simulate the working principle of machine tools. | Apply |
| CO5 | Understand the different finishing processes. | Understand |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | - | - | - | 2 | - | 3 | - | - | - | 2 | 3 | 3 | 2 |
| CO2 | 3 | - | - | - | 2 | - | 3 | - | - | - | 2 | 3 | 2 | 2 |
| CO3 | 3 | - | - | - | 2 | - | 3 | - | - | - | 2 | 3 | 3 | 3 |
| CO4 | 3 | - | - | - | 3 | - | 3 | - | - | - | 2 | 3 | 2 | 3 |
| CO5 | 3 | - | - | - | 2 | - | 3 | - | - | - | 2 | 3 | 2 | 3 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 30 | 10 | 30 | 30 |
| Understand | 30 | 20 | 40 | 40 |
| Apply | - | 30 | 30 | 30 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | 100 |



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Mechatronics Engineering

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC 303 – Manufacturing Technology** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Casting and powder metallurgy**<br>Pattern: materials, types, allowances - Moulding: green sand moulding -moulding sand and its properties - Cores: types and making - Casting: sand mould casting, die casting and continuous casting - Casting defects: causes and remedies. Powder metallurgy processes - steps involved-characteristics of metal powders | **[9]** |
| **Joining Processes**<br>Principle of arc and gas welding - Filler and flux materials - Flame types – Welding defects - Safety in welding - Resistance welding, ultrasonic welding, gas tungsten arc welding and gas metal arc welding - Electron beam welding and Laser beam welding - Brazing and soldering | **[9]** |
| **Forming Processes**<br>Hot and cold working of metals –Die forging - Rolling: high roll mills - Extrusion: forward and backward, tube extrusion - Sheet metal work: Shearing, bending and drawing operations - Stretch forming | **[9]** |
| **Machining Processes**<br>Introduction to conventional Lathe and simple operations – Single point and multipoint cutting tools – Simple drilling operations, Reaming and tapping – Gear milling operation – Shaper and Planer operations- Introduction to CNC Machines- G-Code and M-Code - CNC Trainer Simulation Tool – Machining operations: Turning, Drilling and Boring- Basics of Additive and Subtractive Processes. | **[9]** |
| **Finishing Processes**<br>Types of grinding process: cylindrical grinding, surface grinding, centreless grinding, internal grinding, specifications and selection of grinding wheel – Lapping – Honing – Super finishing – Broaching machine: types and operations- Introduction to advanced coating processes- functionally graded coatings. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | J. P. Kaushish, Manufacturing Processes, Prentice Hall of India Learning Private Limited, New Delhi, 2nd Edition,2019. |
| 2. | Rajput, R.K., “A Textbook of Manufacturing Technology”, Laxmi publications Ltd, New Delhi, Third Edition, 2023. |

**Reference(s):**

| | |
|---|---|
| 1. | Hajra Choudhury S.K, “Elements of workshop Technology, Vol I and II”, Media Promotors, Bombay Edition 2011. |
| 2. | P. N. Rao, “Manufacturing Technology - Vol I and II”, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2018. |
| 3. | Dr. Sushil Kumar Choudhary , Dr. R. S Jadoun, “Computer Integrated Manufacturing & Computer Aided Manufacturing” Walnut Publication, 2021 |
| 4. | J. T. Black, Ronald A. Kohser, “Materials and Processes in Manufacturing” 13th edition, John Wiley & Sons, 2020 |

*SDG 9 – Industry Innovation and Infrastructure



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Board Of Studies/
Mechatronics Engineering

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Casting and Powder Metallurgy** | |
| 1.1 | Pattern: materials, types, allowances | 1 |
| 1.2 | Moulding: green sand moulding , | 1 |
| 1.3 | Moulding sand and its properties | 1 |
| 1.4 | Cores: types and making, Casting types | 1 |
| 1.5 | Sand mould casting, die casting and continuous casting | 2 |
| 1.6 | Casting defects: causes and remedies. | 1 |
| 1.7 | Powder metallurgy processes - steps involved- | 1 |
| 1.8 | Characteristics of metal powders | 1 |
| **2.0** | **Joining Processes** | |
| 2.1 | Principle of arc and gas welding | 1 |
| 2.2 | Filler and flux materials,Flame types | 1 |
| 2.3 | Welding defects,Safety in welding | 1 |
| 2.4 | Resistance welding, | 1 |
| 2.5 | Ultrasonic welding, gas tungsten arc welding | 1 |
| 2.6 | Gas metal arc welding | 1 |
| 2.7 | Electron beam welding and Laser beam welding - | 2 |
| 2.8 | Brazing and soldering | 1 |
| **3.0** | **Forming Processes** | |
| 3.1 | Hot and cold working of metals | 1 |
| 3.2 | Die forging,Rolling: high roll mills | 1 |
| 3.3 | Extrusion: forward and backward | 2 |
| 3.4 | Tube extrusion | 1 |
| 3.5 | Sheet metal work: Shearing, | 1 |
| 3.6 | Bending and drawing operations | 2 |
| 3.7 | Stretch forming | 1 |
| **4.0** | **Machining Processes** | |
| 4.1 | Basics of Additive and Subtractive Processes | 1 |
| 4.2 | Introduction to conventional Lathe and simple operations – | 1 |
| 4.3 | single point and multipoint cutting tools | 1 |
| 4.4 | Simple drilling operations, Reaming and tapping | 1 |
| 4.5 | Gear milling operation – Shaper and Planer operations | 1 |
| 4.6 | Introduction to CNC Machines- G-Code and M-Code - | 2 |
| 4.7 | CNC Trainer Simulation Tool Machining operations:Turning, Drilling and Boring | 2 |
| **5.0** | **Finishing Processes** | |
| 5.1 | Types of grinding process,cylindrical grinding | 1 |
| 5.2 | Surface grinding, centreless grinding | 1 |
| 5.3 | Internal grinding,specifications and selection of grinding wheel | 2 |
| 5.4 | Lapping, Honing | 1 |
| 5.5 | Super finishing,Broaching machine: | 1 |
| 5.6 | Types and operations | 1 |
| 5.7 | Introduction to advanced coating processes | 1 |

**Course Designer(s)**


1. Dr.M.Baskaran- baskaranm@ksrct.ac.in




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Mechatronics Engineering

| 60 MC 304 | Mechanics of Solids | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 1 | 0 | 4 |

## Objectives

- To understand the nature of stresses and strains induced in materials under different loads.
- To analyze biaxial stress under given loading conditions for various materials and to analyze cylindrical shells under circumferential and radial loading.
- To plot shear force and bending moment diagrams of beams under different types of loads.
- To understand the deflection of determinate beams using various methods.
- To analyze the stresses and deformations occurring in circular shafts and helical springs caused by torsional forces.

## Pre-requisites

- Engineering Mechanics

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the concepts of stresses and strains in simple and composite bars | Remember |
| CO2 | Determine the stresses and deformations of objects under external loadings | Apply |
| CO3 | Develop shear force and bending moment diagrams for various types of beams with given loading conditions | Apply |
| CO4 | Find the slope and deflection of beams using Macaulay's method and double integration method | Apply |
| CO5 | Estimate torsional rigidity of given materials numerically using torsion equation, buckling effect of columns | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | 1 | 3 | 2 | - | - | - | 2 | - | 2 | 3 | 2 |
| CO2 | 3 | 3 | 3 | 2 | 3 | 2 | - | - | - | 2 | - | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 2 | 3 | 2 | - | - | - | 2 | - | 2 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 3 | 2 | - | - | - | 2 | - | 2 | 2 | 3 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 2 | - | - | - | 2 | - | 2 | 2 | 3 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 10 | 10 | 15 | 15 |
| Understand | 10 | 10 | 15 | 15 |
| Apply | 40 | 40 | 70 | 70 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | 100 |

w.e.f. 07/01/2023
Passed in the BoS Meeting Held on 23/12/2022
Approved in Academic Council Meeting held on 07/01/2023

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Mechatronics Engineering

| Syllabus | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC 304 - Mechanics of Solids** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 |

| | |
|---|---|
| **Stresses and Strains**<br>Mechanical properties of materials - Stress and strain - tensile, compressive and shear stresses - Stress -Strain Diagram - Hooke's law, elastic constants and their relations - volumetric, linear and shear strains - Composite sections - Thermal stresses and strain | **[9]** |
| **Principal Stresses, Thin Cylindrical and Spherical Shells**<br>Stresses on inclined planes - principal stresses and principal strains - Mohr's circle - Thin cylindrical and spherical shells subjected to internal pressure - circumferential and longitudinal stresses - Thick Cylinders - Lame's theory | **[9]** |
| **Shear Force and Bending Moment of Beams**<br>Types of beams and loads - Shear force and bending moment diagrams - Point load, uniformly distributed load and uniformly varying load - Theory of simple bending – Bending stress and shear stress distribution – Simulation of shear force and bending movement diagram. | **[9]** |
| **Deflection of Beams**<br>Elastic curve - computation of slopes and deflection applying Macaulay's method - Simply supported beam - Cantilever beam - Double integration method - Simulation of beam deflection - Cantilever beam and simply supported beam | **[9]** |
| **Torsion and Columns**<br>Torsion in solid and hollow circular shafts - stresses and deformations in circular shafts - Stresses in open and closed coil helical springs - Theory of columns - Euler's theory, slenderness ratio – Rankine's formula | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., New Delhi, Sixth Edition, 2022. |
| 2. | Rajput R.K. "Strength of Materials", S.Chand & Company Ltd., New Delhi, Seventh Edition, 2022. |

**Reference(s):**

| | |
|---|---|
| 1. | Egor. P. Popov, "Engineering Mechanics of Solids", Prentice Hall of India, New Delhi, 2015. |
| 2. | Ferdinand P. Beer, Russell Johnson, J.r. and John J. Dewole, "Mechanics of Materials", Tata McGraw Hill publishing co. Ltd., New Delhi., 2019. |
| 3. | Subramanian R., Strength of Materials, Oxford University Press, Oxford Higher Education Series, Third Edition, 2016. |
| 4. | Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2013 |

*SDG 9 – Industry Innovation and Infrastructure

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Stresses and Strains** | |
| 1.1 | Mechanical properties of materials - Stress and strain | 2 |
| 1.2 | Tensile, compressive and shear stresses | 1 |
| 1.3 | Stress-Strain Diagram - Hooke’s law | 1 |
| 1.4 | Elastic constants and their relations | 1 |
| 1.5 | Linear and shear strains | 1 |
| 1.6 | Volumetric strain | 1 |
| 1.7 | Composite sections | 1 |
| 1.8 | Thermal stresses and strain | 1 |
| **2.0** | **Principal Stresses, Thin Cylindrical and Spherical Shells** | |
| 2.1 | Stresses on inclined planes | 1 |
| 2.2 | Principal stresses and principal strains | 2 |
| 2.3 | Mohr’s circle | 1 |
| 2.4 | Thin cylindrical shells subjected to internal pressure | 1 |
| 2.5 | Thin spherical shells subjected to internal pressure | 1 |
| 2.6 | Circumferential and longitudinal stresses | 1 |
| 2.7 | Thick Cylinders | 1 |
| 2.8 | Lame’s theory | 1 |
| **3.0** | **Shear Force and Bending Moment of Beams** | |
| 3.1 | Types of beams and loads | 1 |
| 3.2 | Shear force and bending moment diagrams - Point load | 2 |
| 3.3 | Shear force and bending moment diagrams - Uniformly distributed load | 1 |
| 3.4 | Shear force and bending moment diagrams - Uniformly varying load | 1 |
| 3.5 | Theory of simple bending | 1 |
| 3.6 | Bending stress distribution | 1 |
| 3.7 | Shear stress distribution | 1 |
| 3.8 | Simulation of shear force and bending movement diagram | 1 |
| **4.0** | **Deflection of Beams** | |
| 4.1 | Elastic curve | 2 |
| 4.2 | Computation of slopes and deflection applying Macaulay's method | 1 |
| 4.3 | Simply supported beam | 1 |
| 4.4 | Cantilever beam | 1 |
| 4.5 | Double integration method - Simply supported beam | 1 |
| 4.6 | Double integration method - Cantilever beam | 1 |
| 4.7 | Simulation of beam deflection - Cantilever beam | 1 |
| 4.8 | Simulation of beam deflection - Simply supported beam | 1 |
| **5.0** | **Torsion and Columns** | |
| 5.1 | Torsion in solid and hollow circular shafts | 2 |
| 5.2 | Stresses and deformations in circular shafts | 1 |
| 5.3 | Stresses in open coil helical springs | 1 |
| 5.4 | Stresses in closed coil helical springs | 1 |
| 5.5 | Theory of columns | 1 |
| 5.6 | Euler’s theory | 1 |
| 5.7 | Slenderness ratio | 1 |
| 5.8 | Rankine’s formula | 1 |

**Course Designer(s)**

Dr. A. Ramesh Kumar – rameshkumar@ksrct.ac.in

| 60 MY 002 | Universal Human Values | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | MY | 3 | 0 | 0 | 3* |

## Objectives

- To identify the essential complementarily between 'values' and 'skills'
- To ensure core aspirations of all human beings.
- To acquire ethical human conduct, trustful and mutually fulfilling human behaviour
- To enrich interaction with Nature
- To achieve holistic perspective towards life and profession

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the significance of value inputs in formal education and start applying them in their life and profession | Understand |
| CO2 | Evaluate coexistence of the “I” with the body. | Analyze |
| CO3 | Identify and evaluate the role of harmony in family, society and universal order. | Analyze |
| CO4 | Classify and associate the holistic perception of harmony at all levels of existence and Nature | Analyze |
| CO5 | Develop appropriate human conduct and management patterns to create harmony in professional and personal lives. | Create |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | - | - | - | - | - | - | - | 3 | 2 | - | 2 | 3 | - | - |
| CO2 | - | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - | - |
| CO3 | - | - | - | - | - | 3 | 3 | 3 | 3 | - | - | 3 | - | - |
| CO4 | - | - | - | - | - | 3 | 3 | 3 | 3 | - | - | 3 | - | - |
| CO5 | - | - | - | - | - | 3 | 3 | 3 | 3 | 3 | - | 3 | - | - |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom’s Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 10 | 10 | 20 | - |
| Understand | 10 | 10 | 20 | - |
| Apply | 20 | 20 | 30 | - |
| Analyse | 20 | 20 | 30 | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | - |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MY 002 - Universal Human Values** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 0 | 45 | 3* | 100 | 0 | 100 |

| | |
|---|---|
| **Introduction to value Education*** Understanding value Education-Self exploration as the process for value education-Continuous Happiness and prosperity-the basic human aspirations-right understanding-relationship and physical facility –happiness and prosperity - current scenario – **method to fulfill the basic human aspirations.**** | **[9]** |
| **Harmony in the Human Being*** Understanding Human being as the Co-Existence of the self and the Body-Distinguishing between the needs of the self and the body-the body as an instrument of the self-**understanding harmony in the self-harmony of the self with the body**** — programme to ensure self-regulation and health | **[9]** |
| **Harmony in the Family and Society*** Harmony in the Family –the basic unit of human interaction-values in human- to - human relationship –'Trust' the foundation value in relationship –'Respect'- as the right evaluation-understanding harmony in the society –vision for the universal human order. | **[9]** |
| **Harmony in the Nature/Existence*** Understanding harmony in the Nature-Interconnectedness, self-regulation and mutual fulfillment among the four orders of nature – realizing existence as co-existence at all levels –the holistic perception of harmony in existence. | **[9]** |
| **Implications of the Holistic Understanding*** Natural Acceptance of human values- definitiveness of human conduct- a basis for humanistic education, humanistic constitution and universal human order- competence in professional ethics –holistic technologies, production systems and management models-typical case studies — strategies for transition towards value base life and profession. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1 |
| 2. | Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2 |

**Reference(s):**

| | |
|---|---|
| 1. | Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999. |
| 2. | Human Values, A.N. Tripathi, New Age International. Publishers, New Delhi, 2004. |

*SDG 3 – Good Health and Well – Being
** SDG 5 – Quality Education



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| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Introduction to Value Education** | |
| 1.1 | Discussion on Present Education System and Skill Based Education | 1 |
| 1.2 | Understanding Value Education | 1 |
| 1.3 | Self-exploration as the process for value education | 1 |
| 1.4 | Basic Human Aspirations - Continuous Happiness and Prosperity | 1 |
| 1.5 | Basic requirements to fulfill Human Aspirations - Right understanding, Relationship and Physical facility | 1 |
| 1.6 | Transformation from Animal Consciousness to Human Consciousness | 1 |
| 1.7 | Sources of Happiness and Prosperity – Harmony and Disharmony | 1 |
| 1.8 | Current Scenario and Role of Education | 1 |
| 1.9 | Outcome of Human Education and Method to fulfill the basic human aspirations | 1 |
| **2.0** | **Harmony in the Human Being** | |
| 2.1 | Understanding Human being - As Co-Existence of the self and the Body - The Needs of the Self and the Body | 1 |
| 2.2 | Understanding Human being - As Co-Existence of the self and the Body - The Activities and Response of the Self and the Body | 2 |
| 2.3 | The body as an instrument of the self | 1 |
| 2.4 | Understanding harmony in the self | 1 |
| 2.5 | Harmony of the self with the body | 2 |
| 2.6 | Programme to ensure self-regulation and health | 1 |
| 2.7 | My Participation (Value) regarding Self and my Body - Correct Appraisal of our Physical needs | 1 |
| **3.0** | **Harmony in the Family and Society** | |
| 3.1 | Harmony in the Family - Understanding Values in Human Relationships | 1 |
| 3.2 | Family as the basic Unit of Human Interaction | 1 |
| 3.3 | Values in human Relationships | 1 |
| 3.4 | Trust - the foundation value in relationship | 1 |
| 3.5 | Respect as the right evaluation, the Basis for Respect, Assumed Bases for Respect today | 1 |
| 3.6 | Harmony from Family to World Family: Undivided Society | 1 |
| 3.7 | Extending Relationship from family to society, Identification of the Comprehensive Human Goal | 1 |
| 3.8 | Programs needed to achieve the Comprehensive Human Goal: The Five Dimensions of Human Endeavour | 1 |
| 3.9 | Harmony from Family Order to World Family Order – Universal Human Order | 1 |
| **4.0** | **Harmony in the Nature / Existence** | |
| 4.1 | The Four Orders in Nature | 1 |
| 4.2 | Participation of Human Being in Entire Nature | 1 |
| 4.3 | Natural Characteristics - Tendency of Human Living with Animal Consciousness / The Holistic Perception of Harmony in Existence | 1 |
| 4.4 | Present day Problems | 1 |
| 4.5 | Recyclability and self-regulation in Nature | 1 |
| 4.6 | Relationship of Mutual Fulfillment | 1 |
| 4.7 | An Introduction to space, Co-existence of Units in Space | 1 |
| 4.8 | Harmony in Existence – Understanding Existence as Co- Existence | 1 |
| 4.9 | Natural Characteristic of Human Living with Human Consciousness | 1 |

| 5.0 | **Implications of the Holistic Understanding** | |
|---|---|---|
| 5.1 | Natural Acceptance of human values | 1 |
| 5.2 | Definitiveness of Ethical Human Conduct - Development of Human Consciousness | 1 |
| 5.3 | Identification of Comprehensive Human Goal | 1 |
| 5.4 | Basis for Humanistic Education and Humanistic Constitution | 1 |
| 5.5 | Ensuring Competence in professional Ethics | 1 |
| 5.6 | Issues in Professional Ethics-The Current Scenario | 1 |
| 5.7 | Holistic Technologies and Production Systems and management models - Typical Case Studies | 2 |
| 5.8 | Strategies for transition towards value-based life and profession | 1 |

**Course Designer(s)**


1. Dr.G.Vennila- vennila@ksrct.ac.in
2. Dr.K.Raja - rajak@ksrct.ac.in

| 60 GE 002 | Tamils and Technology | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | GE | 1 | 0 | 0 | 1 |

## Objectives

- To learn weaving, ceramic and construction technology of Tamils.
- To understand the agriculture, irrigation and manufacturing technology of Tamils.
- To realize the development of scientific Tamil and Tamil computing

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the weaving and ceramic technology of ancient Tamil people nature. | Understand |
| CO2 | Comprehend the construction technology, building materials in sangam period and case studies. | Understand |
| CO3 | Infer the metal process, coin and beads manufacturing with relevant archeological evidence. | Understand |
| CO4 | Realize the agriculture methods, irrigation technology and pearl diving. | Understand |
| CO5 | Apply the knowledge of scientific Tamil and Tamil computing. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | - | - | - | - | - | - | 3 | 3 | - | 2 | - | 3 | - | - |
| CO2 | - | - | - | - | - | - | 3 | 3 | - | 2 | - | 3 | - | - |
| CO3 | - | - | - | - | - | - | 3 | 3 | - | 2 | - | 3 | - | - |
| CO4 | - | - | - | - | - | - | 3 | 3 | - | 2 | - | 3 | - | - |
| CO5 | - | - | - | - | - | - | 3 | 3 | - | 2 | - | 3 | - | - |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 30 | 30 | 40 | 40 |
| Understand | 30 | 30 | 40 | 40 |
| Apply | - | - | 20 | 20 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | 100 |



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**Syllabus**

| K.S.Rangasamy College of Technology– AutonomousR2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Common to all Departments** | | | | | | | | |
| **60 GE 002- Tamils and Technology** | | | | | | | | |
| Semester | Hours/W eek | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| III | 1 | 0 | 0 | 15 | 1# | 100 | 0 | 100 |

| | |
|---|---|
| **Weaving and Ceramic Technology***<br>Weaving Industry during Sangam Age – Ceramic Technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries. | **[3]** |
| **Design and Construction Technology***<br>Designing and Structural construction House & Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram – Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places – Temples of Nayaka Period - Type Study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal – Chetti Nadu Houses , Indo – Saracenic architecture at Madras during British Period. | **[3]** |
| **Manufacturing Technology***<br>Art of Ship Building – Metallurgical studies – Iron Industry – Iron smelting ,Steel -Copper and gold coins as source of history – Minting of Coins – Beads making – industries Stone beads – Glass beads – Terracotta beads – Shell beads/bone beats – Archeological evidences -Gem stone types described in Silappathikaram. | **[3]** |
| **Agriculture and Irrigation Technology***<br>Dam,Tank,Ponds,Sluice,Significance of Kumizhi Thoompu of Chola Period,Animal Husbandry – Wells designed for cattle use – Agriculture and Agro Processing – Knowledge of Sea-Fisheries – Pearl – Conche diving -Ancient Knowledge of Ocean – Knowledge Specific Society. | **[3]** |
| **Scientific Tamil and Tamil Computing***<br>Development of Scientific Tamil – Tamil Computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy- Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project. | **[3]** |
| **Total Hours** | 15 |

**TextBook(s):**

| | |
|---|---|
| 1. | **முனைவர் கே. கே. பிள்ளை, தமிழக வரலாறு - மக்களும் பண்பாடும், தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம், 18th Edition, 2022.** |
| 2. | **முனைவர் இல. சுந்தரம், கணினித்தமிழ்,விகடன் பிரசுரம், 2nd Edition, 2021** |
| 3. | **முனைவர் இரா.சிவானந்தம், மு.சேரன், கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம், தொல்லியல் துறை வெளியீடு, 6th Edition 2020.** |
| 4. | **முனைவர் இரா.சிவானந்தம் , முனைவர் ஜெ.பாஸ்கர், பொருநை - ஆற்றங்கரை நாகரிகம், தொல்லியல் துறை வெளியீடு,1st Edition, 2022** |
| 5. | Dr.K.K.Pillay, Social Life of Tamils, TNTB & ESC and RMRL – (In print). |
| 6. | Dr.S.Singaravel, Social Life of the Tamils - The Classical Period, International Institute of Tamil Studies, 1st Ed, 2001. |
| 7. | Dr.S.V.Subaramanian, Dr.K.D. Thirunavukkarasu, Historical Heritage of the Tamils, International Institute of Tamil Studies, 2nd, 2010 |
| 8. | Dr.M.Valarmathi, The Contributions of the Tamils to Indian Culture, International Institute of Tamil Studies, |
| 9. | Dr.R.Sivanantham, Keeladi - Sangam City Civilization on the banks of river Vaigai, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, |
| 10. | Dr.K.K.Pillay, Studies in the History of India with Special Reference to Tamil Nadu, K.K. Pillay Published by the Author. |
| 11. | Dr.R.Sivanantham, Dr.J.Baskar, Porunai Civilization, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation. |
| 12. | R.Balakrishnan, Journey of Civilization Indus to Vaigai, Roja Muthiah Research Library, 3rd Ed 2022 |

*SDG 4 – Quality Education

# For Tamils and Technology, additional 1 credit is offered and not accounted for CGPA.

**Syllabus**

| K.S.Rangasamy College of Technology–Autonomous R2022 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 60 GE 002- தமிழரும் தொழில்நுட்பமும் (அனைத்து துறைகளும் பொதுவானது) | | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | | |
| | L | T | P | | C | CA | ES | Total | |
| III | 1 | 0 | 0 | 15 | 1# | 100 | 0 | 100 | |

| | |
|---|---|
| நெசவு மற்றும் பானைத் தொழில்நுட்பம்*<br>சங்க காலத்தில் நெசவுத் தொழில் -பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள். | [3] |
| வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்*<br>சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை. | [3] |
| உற்பத்தித் தொழில் நுட்பம்*<br>கப்பல் கட்டும் கலை - உலோகவியல் -இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் -மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள். | [3] |
| வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்*<br>அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம். | [3] |
| அறிவியல் தமிழ் மற்றும் கணித்தமிழ்*<br>அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் -தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம். | [3] |
| **Total Hours** | 15 |

**Text Book(s):**

| | |
|---|---|
| 1. | **முனைவர் கே. கே. பிள்ளை, தமிழக வரலாறு - மக்களும் பண்பாடும், தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம், 18th Edition, 2022.** |
| 2. | **முனைவர் இல. சுந்தரம், கணினித்தமிழ்,விகடன் பிரசுரம், 2nd Edition 2021** |
| 3. | **முனைவர் இரா.சிவானந்தம், மு.சேரன், கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம், தொல்லியல் துறை வெளியீடு, 6th Edition 2020.** |
| 4. | **முனைவர் இரா.சிவானந்தம் , முனைவர் ஜெ.பாஸ்கர், பொருநை - ஆற்றங்கரை நாகரிகம், தொல்லியல் துறை வெளியீடு, 1st Edition 2022** |
| 5. | Dr.K.K.Pillay, Social Life of Tamils, TNTB & ESC and RMRL – (In print). |
| 6. | Dr.S.Singaravel, Social Life of the Tamils - The Classical Period, International Institute of Tamil Studies, 1st Ed 2001. |
| 7. | Dr.S.V.Subaramanian, Dr.K.D. Thirunavukkarasu, Historical Heritage of the Tamils, International Institute of Tamil Studies, 2nd Ed, 2010 |
| 8. | Dr.M.Valarmathi, The Contributions of the Tamils to Indian Culture, International Institute of Tamil Studie akrishnan, Journey of Civilization Indus to Vaigai, Roja Muthiah Research Library,3rd Ed 2022s, |
| 9. | Dr.R.Sivanantham, Keeladi - Sangam City Civilization on the banks of river Vaigai, Department of |

| | |
|---|---|
| | Archaeology & Tamil Nadu Text Book and Educational Services Corporation, |
| 10. | Dr.K.K.Pillay, Studies in the History of India with Special Reference to Tamil Nadu, K.K. Pillay( Published by the Author. |
| 11. | Dr.R.Sivanantham, Dr.J.Baskar, Porunai Civilization, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation. |
| 12. | R.Bal |

*SDG 4 – Quality Education

# For Tamils and Technology, additional 1 credit is offered and not accounted for CGPA.



CHAIRMAN
Board Of Studies/
Mechatronics Engineering

| 60 MC 3P1 | Analog Devices and Digital Circuits Laboratory | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 0 | 0 | 4 | 2 |

## Objectives

- To Learn the Volt-Ampere characteristic of semiconductor diodes and assessing performance of rectifier circuit using filter.
- To Evaluate frequency response and understand the behavior of amplifier circuits
- To explore a basic knowledge of bit manipulation and Develop the ability to analyze and design digital electronic circuits
- To illustrate the different analog electronic circuits and their application in practice.
- To illustrate the different digital electronic circuits and their application in practice.

## Pre-requisites

- Basic Electrical and Electronics Engineering

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Analyze the characteristics of semiconductor devices and determine the input and output parameters. | Analyze |
| CO2 | Identify the various operating regions and analyze the characteristics of BJT and MOSFET | Analyze |
| CO3 | Apply the fundamentals of digital electronic circuit and their application in practice | Apply |
| CO4 | Construct basic combinational circuits and verify their functionalities | Analyze |
| CO5 | Design and implement synchronous and asynchronous sequential circuits. | Analyze |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 2 | - | - | - | 3 | - | - | - | 1 | 1 | 1 | 1 | 3 | - |
| CO2 | 2 | 3 | 2 | - | 1 | - | - | 1 | 3 | 2 | - | 1 | 3 | - |
| CO3 | 2 | 2 | 1 | - | 2 | - | - | 1 | 2 | 2 | 1 | 1 | 3 | - |
| CO4 | 2 | 3 | 2 | 2 | 2 | - | - | 2 | - | 2 | 1 | 1 | 3 | - |
| CO5 | 2 | 3 | - | 2 | 2 | - | - | - | - | - | 1 | 1 | 3 | - |
| 3 - Strong; 2 - Medium; 1 – Some- | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Lab Experiments Assessment (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | Lab | Activity | | |
| Remember | - | - | - | - |
| Understand | - | - | - | - |
| Apply | 25 | 15 | 50 | 50 |
| Analyse | 25 | 10 | 50 | 50 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 50 | 25 | 100 | 100 |

w.e.f. 07/01/2023
Passed in the BoS Meeting Held on 23/12/2022
Approved in Academic Council Meeting held on 07/01/2023

CHAIRMAN
Board Of Studies/
Mechatronics Engineering

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC 3P1– Analog Devices and Digital Circuits Laboratory** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hrs** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| III | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |

**List of Experiments:**

1. Study the VI Characteristics of PN junction diode and Zener diode
2. Study the ripple and regulation characteristics of full wave rectifier with and without capacitor filter.
3. Construct the clipper and clamper circuit using PN junction diode
4. Combinational Logic and Circuit Simulation in LabVIEW
5. Determination of Input and Output Characteristics of MOSFET
6. Design and verify the summing amplifier using IC 741 in LabVIEW.
7. Design and implementation of 4-bit binary Adder/ Subtractor using IC 7483
8. Design and implementation of Multiplexer and De-multiplexer using IC 741XX
9. Construction and verification of 4 bit ripple counter and Mod-10 Ripple counters
10. Design and study the operation inverting and non inverting amplifier using IC741

| **Lab Manual** | |
|---|---|
| 1. | “Analog Devices and Digital Circuits Lab Manual”, Department of Mechatronics Engineering, KSRCT. |

*SDG 9 – Industry Innovation and Infrastructure

**Course Designer(s)**

Mrs V Indumathi- indumathi@ksrct.ac.in

w.e.f. 07/01/2023
Passed in the BoS Meeting Held on 23/12/2022
Approved in Academic Council Meeting held on 07/01/2023

CHAIRMAN
Board Of Studies/
Mechatronics Engineering

| 60 MC 3P2 | Manufacturing Technology Laboratory | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 0 | 0 | 4 | 2 |

## Objectives

- To enhance the working knowledge on Lathe.
- To conversant the drilling and shaping machine operations.
- Demonstration and study of the milling and grinding machine.
- To gain the knowledge on green sand moulding process.
- To enhance the working skill in CNC turning machine.

## Pre-requisites

- Thermal Engineering

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Perform the various operations using conventional lathe. | Understand |
| CO2 | Make the operations using drilling and shaping machine. | Understand |
| CO3 | Develop a component using milling and grinding machine. | Understand |
| CO4 | Prepare a model using green sand moulding process. | Apply |
| CO5 | Perform the operation of given work piece using CNC turning machine. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 2 | 2 | 3 | 3 |
| CO2 | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 2 | 2 | 3 | 3 |
| CO3 | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 2 | 2 | 3 | 3 |
| CO4 | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 2 | 2 | 3 | 3 |
| CO5 | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 2 | 2 | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Lab Experiments Assessment (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | Lab | Activity | | |
| Remember | - | - | - | - |
| Understand | 25 | 13 | 50 | 50 |
| Apply | 25 | 12 | 50 | 50 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 50 | 25 | 100 | 100 |

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC 3P2 – Manufacturing Technology Laboratory** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hrs** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| III | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |

**List of Experiments:**

1. Machining a work piece by facing, plain turning and taper turning operations using a lathe.
2. Machining a work piece by knurling and external thread cutting operations using a lathe.
3. Performing a work piece by drilling reaming and tapping operations using a drilling machine.
4. Machining a work piece by hexagonal component using appropriate machine.
5. Machining a work piece by spur gear using milling machine.
6. Grinding a work piece by flat and cylindrical surfaces using grinding machine.
7. Preparation of stepped pulley mould using green sand moulding process.
8. Preparation of hollow cylindrical pipe mould using green sand moulding process.
9. Machining a work piece by facing and turning using CNC turning machine.
10. Machining a work piece by plain turning and step turning using CNC turning machine.
11. Demonstration on additive manufacturing process (3D Printing Machine).

**Lab Manual**

| | |
|---|---|
| 1. | "**Manufacturing Technology Laboratory**", Department of Mechatronics Engineering, KSRCT. |

*SDG 9 – Industry Innovation and Infrastructure

**Course Designer(s)**

1. Dr.M.Baskaran – baskaranm@ksrct.ac.in

| 60 CG 0P2 | Career Skill Development II | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | CG | 0 | 0 | 2 | 1* |

## Objectives

- To help learners improve their vocabulary and enable them to use words appropriately in different academic and professional contexts.
- To help learners develop strategies that could be adopted while reading texts.
- To help learners acquire the ability to speak and write effectively in English in real life and career related situations.
- Improve listening, observational skills, and problem-solving capabilities
- Develop message generating and delivery skills

## Pre-requisites

- Basic knowledge of reading and writing in English.

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Compare and contrast products and ideas in technical texts. | Analyze |
| CO2 | Identify cause and effects in events, industrial processes through technical Texts | Analyze |
| CO3 | Analyze problems in order to arrive at feasible solutions and communicate them orally and in the written format. | Analyze |
| CO4 | Report events and the processes of technical and industrial nature. | Apply |
| CO5 | Articulate their opinions in a planned and logical manner, and draft effective résumés in context of job search. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | - | - |
| CO2 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | 2 | - |
| CO3 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | - | 2 |
| CO4 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | - | - |
| CO5 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Common to All Branches** | | | | | | | | |
| **60 CG 0P2-Career Skill Development II** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| III | 0 | 0 | 2 | 30 | 1* | 100 | 0 | 100 |

| | |
|---|---|
| **Listening**<br>Evaluative Listening: Advertisements, Product Descriptions, - Audio / Video; Filling a Graphic Organizer (Choosing a Product or Service by Comparison) — Listening to Longer Technical Talks and Completing– Gap Filling Exercises. Listening Technical Information from Podcasts<br>— Listening to Process/Event Descriptions to Identify Cause & Effects, Documentaries Depicting a Technical Problem and Suggesting Solutions – Listening to TED Talks | **[6]** |
| **Speaking**<br>Marketing a Product, Persuasive Speech Techniques — Describing and Discussing the Reasons of Accidents or Disasters Based on News Reports, Group Discussion (Based on Case Studies), Presenting Oral Reports, Mini Presentations on Select Topics with Visual Aids, Participating in Role Plays, Virtual Interviews | **[6]** |
| **Reading**<br>Reading Advertisements, User Manuals and Brochures – Longer Technical Texts– Cause and Effect Essays, and Letters / Emails of Complaint – Case Studies, Excerpts from Literary Texts, News Reports etc. – Company Profiles, Statement of Purpose (SoPs) | **[6]** |
| **Writing**<br>Professional Emails, Email Etiquette – Compare and Contrast Essay – Writing Responses to Complaints Precis Writing, Summarizing and Plagiarism- Job / Internship Application – Cover Letter & Résumé | **[6]** |
| **Verbal Ability II**<br>Reading Comprehension (Inferential Fillups) – Spotting Errors – Verbal Analogies – Theme Detection – Change of Voice – Change of Speech – One Word Substitution | **[6]** |
| **Total Hours:** | **30** |

**Reference(s):**


| | |
|---|---|
| 1. | 'English for Engineers & Technologists' Orient Blackswan Private Ltd. Department of English, Anna University, 2020 |
| 2. | Norman Lewis, 'Word Power Made Easy – The Complete Handbook for Building a Superior Vocabulary Book', Penguin Random House India, 2020 |
| 3. | Raman. Meenakshi, Sharma. Sangeeta, 'Professional English'. Oxford University Press. New Delhi. 2019 |
| 4. | Arthur Brookes and Peter Grundy,' Beginning to Write: Writing Activities for Elementary and Intermediate Learners', Cambridge University Press, New York, 2003 |


*SDG- 04- Quality Education



CHAIRMAN
Board Of Studies/
Mechatronics Engineering

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Listening** | |
| 1.1 | Evaluative Listening: Advertisements, Product Descriptions | 1 |
| 1.2 | Listening to Longer Technical Talks and Completing– Gap Filling Exercises. | 1 |
| 1.3 | Listening Technical Information from Podcasts | 1 |
| 1.4 | Listening to Process/Event Descriptions to Identify Cause & Effects and Documentaries Depicting a Technical Problem and Suggesting Solutions | 1 |
| 1.5 | Listening to TED Talks | 1 |
| **2.0** | **Speaking** | |
| 2.1 | Marketing a Product, Persuasive Speech Techniques | 1 |
| 2.2 | Describing and Discussing the Reasons of Accidents or Disasters Based on News Reports, | 1 |
| 2.3 | Group Discussion (Based on Case Studies) | 1 |
| 2.4 | Presenting Oral Reports, Mini Presentations on Select Topics with Visual Aids | 1 |
| 2.5 | Participating in Role Plays and Virtual Interviews | 1 |
| **3.0** | **Reading** | |
| 3.1 | Reading Advertisements, User Manuals and Brochures | 1 |
| 3.2 | Reading – Longer Technical Texts– Cause and Effect Essays, and Letters / Emails of Complaint | 1 |
| 3.3 | Case Studies, Excerpts from Literary Texts, News Reports Etc. | 1 |
| 3.4 | Company Profiles | 1 |
| 3.5 | Statement of Purpose (SoPs) | 1 |
| **4.0** | **Writing** | |
| 4.1 | Professional Emails, Email Etiquette | 1 |
| 4.2 | Compare and Contrast Essay | 1 |
| 4.3 | Writing Responses to Complaints | 1 |
| 4.4 | Precis Writing, Summarizing and Plagiarism | 1 |
| 4.5 | Job / Internship Application – Cover Letter & Résumé | 1 |
| **5.0** | **Verbal Ability** | |
| 5.1 | Reading Comprehension (Inferential Fillups) and Theme Detection | 1 |
| 5.2 | Spotting Errors | 1 |
| 5.3 | Verbal Analogies | 1 |
| 5.4 | Change of Voice and Change of Speech | 1 |
| 5.5 | One Word Substitution | 1 |

**Course Designer(s)**

1. Dr.A.Palaniappan- palaniappan@ksrct.ac.in

**K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE – 637215**
(An Autonomous Institution affiliated to Anna University)
B.E. / B.Tech. Degree Programme
**SCHEME OF EXAMINATIONS**
(For the candidates admitted in 2022 –2023)

FOURTH SEMESTER

| S. No. | Course Code | Name of the Course | Duration of Internal Exam | Weightage of Marks | | | Minimum Marks for Pass in End Semester Exam | |
|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment* | End Semester Exam** | Max. Marks | End Semester Exam | Total |
| **THEORY** | | | | | | | | |
| 1 | 60 MC 401 | Industrial Drives and Control | 2 | 40 | 60 | 100 | 45 | 100 |
| 2 | 60 MC 402 | Fluid Mechanics and Thermodynamics | 2 | 40 | 60 | 100 | 45 | 100 |
| 3 | 60 MC 403 | Metrology and Statistical Quality control | 2 | 40 | 60 | 100 | 45 | 100 |
| 4 | 60 MC 404 | Hydraulic and Pneumatic Control | 2 | 50 | 50 | 100 | 45 | 100 |
| 5 | 60 MC 405 | Virtual Instrumentation and Applications | 2 | 50 | 50 | 100 | 45 | 100 |
| 6 | 60 OE L0* | Open Elective-I | 2 | 40 | 60 | 100 | 45 | 100 |
| **PRACTICAL** | | | | | | | | |
| 7 | 60 MC 4P1 | Industrial Drives and Control Laboratory | 3 | 60 | 40 | 100 | 45 | 100 |
| 8 | 60 MC 4P2 | Applied Mechanics Laboratory | 3 | 60 | 40 | 100 | 45 | 100 |
| 9 | 60 CG 0P3 | Career Skill Development-III | 3 | 100 | - | 100 | - | 100 |
| 10 | 60 CG 0P6 | Internship | - | 100 | - | 100 | - | 100 |

*** CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.**
**** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory courses, 50 marks for theory cum practical courses and 40 marks for Practical End Semester Examination.**

w.e.f. 03/06/2023
Passed in the BoS Meeting Held on 18/05/2023
Approved in Academic Council Meeting held on 03/06/2023

CHAIRMAN
Board Of Studies/
Mechatronics Engineering

| 60 MC 401 | Industrial Drives and Control | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

## Objectives

- To learn the structure of Electric Drive systems and their role in various loads
- To impart the knowledge on starting methods of DC and AC motors
- To understand the operation of D.C motor speed control using converters and choppers.
- To introduce the concept of control circuit for industrial drives.
- To provide the knowledge on construction, working and control strategies of special drives.

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the need of electrical drives and their applications in various loads. | Understand |
| CO2 | Describe the starting methods of AC and DC Drives | Understand |
| CO3 | Understand the solid-state speed control techniques in DC & AC Drives | Understand |
| CO4 | Develop motor control circuit basics in industrial standard | Apply |
| CO5 | Understand the principle of operation of special drives and their applications. | Understand |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | 3 | 3 | - | - | 2 | 1 | 1 | 1 | 1 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | 2 | - | - | 2 | 2 | 1 | - | 1 | 3 | 3 |
| CO3 | 3 | 2 | 3 | 3 | 3 | - | - | 3 | 1 | 1 | 1 | 1 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | - | 1 | 1 | - | 1 | 1 | 3 | 3 |
| CO5 | 3 | 2 | 3 | 2 | 3 | - | - | 1 | 1 | 1 | 1 | 1 | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 20 | 20 | 30 | 30 |
| Understand | 40 | 35 | 65 | 65 |
| Apply | - | 05 | 05 | 05 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | 100 |

**Syllabus**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
| **B.E – Mechatronics Engineering** | | | | | | | | |
| **60 MC 401 – Industrial Drives and Control** | | | | | | | | |
| **Semester** | **Hours / Week** | | | **Total hrs** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| IV | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction**<br>Basic Elements-Types of Electric Drives-factors influencing the choice of electrical drives-Heating and cooling curves-Loading conditions and classes of duty-Selection of power rating for drive motors with regard to thermal overloading and Load variation factors | **[9]** |
| **Drive motor characteristics and Starting Methods**<br>Speed-Torque characteristics–Braking of Electrical motors -Types of D.C Motor starters-Typical control circuits for shunt and series motors — Types of A.C Motor starters- Three phase squirrel cage and slip ring induction motors | **[9]** |
| **Solid State Speed Control of DC Drives & AC Drives**<br>Speed control of DC series and shunt motors-Armature and field control, Ward-Leonard control system- Using controlled rectifiers and DC choppers.<br>Speed control of three phase induction motor-Voltage control, voltage / frequency control, slip power recovery scheme- Using inverters and AC voltage regulators.. | **[9]** |
| **Development of Control Circuit**<br>Develop ladder diagram for control from one place, remote control, interlocking, DOL starter, Forward and reverse motoring, Automatic star delta starter, Automatic Plugging, Jogging and sequence speed control, Thyristor controlled DC Motor Drive and Induction motor drive. | **[9]** |
| **Special motor Drives**<br>Stepper motors-Permanent magnet, Variable reluctance, Single and multi-stack configurations, Hybrid motor. Switched reluctance motors-AC & DC Servo motors–Brushless DC motors. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Gopal.K.Dubey ,"Fundamentals of Electrical Drives" Narosa Publishing House, 2nd Edition, 2013. |
| 2. | A.K., "A text book of Electrical Technology–Volume II (AC & DC Machines)"S.Chand & Company Ltd., New Delhi, 2005. |

**Reference(s):**

| | |
|---|---|
| 1. | Vedam Subrahmanyam, "Electric Drives Concepts and Applications" Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 2001. |
| 2. | M.D.Singh and K.B. Khanchandani, "Power Electronics", Tata Mc Graw Hill Publishing Company Ltd.,New Delhi, 2008. |
| 3. | Shepherd Hullay & Liag,"Power Electronics & Motor Control", Cambridge University Press. . |
| 4. | Partab. H., "Art and Science and Utilisation of Electrical Energy", Dhanpat Rai and Sons, 2017 |

*SDG 9 – Industry Innovation and Infrastructure

**SDG 8– Design Work and Economic Growth

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Introduction** | |
| 1.1 | Basic Elements of electrical drives | 2 |
| 1.2 | Types of Electric Drives, factors influencing the choice of electrical drives | 1 |
| 1.3 | heating and cooling curves | 2 |
| 1.4 | Selection of power rating for drive motors with regard to thermal overloading Load variation factors | 2 |
| 1.5 | Loading condition & class of duty | 1 |
| 1.6 | Load variation factors of electrical drive | 1 |
| **2.0** | **Drive motor characteristics and Starting Methods** | |
| 2.1 | Speed-Torque characteristics | 1 |
| 2.2 | Braking of Electrical motors | 1 |
| 2.3 | Types of D.C Motor starters, single phase three phase | 1 |
| 2.4 | Typical control circuits for shunt motors | 2 |
| 2.5 | Typical control circuits for series motors | 1 |
| 2.6 | Starters for Three phase squirrel cage. | 2 |
| 2.7 | Starting methods of slip ring induction motors, | 1 |
| **3.0** | **Solid State Speed Control of DC Drives & AC Drives** | |
| 3.1 | Speed control of DC series and shunt motors | 1 |
| 3.2 | Armature and field control | 1 |
| 3.3 | Ward-Leonard control system | 1 |
| 3.4 | Using controlled rectifiers and DC choppers | 1 |
| 3.5 | Speed control of three phase induction motor | 1 |
| 3.6 | Voltage control, voltage / frequency control | 1 |
| 3.7 | Slip power recovery scheme | 2 |
| 3.8 | Using inverters and AC voltage regulators. | 1 |
| **4.0** | **Development Of Control Circuit** | |
| 4.1 | Develop ladder diagram for control from one place, remote control, interlocking | 1 |
| 4.2 | DOL starter, Forward and reverse motoring | 1 |
| 4.3 | Automatic star delta starter | 1 |
| 4.4 | 3 speed motor Control | 1 |
| 4.5 | Automatic Plugging, Jogging | 1 |
| 4.6 | Sequence speed control, Motor control centre | 1 |
| 4.7 | Sequence functions and applications | 1 |
| 4.8 | Thyristor controlled DC Motor Drive; Thyristor controlled Induction motor drive | 2 |
| **5.0** | **Special motor Drives** | |
| 5.1 | Stepper motors | 1 |
| 5.2 | Permanent magnet, Variable reluctance | 2 |
| 5.3 | Single and multi-stack configurations | 2 |
| 5.4 | Hybrid motor. | 1 |
| 5.5 | Switched reluctance motors | 1 |
| 5.6 | AC & DC Servo motors | 1 |
| 5.7 | Brushless DC motors | 1 |

**Course Designer(s)**

Dr.M.Ravi - ravi@ksrct.ac.in

| 60 MC 402 | Fluid Mechanics and Thermodynamics | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 1 | 0 | 4 |

## Objectives

- To understand the properties of fluids, manometry and buoyancy
- To recognize mass and momentum conservation laws for fluid flows.
- To know the pressure and velocity variation in flow of fluids through pipes
- To know the basics of thermodynamics and evaluate the properties of changes in open and closed systems.
- To apply the concept of thermodynamics laws to various applications such as heat engine, heat pump and refrigeration systems

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Estimate the properties of fluids, manometry and buoyancy | Remember |
| CO2 | Identify the type of flow and apply the fluid dynamics concepts. | Understand |
| CO3 | Evaluate the velocity and pressure variation in flow through pipes. | Understand |
| CO4 | Describe the basic concepts of zeroth law and first law of thermodynamics and apply the conceptsof first law of thermodynamics to open and closed system. | Apply |
| CO5 | Relate the concept of second laws of thermodynamics to heat engine, heat pump and refrigerator and discuss the concept of entropy. | Apply |

## Mapping with Programme Outcomes

| Cos | Pos | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | - | - | 1 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | - | - | 1 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | - | - | 1 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | - | - | 1 | 3 | 3 |
| CO5 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | - | - | 1 | 3 | 3 |
| 3 – Strong; 2 – Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 20 | 10 | 20 | 20 |
| Understand | 40 | 20 | 40 | 40 |
| Apply | - | 30 | 40 | 40 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E – Mechatronics Engineering** | | | | | | | | |
| **60 MC 402 – Fluid Mechanics and Thermodynamics** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| IV | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 |

| | |
|---|---|
| **Fluid Properties and Fluid Statics**<br>Fluid Definition and Classification – Properties of fluids: Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity, Compressibility, Bulk Modulus, Capillary and Surface Tension – Fluid statics: Concept of fluid static pressure – Pascal's law –Absolute and Gauge<br>pressures – Manometers: piezometer, U-tube Manometer and Pressure measurement – Concept of Buoyancy and Floatation. | **[9]** |
| **Fluid kinematics and fluid dynamics**<br>Fluid Kinematics: Types of fluid flow – Continuity equation in two and three dimensions – Velocity and Acceleration of fluid particle – Velocity potential function and Stream function. Fluid dynamics: Euler's equation along a streamline –Bernoulli's equation and applications – Venturi meter, Orifice meter and Pitot tube. | **[9]** |
| **Flow through pipes**<br>Laminar and Turbulent flow: Hagen-Poiseuille equation, Darcy friction factor, Darcy-Weisbach Equation-Major and Minor losses – application of Moody's chart —Hydraulic gradient and Total energy lines – Flow through pipes in series and in parallel – Power transmission through<br>pipes. | **[9]** |
| **Basics of Thermodynamics and First Law of Thermodynamics:**<br>Thermodynamics – Microscopic and macroscopic point of view – Systems, properties, process, path, cycle. Thermodynamic equilibrium – Zeroth law of Thermodynamics – internal energy, enthalpy, specific heat capacities CV and CP, Relationship between CV and CP. First law of Thermodynamics – Application to closed and open systems – Steady Flow Energy Equation (SFEE) – Simple problems. | **[9]** |
| **Second Law of Thermodynamics and Entropy:**<br>Second Law of thermodynamics – Kelvin Planck and Clausius Statements – Reversibility – Irreversibility, reversible cycle – Heat engine, heat pump and refrigerator. Carnot cycle and Clausius theorem. Entropy principle – General expression for entropy – property of entropy – P-V and T-S diagrams – Simple problems in entropy | **[9]** |
| **Total Hours:(Lecture - 45; Tutorial - 15)** | **60** |

**Text Book(s):**

| | |
|---|---|
| 1. | Bansal R.K., Fluid Mechanics and Hydraulic Machines, 11th Edition, Laxmi Publications, New Delhi, 2022. |
| 2. | Cengel, Y. A., "Thermodynamics – An Engineering Approach", 9th Edition, Tata McGraw Hill Pub., New Delhi, 2019 |

**Reference(s):**

| | |
|---|---|
| 1. | Nag. P.K., "Engineering Thermodynamics", 6th Edition, Tata McGraw-Hill Publications, New Delhi, 2017. |
| 2. | Moran, M. J. and Shapiro, H. N., "Fundamentals of Engineering Thermodynamics", 8th Edition, John Wiley andSons, 2014. |
| 3. | Rajput, R.K., "A Textbook of Engineering Thermodynamics, 6th Edition, Laxmi Publications, 2023. |
| 4. | Ramamrutham.S. "Hydraulics Fluid Mechanics and Fluid Machines", 8th Edition, DhanpatRai Publishing Company (P) Ltd, New Delhi, 2014 |

*SDG 9 – Industry Innovation and Infrastructure

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Fluid Properties and Fluid Statics** | |
| 1.1 | Fluid Definition and Classification | 1 |
| 1.2 | Properties of fluids: Density, Specific Weight, Specific Volume, | 1 |
| 1.3 | Specific Gravity, Viscosity, Compressibility, Bulk Modulus, Capillary and Surface Tension Fluid statics: Concept of fluid static pressure | 1 |
| 1.4 | Pascal's law ,Absolute and Gauge pressures | 2 |
| 1.5 | Manometers: piezometer, U-tube Manometer and Pressure measurement | 2 |
| 1.6 | Concept of Buoyancy and Floatation. | 1 |
| 1.7 | Fluid Properties and Fluid Statics | 1 |
| **2.0** | **Fluid kinematics and fluid dynamics** | |
| 2.1 | Fluid Kinematics: Types of fluid flow | 1 |
| 2.2 | Continuity equation in two and three dimensions | 1 |
| 2.3 | Velocity and Acceleration of fluid particle | 1 |
| 2.4 | Velocity potential function and Stream function. | 2 |
| 2.5 | Fluid dynamics: Euler's equation along a streamline | 2 |
| 2.6 | Bernoulli's equation and applications | 1 |
| 2.7 | Venturi meter, Orifice meter and Pitot tube. | 1 |
| **3.0** | **Flow through pipes** | |
| 3.1 | Laminar and Turbulent flow | 1 |
| 3.2 | Hagen-Poiseuille equation, Darcy friction factor, | 1 |
| 3.3 | Darcy-Weisbach Equation | 2 |
| 3.4 | Major and Minor losses, Application of Moody's chart | 2 |
| 3.5 | Hydraulic gradient and Total energy lines | 1 |
| 3.6 | Flow through pipes in series and in parallel | 1 |
| 3.7 | Power transmission through pipes. | 1 |
| **4.0** | **Basics of Thermodynamics and First Law of Thermodynamics** | |
| 4.1 | Thermodynamics, Microscopic and macroscopic point of view | 1 |
| 4.2 | Systems, properties, process, path, cycle, | 1 |
| 4.3 | Thermodynamic equilibrium | 1 |
| 4.4 | Zeroth law of Thermodynamics, internal energy, enthalpy, | 1 |
| 4.5 | Specific heat capacities CV and CP, Relationship between CV and CP. | 1 |
| 4.6 | First law of Thermodynamics | 1 |
| 4.7 | Application to closed and open systems | 1 |
| 4.8 | Steady Flow Energy Equation (SFEE) | 1 |
| 4.9 | Simple problems. | 1 |
| **5.0** | **Second Law of Thermodynamics and Entropy:** | |
| 5.1 | Second Law of thermodynamics | 1 |
| 5.2 | Kelvin Planck and Clausius Statements | 2 |
| 5.3 | Reversibility, Irreversibility, reversible cycle | 1 |
| 5.4 | Heat engine, heat pump and refrigerator. | 1 |
| 5.5 | Carnot cycle and Clausius theorem. | 1 |
| 5.6 | Entropy principle, General expression for entropy | 1 |
| 5.7 | Property of entropy, P-V and T-S diagrams | 1 |
| 5.8 | Simple problems in entropy | 1 |

**Course Designer(s)**


1. Dr.R.Senthilmurugan- senthilmurugan@ksrct.ac.in
2. Dr.M.Baskaran- baskaranm@ksrct.ac.in

| 60 MC 403 | Metrology and Statistical Quality Control | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

## Objectives

- To give insights on the basics of metrology and measurements.
- To facilitate the knowledge on the various measurement techniques.
- To provide exposure on the fundamental working of optical measuring techniques
- To deliver insights on the basics of different forms of measurements
- To familiarize the statistical tools in the quality analysis

## Pre-requisites

- Engineering physics

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Describe the fundamental concepts of measurement. | Understand |
| CO2 | Recognise the linear and angular measurement techniques to inspect the products. | Understand |
| CO3 | Understand the optical measurement techniques to inspect the products. | Understand |
| CO4 | Demonstrate and simulate the different forms of measurements. | Apply |
| CO5 | Apply the statistical tools and control charts in measurements. | Apply |

## Mapping with Programme Outcomes

| Cos | Pos | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | - | - | 1 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | - | - | 1 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | - | - | 1 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | - | - | 1 | 3 | 3 |
| CO5 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | - | - | 1 | 3 | 3 |
| 3 – Strong; 2 – Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | 1 | 2 | | |
| Remember | 30 | 20 | 40 | 40 |
| Understand | 30 | 20 | 40 | 40 |
| Apply | - | 20 | 20 | 20 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 60 | 60 | 100 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E – Mechatronics Engineering** | | | | | | | | |
| **60 MC 403- Metrology and Statistical Quality Control** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| IV | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Fundamentals of Metrology**<br>Measurements, classifications and its Characteristics – Evolution of Standards – Sources of errors – Calibration – Concepts of interchangeability and selective assembly – Limits,fits and tolerances – Limit gauges. | **[9]** |
| **Linear and Angular Measurements**<br>Linear measurements: Vernier instruments, micrometres, Surface plates, V-Blocks, Feeler gauges, Thread gauges, Scribers, slip gauges – Angular measurements: Sine bar, bevel protractor, clinometers, angle gauges – Mechanical, optical and pneumatic comparators. | **[9]** |
| **Advancements in Metrology**<br>Interference of two rays, Light source, Interference in testing – Interferometers: Michelson Interferometer, Twyman-Green Interferometer, N.P.L. Flatness Interferometer, Laser Interferometers – Coordinate measuring machines – Types, probes and applications – Machine vision system: Principle and applications. | **[9]** |
| **Form Measurement**<br>Principle and Methods of straightness, flatness measurement, thread measurement, gear measurement, surface finish measurement and roundness measurement – Applications – Surface finish measurements with Gwyddion software. | **[9]** |
| **Statistical Quality Control**<br>Introduction to quality control and quality assurance – Statistical process control – Statistical tools of quality control, Control charts for variable, objective, relation between $\bar{X}$, s, $\bar{R}$, control limits — Control charts for attributes — p chart and np chart — Process capability studies – Acceptance sampling. Creation of control charts using Minitab software. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Samir Mekid, “Metrology and Instrumentation Practical Applications for Engineering and Manufacturing”, John Wiley &Sons, 2021 |
| 2. | Douglas C. Montgomery, “Introduction to Statistical Quality Control”, John Wiley &Sons, 2020 |

**Reference(s):**

| | |
|---|---|
| 1. | Anup Goel, “Metrology & Quality Control”, Repro Books Limited, 2020 |
| 2. | Venkateshan, S. P., “Mechanical Measurements”, Second edition, John Wiley &Sons, 2015 |
| 3. | Raghavendra, Krishnamurthy “Engineering Metrology & Measurements”, Oxford Univ. Press, 2013. |
| 4. | M. Mahajan, “Statistical Quality Control”, Dhanpatrai Publications, 2016 |

*SDG 9 – Industry Innovation and Infrastructure



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**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Fundamentals of Metrology** | |
| 1.1 | Introduction to Metrology and Measurement, | 1 |
| 1.2 | Classifications and its characteristics | 1 |
| 1.3 | Evolution of Standards | 1 |
| 1.4 | Sources of errors | 2 |
| 1.5 | Calibration | 1 |
| 1.6 | Concepts of interchangeability and selective assembly | 1 |
| 1.7 | Limits, fits and tolerances | 1 |
| 1.8 | Limit gauges | 1 |
| **2.0** | **Linear And Angular Measurements** | |
| 2.1 | Introduction to measurements, Vernier instruments | 1 |
| 2.2 | Micrometers | 1 |
| 2.3 | Surface plates, V-Blocks | 1 |
| 2.4 | Feeler gauges, Thread gauges, Scribers | 1 |
| 2.5 | Slip gauges | 1 |
| 2.6 | Angular measurements – sine bar | 1 |
| 2.7 | Bevel protractor, clinometers, angle gauges | 1 |
| 2.8 | Comparators- Mechanical | 1 |
| 2.9 | Comparators- optical and pneumatic | 1 |
| **3.0** | **Advancements in metrology** | |
| 3.1 | Basics – Interference of two rays | 1 |
| 3.2 | Light source, Interference in testing | 1 |
| 3.3 | Interferometers – Michelson Interferometer, Twyman-Green Specialisation of Michelson Interferometer, N.P.L. Flatness Interferometer, Laser Interferometers | 2 |
| 3.4 | Coordinate measuring machines -Types | 2 |
| 3.5 | Coordinate measuring machines – Probes, applications | 1 |
| 3.6 | Machine vision system – Introduction | 1 |
| 3.7 | Machine vision system – Principle, and Applications | 1 |
| **4.0** | **Form Measurement** | |
| 4.1 | Principles and Methods of straightness | 1 |
| 4.2 | Flatness measurement | 1 |
| 4.3 | Thread measurement | 2 |
| 4.4 | Gear measurement | 1 |
| 4.5 | Surface finish measurement, Surface finish measurements with Gwyddion and LAB View software | 2 |
| 4.6 | Roundness measurement | 1 |
| 4.7 | Applications of measurement | 1 |
| **5.0** | **Statistical Process Control** | |
| 5.1 | Introduction to quality control and quality assurance | 1 |
| 5.2 | Statistical process control, Statistical tools of quality control | 1 |
| 5.3 | Control charts for variable, objective, relation between $X, s, R$ control limits | 2 |
| 5.4 | Control charts for variable, control limits | 1 |
| 5.5 | Control charts for attributes, p chart and np chart, Creation of Control charts using minitab | 2 |
| 5.6 | Process capability studies | 1 |
| 5.7 | Acceptance sampling | 1 |

**Course Designer(s)**

Dr.S.Sathish – sathishs@ksrct.ac.in



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Mechatronics Engineering

| 60 MC 404 | Hydraulic and Pneumatic Control | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 2 | 4 |

## Objectives

- To familiarize about the basics fundamentals of hydraulic and pneumatic transmission power using pressurized fluids.
- To understand working principles, operation of hydraulic and pneumatic components.
- To expose to various techniques for choosing pumps, valves and pneumatics components for suitable application.
- Have exposure to diagnose / troubleshoot hydraulic, pneumatic, electro pneumatic circuits.
- To design the circuits using pneumatic / hydraulic components for an industrial
- application

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Explain the fundamental properties of fluids and understand the applications, advantages of fluid power system. | Apply |
| CO2 | Identify the various pumps, valves, actuators and its working principles inhydraulic circuit. | Apply |
| CO3 | Describe and illustrate the construction and working principles of various compressors, pneumatic valves and FRL unit importance in pneumatic circuit. | Apply |
| CO4 | Design and develop the hydraulic and pneumatic circuit for variousapplications. | Apply |
| CO5 | Know the significance of failures and troubleshooting, fluid power circuit for industry 4.0 and software used in fluid power automation | Apply |

## Mapping with Programme Outcomes

| Cos | Pos | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | - | - | - | 2 | - | | - | - | - | 1 | 1 |
| CO2 | 3 | 2 | 3 | - | - | 1 | - | - | 1 | - | - | - | 1 | 1 |
| CO3 | 3 | 3 | 3 | - | - | 1 | - | - | 1 | - | - | - | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 3 | 1 | - | - | 3 | - | - | - | 3 | 3 |
| CO5 | - | 2 | 2 | 2 | 2 | 1 | - | - | | - | - | - | 3 | 3 |
| 3 – Strong; 2 – Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | | | Model Examination (Marks) | | End Sem Examination (Marks) | |
|---|---|---|---|---|---|---|---|---|
| | Test 1 | | Test 2 | | | | | |
| | Theory | Lab | Theory | Lab | Theory | Lab | Theory | Lab |
| Remember | 10 | - | 10 | - | 20 | - | 20 | - |
| Understand | 20 | 50 | 20 | 50 | 30 | 25 | 30 | 25 |
| Apply | 30 | 50 | 30 | 50 | 50 | 75 | 50 | 75 |
| Analyse | - | - | - | - | - | | - | |
| Evaluate | - | - | - | - | - | - | - | - |
| Create | - | - | - | - | - | - | - | - |
| Total | 60 | 100 | 60 | 100 | 100 | 100 | 100 | 100 |



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| K.S.Rangasamy College of Technology – AutonomousR2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **60 MC 404 – Hydraulic and Pneumatic Control** | | | | | | | | |
| **B.E. Mechatronics Engineering** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| IV | 3 | 0 | 2 | 75 | 4 | 50 | 50 | 100 |

| | |
|---|---|
| **Fluid Power System**<br>Introduction to fluid power - properties of fluids: Viscosity index, Oxidation index, Demulsibility, Lubricity, Rust prevention, Pour point, Flash point and Fire point, Types of hydraulic fluids - Advantages and drawbacks of fluid power - Applications of fluid power — Fluid power components and symbols- Pascal's law: Multiplication of Force - Analysis of simple hydraulic jack - Applications of Pascal's law: Hand operated hydraulic jack, Air to Hydraulic Pressure Booster | **[9]** |
| **Hydraulic Pumps, Actuator and Valves**<br>Pumps Pumping theory - Pump classification - working principle of Gear pump, Vane pump, Screw pump - Hydraulic Actuators: Hydraulic motors — gear and vane motors, Hydraulic cylinders: single acting and double acting cylinders, Special type cylinders: rodless, tandem and telescopic - Hydraulic valves: Pressure Control Valve types, Direction control valve types, Flow control valve types, Counter balance valve. | **[9]** |
| **Pneumatic System**<br>Properties of air-Compressors: Rotary compressor - Screw compressor, vane compressor - Piston Compressor: Single and Multi-Stage Compressor - Filter, Regulator and Lubricator Unit - Valves: Direction control valves, Two way, Three way, Four way valves - Pneumatic check valves - Flow control valve, Pneumatic shuttle valve - AND type valve - Quick exhaust valve. | **[9]** |
| **Design of Hydraulic and Pneumatic Circuits**<br>Construction of Hydraulic circuits - Fail safe circuit - Regenerative circuit - pressure intensifier circuits - Accumulator circuits. Construction of Pneumatic circuits: Cascade method - sequence circuit. Electro - pneumatic circuit – IoT based solenoid valve. | **[9]** |
| **Industrial Automation**<br>Fluid power circuit for hydraulic braking system-Fluid power circuit for robot arm for pick and placePneumatic automation for Industry 4.0-Hydraulic system for Industry 4.0- Trouble shooting of Fluid power system [09] | **[9]** |
| **Practical:**<br>1. Assembling of hydraulic components for basic Hydraulic circuit.<br>2. Assembling of pneumatic components for basic Pneumatic circuit.<br>3. Assembling of pneumatic components for Meter in & Meter out circuit<br>4. Assembling of pneumatic components for Synchronizing circuit.<br>5. IoT based pneumatic circuit | **[30]** |
| **Total Hours: (Lecture - 45; Practical - 30)** | **75** |


| **Text book(s) :** | |
|---|---|
| 1 | Anthony Esposito, "Fluid Power with Applications", Pearson Education New Delhi, 2015. |
| 2. | Srinivasan R ,"Hydraulic and Pneumatic Controls",2nd Edition', Vijay Nicole Imprint (P) Ltd., Chennai, 2016. |
| **Reference(s) :** | |
| 1 | S. R. Majumdar, "Oil Hydraulics", Tata McGraw Hill Publishing Company Pvt Ltd. New Delhi, 2014. |
| 2 | S. R. Majumdar, "Pneumatic systems - Principles and Maintenance", Tata McGraw HillPublishing Company Pvt Ltd. New Delhi, 2014. |
| 3 | Andrew Parr, Hydraulics and Pneumatics, Jaico Publishing House, 2015. |
| 4 | James L. Johnson, "Introduction to Fluid Power", Delmar Thomson Learning, 2013. |


SDG No.9 – Industry, Innovation and Infrastructure

**Course Contents and Lecture Schedule**

| S.No | Topic | No.of Hours |
|---|---|---|
| **1.0** | **Fluid Power System** | |
| 1.1 | troduction to fluid power , Types of hydraulic fluids | 2 |
| 1.2 | Advantages and drawbacks of fluidpower ,Applications of fluid power | 1 |
| 1.3 | Fluid power components and symbols | 1 |
| 1.4 | Pascal’s law: Multiplication of Force | 1 |
| 1.5 | Applications of Pascal’s law: Hand operated hydraulic jack | 1 |
| **2.0** | **Hydraulic Pumps, Actuator and Valves** | |
| 2.1 | Pumping theory, Pump classification | 1 |
| 2.2 | Working principle of pump, Hydraulic cylinders: single acting and double acting Cylinders | 2 |
| 2.3 | Special type cylinders: rod less, tandem and telescopic | 1 |
| 2.4 | Hydraulic valves: Pressure Control Valve types | 1 |
| 2.5 | Direction control valve types, Flow control valve | 1 |
| **3.0** | **Pneumatic System** | |
| 3.1 | Properties of air,Compressors: Piston Compressor:Single and Multi-Stage Compressor | 1 |
| 3.2 | Filter, Regulator and Lubricator Unit | 1 |
| 3.3 | Valves: Direction control valves, Two-way, Three-way, Four-way valves | 1 |
| 3.4 | Pneumatic check valves | 1 |
| 3.5 | Flow control valve, Pneumatic shuttle valve | 1 |
| 3.6 | AND type valve, Quick exhaust valve. | 1 |
| **4.0** | **Design of Hydraulic and Pneumatic Circuits** | |
| 4.1 | Construction of Hydraulic circuits | 1 |
| 4.2 | Regenerative circuit | 1 |
| 4.3 | Pressure intensifier circuits | 1 |
| 4.4 | Accumulator circuits | 2 |
| 4.5 | Construction of Pneumatic circuits: Electro ,pneumatic circuit | 2 |
| **5.0** | **Industrial Automation** | |
| 5.1 | Fluid power circuit for robot arm for pick and place Pneumatic automation for Industry 4.0 | 2 |
| 5.2 | Hydraulic system for Industry 4.0 | 2 |
| 5.3 | Trouble shooting of Fluid power system | 2 |

## Course Designers


1. Dr.R.Senthilmurugan – senthilmurugan@ksrct.ac.in

| 60 MC 405 | Virtual Instrumentation and Applications | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 2 | 0 | 2 | 3 |

## Objectives

- To understand the fundamentals of virtual instrumentation and basic concept of graphical programming with their functions in LabVIEW.
- To impart the fundamental knowledge on the software tools in virtual instrumentation.
- To develop programming through LabVIEW graphical programming environment.
- To know about the data acquisition and various types Interfaces used in VI.
- To familiarize students with various applications of VI

## Pre-requisites

- Sensors and Instrumentation

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the basic concepts about virtual instrumentation. | Understand |
| CO2 | Interpret the software tools in virtual instrumentation | Apply |
| CO3 | Develop programming through LabVIEW graphical programming environment. | Analyze |
| CO4 | Describe the functions and the interface requirements in Data acquisition system. | Analyze |
| CO5 | Understand the different applications and advanced concept of VI. | Understand |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 2 | 3 | - | - | 2 | - | - | - | - | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 3 | 2 | - | - | 2 | - | - | - | 3 | 3 |
| CO3 | 3 | 3 | 2 | 2 | 3 | 2 | - | - | - | 3 | - | - | 3 | 3 |
| CO4 | 3 | 3 | 2 | 2 | 3 | - | 2 | - | - | - | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 1 | 3 | 3 | - | - | - | - | - | 3 | 2 | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | | | Model Examination (Marks) | | End Sem Examination (Marks) | |
|---|---|---|---|---|---|---|---|---|
| | Test 1 | | Test 2 | | | | | |
| | Theory | Lab | Theory | Lab | Theory | Lab | Theory | Lab |
| Remember | 30 | - | 30 | - | 34 | - | 34 | - |
| Understand | 30 | 50 | 30 | - | 66 | - | 66 | - |
| Apply | - | 50 | - | 50 | - | 50 | - | 50 |
| Analyse | - | - | - | 50 | - | 50 | - | 50 |
| Evaluate | - | - | - | - | - | - | - | - |
| Create | - | - | - | - | - | - | - | - |
| Total | 60 | 100 | 60 | 100 | 100 | 100 | 100 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC 405 - Virtual Instrumentation and Applications** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| IV | 2 | 0 | 2 | 60 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| **Introduction to VI**<br>Historical perspective and Traditional bench-top instruments–General functional description of a digital instrument – Block diagram of a Virtual Instrument – Physical quantities and analog interfaces – Hardware and Software–Advantages of Virtual Instruments over conventional instruments–<br>Architecture of a Virtual Instrument and its relation to the operating system. | **[9]** |
| **VI Software Tools****<br>Graphical User Interfaces–Controls and Indicators–Modular programming–Data types–Data flow programming–Editing, Debugging and Running a Virtual Instrument–Graphical programming palettes and tools–Function and Libraries–VI and sub-VI, Structures: FOR Loops, WHILE loops, Shift Registers, CASE structure, Formula nodes, Sequence structures, Timed looped structures. | **[9]** |
| **VI Programming Techniques***<br>Arrays and Clusters: Array operation – Bundle/Unbundle and Bundle/Unbundle by name – Plotting data: graphs and charts – String and File I/O: High level and Low level file I/O's – Attribute nodes –Local and global variables. | **[9]** |
| **Data Acquisition and Interface System****<br>Introduction to data acquisition on PC, Sampling fundamentals. Concepts of Data Acquisition and terminology –Installing Hardware and drivers – Configuring and addressing the hardware – Digital and Analog I/O function –Real time Data Acquisition – USB based DAQ. Common Instrument Interfaces: Current loop – RS 232C – RS 485 and Bus Interfaces. | **[9]** |
| **VI Applications**<br>Advantages and Applications–Advanced concepts–TCP / IP– PXI –Instrument Control–Image acquisition – Motion Control – Signal processing – Signal analysis: Power spectral analysis – Control design and simulation. | **[9]** |
| **Practical:**<br>1. Debugging a VI, sub VI's using LabVIEW.<br>2. Programming structure, arrays, clusters, and File I/O using LabVIEW.<br>3. Control of temperature using data acquisition card.<br>4. Model and simulate a LED interface unit using DAQ | **[15]** |
| **Total Hours: (Lecture - 45; Practical - 15)** | **60** |

**Text Book(s):**

| | |
|---|---|
| 1. | Jeffrey Travis, Jim Kring, "LabVIEW for Everyone: Graphical Programming Made Easy and Fun" (3rd Edition), Prentice Hall, 2022. |
| 2. | Sanjay Gupta,"Virtual instrumentation using LabVIEW : principles and practices of graphical programming",TMH,2017. |

**Reference(s):**

| | |
|---|---|
| 1. | Jovitha Jerome, "Virtual Instrumentation using LabView", PHI Learning Pvt. Ltd, New Delhi, 2010 |
| 2. | Gary W. Johnson, Richard Jennings, "Lab-view Graphical Programming", McGraw Hill Professional Publishing, 2011. |
| 3. | LabVIEW user manual, National Instruments,1998. |
| 4. | Kevin James, "PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control", Newness, 2010. |

*SDG 9 – Industry Innovation and Infrastructure
**SDG 7 – Affordable and Clean Energy

## Course Contents and Lecture Schedule

| S.No | Topic | No.of Hours |
|---|---|---|
| **1** | **Introduction to VI** | |
| 1.1 | Historical perspective and traditional bench | 1 |
| 1.2 | Top instruments | 1 |
| 1.3 | General functional description of a digital instrument | 2 |
| 1.4 | Block diagram of a Virtual Instrument | 1 |
| 1.5 | Physical quantities and analog interfaces | 1 |
| 1.6 | Hardware and Software | 1 |
| 1.7 | Advantages of Virtual Instruments over conventional instrument | 1 |
| 1.8 | Architecture of a Virtual Instrument and its relation to the operating system | 1 |
| **2** | **VI Software Tools** | |
| 2.1 | Graphical user interfaces | 1 |
| 2.2 | Controls and Indicators | 1 |
| 2.3 | Modular programming, Data types | 1 |
| 2.4 | Data flow programming ,Editing | 1 |
| 2.5 | Debugging and Running a Virtual Instrument | 1 |
| 2.6 | Graphical programming palettes and tools | 1 |
| 2.7 | Function and Libraries–VI and sub VI | 1 |
| 2.8 | Structures: FOR Loops ,WHILE loops ,Shift Registers | 1 |
| 2.9 | CASE structure, Formula nodes, Sequence structures, Timed looped structures. | 1 |
| **3** | **VI Programming Techniques** | |
| 3.1 | Arrays and Clusters: Array operation | 1 |
| 3.2 | Bundle/Unbundle and Bundle/Unbundle by name | 2 |
| 3.3 | Plotting data: graphs and charts | 1 |
| 3.4 | String and File I/O: High level and Low level file I/O's | 1 |
| 3.5 | Local and global variables. | 2 |
| 3.6 | Debugging a VI, sub VI's using LabVIEW. | 1 |
| 3.7 | Programming structure, arrays, clusters, and File I/O using LabVIEW. | 1 |
| **4** | **Data Acquisition and Interface System** | |
| 4.1 | Introduction to data acquisition on PC, Sampling fundamentals | 1 |
| 4.2 | Concepts of Data Acquisition and terminology | 1 |
| 4.3 | Installing Hardware and drivers | 1 |
| 4.4 | Configuring and addressing the hardware | 1 |
| 4.5 | Digital and Analog I/O function | 1 |
| 4.6 | Real time Data Acquisition | 1 |
| 4.7 | USB based DAQ. | 1 |
| 4.8 | Common Instrument Interfaces: Current loop, RS 232C- RS 485 and Bus Interfaces. | 1 |
| 4.9 | Control of temperature using Data Acquisition Card. | 1 |
| **5** | **VI Applications** | |
| 5.1 | Advantages and Applications | 1 |
| 5.2 | Advanced concepts | 1 |
| 5.3 | TCP/IP , PXI | 1 |
| 5.4 | Instrument Control | 1 |
| 5.5 | Image acquisition | 1 |
| 5.6 | Motion Control, Signal processing | 1 |
| 5.7 | Signal analysis, Power spectral analysis | 1 |
| 5.8 | Control design and simulation | 1 |
| 5.9 | Model and simulate a LED interface unit using DAQ. | 1 |

## Course Designers

1. Mrs.V.Indumathi - indumathi@ksrct.ac.in



CHAIRMAN
Board Of Studies/
Mechatronics Engineering

| 60 MC 4P1 | Industrial Drives and Control Laboratory | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 0 | 0 | 4 | 2 |

## Objectives

- To acquire knowledge about speed control of DC drives.
- To determine the performance characteristics of the given DC drives.
- To provide the knowledge about speed control of AC drives.
- To determine the performance characteristics of the given AC drives.
- To acquire the knowledge of solid state speed control of AC & DC drives.

## Pre-requisites

- Basic Electrical and Electronics Engineering

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Test the performance of DC motors under different load condition | Analyze |
| CO2 | Test the performance of induction motors under different load conditions. | Analyze |
| CO3 | Analyze the performance of conventional speed control systems for DC motors | Analyze |
| CO4 | Design power electronics-based speed control systems for DC drives. | Apply |
| CO5 | Design power electronics-based speed control systems for Induction motor drives | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 2 | - | - | - | 3 | - | - | - | 1 | 1 | 1 | 1 | 3 | 3 |
| CO2 | 2 | 3 | 2 | - | 1 | - | - | 1 | 3 | 2 | - | 1 | 3 | 3 |
| CO3 | 2 | 2 | 1 | - | 2 | - | - | 1 | 2 | 2 | 1 | 1 | 3 | 3 |
| CO4 | 2 | 3 | 2 | 2 | 2 | - | - | 2 | - | 2 | 1 | 1 | 3 | 3 |
| CO5 | 2 | 3 | - | 2 | 2 | - | - | - | - | - | 1 | 1 | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Lab Experiments Assessment (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | Lab | Activity | | |
| Remember | - | - | - | - |
| Understand | - | - | - | - |
| Apply | 25 | 12 | 50 | 50 |
| Analyse | 25 | 13 | 50 | 50 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 50 | 25 | 100 | 100 |

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC 4P1– Industrial Drives and Control Laboratory** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hrs** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| IV | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |

**List of Experiments:**

1. Load characteristics of DC shunt motor and compound motor.
2. Load characteristics of DC series motor.
3. Load test on three-phase squirrel cage induction motor.
4. Load test on three-phase slip ring induction motor.
5. Load test on single phase induction motor.
6. Speed control of DC shunt motor.
7. Speed control of DC shunt motor using controlled rectifier.
8. Speed control of DC shunt motor using chopper.
9. Speed control of three–phase induction motor by V/F method.
10. Speed control of three phase induction motor (Voltage control)

**Lab Manual**

| | |
|---|---|
| 1. | "Industrial Drives and Control Laboratory Manual", Department of Mechatronics Engineering, KSRCT. |

*SDG 9 – Industry Innovation and Infrastructure
**SDG 8 – Decent Work and Economic Growth

**Course Designer(s)**

1. Dr.M.Ravi – ravi@ksrct.ac.in



CHAIRMAN
Board Of Studies/
Mechatronics Engineering

| 60 MC 4P2 | Applied Mechanics Laboratory | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 0 | 0 | 4 | 2 |

## Objectives

- To study the mechanical properties of metals under tension, hardness, torsion, and impact by testing in laboratory.
- To study on the deflection of open and closed coil springs.
- To facilitate the experimental knowledge about coefficient of discharge using orifice meter.
- To emphasize the concept of fluid mechanics and machinery theory to determine friction factor.
- To analyse the performance characteristics of pumps and turbines.

## Pre-requisites

- Strength of Materials, Fluid Mechanics

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Determine the tensile, hardness, torsion and impact properties of metals. | Apply |
| CO2 | Determine the stiffness of open and closed springs. | Apply |
| CO3 | Estimate the coefficient of discharge using orifice meter | Analyse |
| CO4 | Apply the fluid mechanics and machinery theory to determine the friction factor for various pipes. | Analyse |
| CO5 | Determine the performance characteristics of pumps and turbines. | Analyse |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | - | - | - | 2 | 3 | - | 2 | 2 | - | 2 | 3 | 3 |
| CO2 | 3 | 2 | - | - | - | 2 | 3 | - | 2 | 2 | - | 2 | 3 | 3 |
| CO3 | 3 | 2 | - | - | - | 2 | 3 | - | 2 | 2 | - | 2 | 3 | 3 |
| CO4 | 3 | 2 | - | - | - | 2 | 3 | - | 2 | 2 | - | 2 | 3 | 3 |
| CO5 | 3 | 2 | - | - | - | 2 | 3 | - | 2 | 2 | - | 2 | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Lab Experiments Assessment (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | Lab | Activity | | |
| Remember | - | - | - | - |
| Understand | - | - | - | - |
| Apply | 25 | 12 | 50 | 50 |
| Analyse | 25 | 13 | 50 | 50 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 50 | 25 | 100 | 100 |

w.e.f. 03/06/2023
Passed in the BoS Meeting Held on 18/05/2023
Approved in Academic Council Meeting held on 03/06/2023

CHAIRMAN
Board Of Studies/
Mechatronics Engineering

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC 4P2 - Applied Mechanics Laboratory** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hrs** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| IV | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |

**List of Experiments:**

1. Determination of tensile behavior of metals.
2. Determination of Hardness of material (Rockwell and Brinell Hardness)
3. Determination of impact strength of metals using Charpy and Izod testers.
4. Determination of torsional strength on given material.
5. Determination of tension and compressive behavior of helical springs.
6. Determination of coefficient of discharge of orifice meter.
7. Determination of friction factor for a set of pipes.
8. Determination of Pelton wheel performance under various interval loads.
9. Determination of Kaplan turbine performance under various interval loads.
10. Determination of centrifugal pump performance under various interval loads.

**Lab Manual**

| | |
|---|---|
| 1. | "Applied Mechanics Laboratory Manual", Department of Mechatronics Engineering, KSRCT. |

*SDG 9 – Industry Innovation and Infrastructure

**Course Designer(s)**

1. Mr.R. Vivek- vivek@ksrct.ac.in

| 60 CG 0P3 | Career Skill Development III | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | CG | 0 | 0 | 2 | 1* |

## Objectives

- To help learners improve their logical reasoning skills at different academic and professional contexts.
- To help learners relate basic quantitative problems and solve them.
- To help learners Infer critically the statements with optimal conclusions and assumptions.
- To Solve the quantitative problems pertaining to calculations of averages, ratio and proportions, and profit and loss effectively
- To compute quantitative problems related to time and work, speed and distance, and simple and compound interest

## Pre-requisites

- Basic knowledge of Arithmetic and Logical Reasoning

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Deduce the topics in logical reasoning at the preliminary and intermediate level. | Analyze |
| CO2 | Relate basic quantitative problems and solve them effectively at the preliminary level | Apply |
| CO3 | Infer critically the statements with optimal conclusions and assumptions with the data and information given. | Analyze |
| CO4 | Solve the quantitative problems pertaining to calculations of averages, ratio and proportions, and profit and loss effectively at the pre-intermediate level. | Apply |
| CO5 | Compute quantitative problems related to time and work, speed and distance, and simple and compound interest at intermediate level. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 2 | 2 | 2 | 3 | - | 3 | - | - | - | 2 | 3 | 3 | 1 | - |
| CO2 | 3 | 3 | 3 | 3 | - | 2 | - | - | - | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 2 | - | 3 | - | - | - | 2 | 3 | 3 | - | 1 |
| CO4 | 3 | 3 | 3 | 3 | - | 2 | - | - | - | 2 | 3 | 3 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | - | 2 | - | - | - | 2 | 3 | 3 | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Common to All Branches** | | | | | | | | |
| **60 CG 0P3 – Career Skill Development III** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| IV | 0 | 0 | 2 | 30 | 1* | 100 | 00 | 100 |

| | |
|---|---|
| **Logical Reasoning**<br>Analogies - Alpha and Numeric Series - Number Series - Coding and Decoding - Blood Relations - Coded Relations - Order and Ranking – Odd Man Out - Direction and Distance | **[6]** |
| **Quantitative Aptitude – Part 1**<br>Number System - Squares & Cubes - Divisibility - Unit Digits - Remainder Theorem - HCF & LCM - Geometric and Arithmetic Progression - Surds & Indices | **[6]** |
| **Critical Reasoning**<br>Syllogism - Statements and Conclusions, Cause and Effect, Statements and Assumptions - Identifying Strong Arguments and Weak Arguments – Cause and Action -Data Sufficiency | **[6]** |
| **Quantitative Aptitude – Part 2**<br>Average - Ratio and Proportion – Ages – Partnership– Percentage - Profit & Loss – Discount- Mixture and Allegation | **[6]** |
| **Quantitative Aptitude – Part 3**<br>Time & Work - Pipes and Cistern – Time, Speed & Distance - Trains - Boats and Streams - Simple Interest and Compound Interest | **[6]** |
| **Total Hours:** | **30** |

**Reference(s):**


| | |
|---|---|
| 1. | Aggarwal, R.S. 'A Modern Approach to Verbal and Non-Verbal Reasoning', Revised Edition 2008, Reprint 2009, S.Chand & Co Ltd., New Delhi. |
| 2. | Abhijit Guha, 'Quantitative Aptitude', McGraw Hill Education, 6th edition, 2016 |
| 3. | Dinesh Khattar, 'Quantitative Aptitude For Competitive Examinations', Pearson Education 2020 |
| 4. | Anne Thomson, 'Critical Reasoning: A Practical Introduction' Lexicon Books, 3rd Edition, 2022. Warszaw |


SDG 4 – Quality Education
SDG 8 – Decent work and Economic growth
SDG 9 – Industry, innovation and Infrastructure

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of Hours** |
| **1.0** | **Logical Reasoning** | |
| 1.1 | Analogies - Alpha and Numeric Series | 1 |
| 1.2 | Number Series - Coding and Decoding | 1 |
| 1.3 | Blood Relations - Coded Relations | 1 |
| 1.4 | Order and Ranking – Odd Man Out | 1 |
| 1.5 | Direction and Distance | 1 |
| **2.0** | **Quantitative Aptitude – Part 1** | |
| 2.1 | Number System | 1 |
| 2.2 | Squares & Cubes - Divisibility | 1 |
| 2.3 | Unit digits - Remainder Theorem | 1 |
| 2.4 | HCF & LCM- Geometric and Arithmetic progression | 1 |
| 2.5 | Surds & indices | 1 |
| **3.0** | **Critical Reasoning** | |
| 3.1 | Syllogism | 1 |
| 3.2 | Statements and Conclusions, Cause and Effect | 1 |
| 3.3 | Statements and Assumptions | 1 |
| 3.4 | Identifying Strong Arguments and Weak Arguments | 1 |
| 3.5 | Cause and Action -Data Sufficiency | 1 |
| **4.0** | **Quantitative Aptitude – Part 2** | |
| 4.1 | Average - Ratio and Proportion | 1 |
| 4.2 | Ages – Partnership | 1 |
| 4.3 | Percentage | 1 |
| 4.4 | Profit & Loss | 1 |
| 4.5 | Discount - Mixture and Allegation | 1 |
| **5.0** | **Quantitative Aptitude – Part 3** | |
| 5.1 | Time & Work | 1 |
| 5.2 | Pipes and Cistern | 1 |
| 5.3 | Time, Speed & Distance - Trains | 1 |
| 5.4 | Boats and Streams | 1 |
| 5.5 | Simple Interest and Compound Interest | 1 |

**Course Designer(s)**

1. R. Poovarasan - poovarasan@ksrct.ac.in



CHAIRMAN
Board Of Studies/
Mechatronics Engineering

**K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215**

(An Autonomous Institution affiliated to Anna University)

B.E. / B.Tech. Degree Programme

**SCHEME OF EXAMINATIONS**

(For the candidates admitted in 2022 –2023)

FIFTH SEMESTER

| S. No. | Course Code | Name of the Course | Duration of Internal Exam | Weightage of Marks | | | Minimum Marks for Pass in End Semester Exam | |
|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment* | End Semester Exam** | Max. Marks | End Semester Exam | Total |
| **THEORY** | | | | | | | | |
| 1 | 60 MC 501 | Microprocessors and Microcontrollers | 2 | 40 | 60 | 100 | 45 | 100 |
| 2 | 60 MC 502 | System Design and Control | 2 | 40 | 60 | 100 | 45 | 100 |
| 3 | 60 MC 503 | Kinematics and Dynamics of Machines | 2 | 40 | 60 | 100 | 45 | 100 |
| 4 | 60 HS 003 | Total Quality Management | 2 | 40 | 60 | 100 | 45 | 100 |
| 5 | 60 MY 003 | Start-ups and Entrepreneurship | 2 | 100 | - | 100 | - | 100 |
| 6 | 60 MC E1* | Professional Elective-I | 2 | 40 | 60 | 100 | 45 | 100 |
| 7 | 60 OE L0* | Open Elective-II | 2 | 40 | 60 | 100 | 45 | 100 |
| **PRACTICAL** | | | | | | | | |
| 8 | 60 MC 5P1 | Microprocessors and Microcontrollers Laboratory | 3 | 60 | 40 | 100 | 45 | 100 |
| 9 | 60 MC 5P2 | Metrology and Dynamics Laboratory | 3 | 60 | 40 | 100 | 45 | 100 |
| 10 | 60 MC 5P3 | Design Thinking and Innovation Laboratory | 3 | 60 | 40 | 100 | 45 | 100 |
| 11 | 60 CG 0P4 | Career Skill Development-IV | 3 | 100 | - | 100 | - | 100 |
| 12 | 60 CG 0P6 | Internship | - | 100 | - | 100 | - | 100 |

*** CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.**

**** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for Theory End Semester Examination and 40 marks for Practical End Semester Examination.**

w.e.f. 23/12/2023
Passed in the BoS Meeting Held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

CHAIRMAN
Board Of Studies/
Mechatronics Engineering

| 60 MC 501 | Microprocessor and Microcontrollers | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

## Objectives

- To understand the concept of 8086 Microprocessor.
- To study about the 8086-instruction set and addressing mode.
- To understand the concept of I/O Interfacing
- To understand the concept of 8051 micro controllers.
- To study about interfacing microcontroller.

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Learn the architecture and pin configuration of 8086 Microprocessor. | Apply |
| CO2 | Write assembly language programs using 8086 microprocessor. | Apply |
| CO3 | Interface 8086 Microprocessors with peripheral devices. | Analyse |
| CO4 | Learn the architecture and pin configuration of 8051 Microcontroller. | Apply |
| CO5 | Interface 8051 Microcontroller with peripheral devices | Analyse |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | 2 | 2 | 2 |
| CO2 | - | - | - | - | - | - | - | 3 | - | - | 2 | 2 | 2 | 2 |
| CO3 | 3 | 3 | 2 | 3 | - | 2 | - | - | 3 | 3 | 2 | 2 | 3 | 2 |
| CO4 | 2 | 2 | - | 2 | 3 | - | 2 | 2 | - | - | 2 | 3 | 3 | 2 |
| CO5 | 2 | 2 | 2 | 3 | 2 | - | - | - | - | - | 3 | 3 | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 10 | 20 | 30 |
| Understand | 20 | 25 | 30 |
| Apply | 30 | 10 | 30 |
| Analyse | - | 5 | 10 |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E –Mechatronics Engineering** | | | | | | | | |
| **60 MC 501- Microprocessors and Microcontrollers** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| V | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **8085 Microprocessor***<br>Microprocessor Architecture and Its Operations- Memory, Input & Output Devices-The 8085 MPU- Architecture, Pins and Signals-Timing Diagrams- Logic Devices for Interfacing- Memory Interfacing- Interfacing Output Displays- Interfacing Input Devices- Memory Mapped I/O | **[9]** |
| **8085 Instructions Set and Addressing Mode***<br>Addressing Modes – Instruction Set and Assembler- Flow Chart Symbols-Data Transfer Operations- Arithmetic Operations-Logic Operations- Branch Operation- Writing Assembly Language Programs- Programming Techniques: Looping- Counting and Indexing- Additional Data Transfer and 16-Bit Arithmetic Instruction-Logic Operation: Rotate, Compare Operations – 8085 Interrupts-Assembly Language Programming Examples. | **[9]** |
| **16-Bit Microprocessors (8086)***<br>Architecture- Pin Description- Physical Address- Segmentation--Memory Organization- Addressing Modes- Peripheral Devices- 8237 DMA Controller- 8255 Programmable Peripheral Interface-8253/8254 Programmable Timer/Counter- 8259 Programmable Interrupt Controller- 8251 USART | **[9]** |
| **8051 Microcontrollers***<br>Architecture of 8051 – Special Function Registers (SFRs) – I/O Pins Ports and Circuits – Instruction Set – Addressing Modes – 8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters | **[9]** |
| **Peripheral Interfacing and Applications***<br>Programming Timers – Serial Port Programming – Interrupts Programming – LCD Keyboard Interfacing – ADC, DAC & Sensor Interfacing – External Memory Interface- Stepper Motor and Waveform Generation. Assembly Language Program Using 8051 and 8085 for Mechatronics Application and Control. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**


| | |
|---|---|
| 1. | A.P.Godse, Jairaj Solanke and D.A.Godse, "Microprocessors and Microcontrollers", Technical Publications, 2023. |
| 2. | Yu-Cheng Liu, Glenn A. Gibson, "Microcomputer Systems: The 8086 / 8088 Family – Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2019. |


**Reference(s):**


| | |
|---|---|
| 1. | Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin Mc Kinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2019. |
| 2. | Doughlas V.Hall, —Microprocessors and Interfacing, Programming and Hardware, TMH, 2019. |
| 3. | A.K.Ray, K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd edition, Tata Mc GrawHill, 2019. |
| 4. | Microprocessors and Microcontrollers 8085, 8086 and 8051 – Hardcover, Ganguly, Amar K.; Ganguly, Anuva, Alpha Science 2022 |


*SDG 9 – Industry Innovation and Infrastructure

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **8085 Microprocessors** | |
| 1.1 | Introduction to 8085 | 1 |
| 1.2 | Architecture | 1 |
| 1.3 | Pin Description | 1 |
| 1.4 | External memory interfacing | 1 |
| 1.5 | Bus cycle, some important companion chips | 1 |
| 1.6 | Maximum mode bus cycle, memory interfacing | 1 |
| 1.7 | Minimum mode System configuration | 1 |
| 1.8 | Maximum mode system configuration | 1 |
| **2.0** | **8085 Instruction Set and Addressing Mode** | |
| 2.1 | Addressing modes, Instruction set and assembler directives | 1 |
| 2.2 | Assembly language programming using MASM | 1 |
| 2.3 | Modular Programming, Linking and Relocation | 1 |
| 2.4 | Stacks, Procedures, Macros, Byte and String Manipulation | 1 |
| 2.5 | Assembly language program using 8086 MASM software and 8086 microprocessor kit Addition | 1 |
| 2.6 | Subtraction, multiplication, division | 1 |
| 2.7 | Sorting, searching, string manipulation | 1 |
| 2.8 | Code conversion, matrix operation | 2 |
| **3.0** | **I/O Interfacing** | |
| 3.1 | I/O interfacing, Parallel communication interface | 1 |
| 3.2 | Keyboard /display controller | 2 |
| 3.3 | Timer, D/A and A/D Interface, Serial communication interface | 1 |
| 3.4 | Interrupt controller, DMA controller | 1 |
| 3.5 | Programming and applications Case studies, Traffic Light control, LED display | 2 |
| 3.6 | Keyboard display interface and Alarm Controller, Assembly language program using 8086 kit | 1 |
| 3.7 | For interfacing with 8255, 8253, ADC and DAC,8251. | 1 |
| **4.0** | **8051 Microcontroller** | |
| 4.1 | Architecture of 8051 | 1 |
| 4.2 | Special Function Registers (SFRs) | 1 |
| 4.3 | I/O Pins Ports and Circuits | 1 |
| 4.4 | Instruction set | 1 |
| 4.5 | Addressing modes | 2 |
| 4.6 | Assembly language programming | 1 |
| 4.7 | Assembly language program using 8051 kit addition | 1 |
| 4.8 | Subtraction, Multiplication and Division operations. | 1 |
| **5.0** | **Interfacing Microcontroller** | |
| 5.1 | Programming 8051 Timers | 1 |
| 5.2 | Serial Port Programming | 1 |
| 5.3 | Interrupts Programming | 1 |
| 5.4 | LCD & Keyboard Interfacing, ADC, DAC & Sensor Interfacing | 1 |
| 5.5 | External Memory Interface | 1 |
| 5.6 | Stepper Motor and Waveform generation | 2 |
| 5.7 | Assembly language program using 8051 for Robotic Arm control | 2 |

**Course Designer(s)**

1. Mrs.V.Indumathi -indumathi@ksrct.ac.in

| 60 MC 502 | System Design and Control | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 1 | 0 | 4 |

## Objectives

- To describe feedback control and basic components of control systems
- To understand the various time domain and frequency domain tools for analysis and design of linear control systems.
- To study the methods to analyze the stability of systems from transfer function forms.
- To describe the methods of designing compensators
- To understand the concept of state space analysis

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the open loop and closed loop control system and able to design develop mathematical model, Translations and Rotational systems transfer Function | Apply |
| CO2 | Learn about time domain specifications and about various types of test input. | Apply |
| CO3 | Learn about frequency domain specifications and design and develop different frequency response plots. | Apply |
| CO4 | Understand the concept of stability and knowledge about Root locus, Routh Hurwitz Criterion. | Apply |
| CO5 | Design Lag, Lead, Lag-lead network and knowledge about State space Analysis. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 2 |
| CO2 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 3 | 3 | 2 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 15 | 15 | 30 |
| Understand | 20 | 20 | 40 |
| Apply | 15 | 15 | 30 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |



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Mechatronics Engineering

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| B.E – Mechatronics Engineering | | | | | | | | |
| 60 MC 502-System Design and Control | | | | | | | | |
| Semester | Hours/Week | | | Total Hours | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| V | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 |

| | |
|---|---|
| **Systems and Their Representation***<br>Introduction to Control System: Open and Closed Loop Systems- Examples Residential Heating System, Automobile Drive System, and Temperature Control System. Transfer Function: Mathematical Model-Mechanical Model- Translational & Rotational Systems, Electrical Model, Block Diagram Reduction Techniques-Signal Flow Graph Using Manson's Gain Rule–Related Problems. | **[9]** |
| **Time Response Analysis***<br>Introduction – The Performance Specifications: Transient Response-Rise Time, Peak Time, Peak Overshoot, Settling Time, Measure of Performance of the Standard Second Order System -Steady State Response-SteadyState Error Constants and System Type Numbers. Types of Test Inputs: Step, Ramp, Parabolic, Impulse –First and Second Order System Response. Feed Back Control System Characteristics: - Proportional, Integral, Derivative, PID Modes of Feedback Control. | **[9]** |
| **Frequency Response Analysis***<br>Introduction –The Performance Specifications in Frequency Domain- The Bode Plots – The Polar Plots–Nichols Chart-Determination of Closed Loop Response from Open Loop Response. | **[9]** |
| **Stability of Control Systems***<br>Introduction-Characteristic Equation, Location of Roots in S-plane for Stability. Stability Criterion: Bounded input Bounded Output Stability, Zero Input Stability, Routh Hurwitz Criterion. Root Locus Construction: Root Locus Concept, Guidelines for Sketching Root Loci, Selected Illustrative Root Loci-Gain Margin and Phase Margin. Nyquist Stability Criterion. | **[9]** |
| **Compensator Design and State Space Analysis***<br>Performance criteria - Lag, Lead and Lag-Lead networks-Compensator Design Using Bode Plot, Introduction to State Space Analysis-Simulation of First Order System. | **[9]** |
| **Total Hours:(Lecture - 45; Tutorial - 15)** | **60** |

**Text Book(s):**

| | |
|---|---|
| 1. | Nagrath I J and Gopal M" Control System Engineering", New Age international publisher ,New Delhi,2020. |
| 2. | Katsuhiko Ogata, "Modern Control Engineering", 5th Edition, Pearson Education, New Delhi, 2019. |

**Reference(s):**

| | |
|---|---|
| 1. | Bandyopadhyay M N ,"Control EngineeringTheory and Practice",Prentice Hall of India,2018. |
| 2. | Chesmond C.J."Basic Control System Technology", Viva Low Priced Student Edition, 2016. |
| 3. | Leonard N.E. and William Levine," Using MATLAB to Analyze and Design Control Systems" |
| 4. | Gopal M. "Control System Principles and Design", 5th Edition, TataMcGraw-Hill, New Delhi, 2020 |

*SDG 9 – Industry Innovation and Infrastructure

## Course Contents and Lecture Schedule

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Systems and Their Representation** | |
| 1.1 | Introduction to Control System: Open and Closed loop Systems Examples | 2 |
| 1.2 | Residential Heating System, Automobile Drive System, and Temperature Control System | 1 |
| 1.3 | Transfer function: Mathematical Model, Mechanical Model | 2 |
| 1.4 | Translational & Rotational Systems, Electrical Model, Block Diagram Reduction Techniques Signal flow Graph using Manson's Gain Rule | 2 |
| 1.5 | Signal flow Graph using Manson's Gain Rule | 1 |
| 1.6 | Simple problems. | 1 |
| | Tutorial | 3 |
| **2.0** | **Time Response Analysis** | |
| 2.1 | Introduction, The Performance Specifications: Transient Response, Rise time, Peak time, Peak Over shoot, Settling time, Measure of performance of the Standard Second Order System | 2 |
| 2.2 | Steady State Response | 2 |
| 2.3 | SteadyState Error Constants and System Type Numbers. | 1 |
| 2.4 | Types of Test Inputs: Step, Ramp, Parabolic, Impulse –First and Second Order System Response. | 1 |
| 2.5 | Feed Back Control System Characteristics: - Proportional, Integral, Derivative. | 2 |
| 2.6 | PID Modes of Feedback Control. | 1 |
| | Tutorial | 3 |
| **3.0** | **Frequency Response Analysis** | |
| 3.1 | Introduction | 2 |
| 3.2 | The Performance Specifications in Frequency Domain | 1 |
| 3.3 | The Bode Plot | 2 |
| 3.4 | The Polar Plot | 1 |
| 3.5 | Nichols Chart | 2 |
| 3.6 | Determination of closed loop response from open loop response | 1 |
| | Tutorial | 3 |
| **4.0** | **Stability of Control Systems** | |
| 4.1 | Introduction-Characteristic Equation, Location of Roots in S-plane for Stability. | 2 |
| 4.2 | Stability Criterion: Bounded input Bounded output Stability, Zero input Stability, Routh Hurwitz Criterion. | 2 |
| 4.3 | Root locus construction: Root locus Concept | 1 |
| 4.4 | Guidelines for Sketching Root Loci, Selected illustrative Root Loci-Gain Margin and Phase Margin. | 2 |
| 4.5 | Nyquist Stability Criterion | 2 |
| | Tutorial | 3 |
| **5.0** | **Compensator Design and State space Analysis** | |
| 5.1 | Performance criteria - Lag, Lead and Lag-Lead | 2 |
| 5.2 | Compensator design using Bode Plot- Lag and Lead Network | 2 |
| 5.3 | Compensator design using Bode Plot-Lag-Lead Network | 1 |
| 5.4 | Introduction to state space analysis | 2 |
| 5.5 | Simulation of First order system | 2 |
| | Tutorial | 3 |

## Course Designer(s)

Dr.M.Ravi-ravi@ksrct.ac.in

w.e.f. 23/12/2023
Passed in the BoS Meeting Held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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| 60 MC 503 | Kinematics and Dynamics of Machines | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 1 | 0 | 4 |

## Objectives

- To learn various mechanisms and find their velocity and acceleration.
- To compute the velocity and acceleration for simple mechanisms and able to construct cam profile.
- To determine gear ratio for simple, compound, reverted and epicyclic gear train.
- To understand the function of flywheel and to determine basic parameters of flywheel
- To perform vibration analysis and balancing of engines.

## Pre-requisites

- Engineering Mechanics

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Create simple mechanisms based on the degrees of freedom. | Remember |
| CO2 | Design and analyze the velocity and acceleration of different mechanisms. the cam profile | Analyze |
| CO3 | Solve and evaluate the kinematic aspects of gears and gear trains | Apply |
| CO4 | Plot the turning moment diagram of crank rotation at various strokes and the process of providing continuous energy to the system | Analyze |
| CO5 | Analyze different types of vibrations and understanding of balancing of single and several masses in same or different planes | Analyze |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | 2 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | 2 | 3 |
| CO5 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 10 | 20 | 30 |
| Understand | 20 | 25 | 30 |
| Apply | 20 | 10 | 30 |
| Analyse | 10 | 5 | 10 |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

**Syllabus**

**K.S.Rangasamy College of Technology – Autonomous R2022**

**B.E - Mechatronics Engineering**

**60 MC 503- Kinematics and Dynamics of Machines**

| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| V | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 |

| | |
|---|---|
| **Simple Mechanism***<br>Introduction- Kinematic Links, Structure- Comparison Between Machine and Structure, Joints, Kinematic Pairs- Classification- Types of Constrained Motion. Kinematic Chain- Classification- Degrees of Freedom – Kutzbach Criterion, Gruebler's Criterion – Grashof's Law — Mechanism - Inversions of Four Bar and Slider Crank Chain — Mechanical Advantage – Description of Common Mechanisms: Quick Return Mechanisms, Straight Line Generators, Universal Joint – Rocker Mechanisms. | **[9]** |
| **Kinematic Analysis of Linkages and CAM***<br>Displacement, Velocity and Acceleration Analysis of Simple Mechanisms – Graphical Method of Velocity and Acceleration Diagram for Four Bar and Slider Crank Chain - Cam – Classification of Cams and Follower – Radial Cam Nomenclature – Analysis of Follower Motion - Uniform Velocity, Simple Harmonic Motion, Uniform Acceleration & Retardation<br>and Cycloidal Motion – Construction of Cam Profile for a Radial Cam- Introduction to Kinematic Analysis Software Packages. | **[9]** |
| **Gears and Gear Trains***<br>Gear Tooth Profiles - Gear Tooth Action - Interference and Undercutting - Requirement of Minimum Number of Teeth in Gears - Gear Trains - Simple and Compound Gear Trains -Determination of Speed and Torque in Epicyclic Gear Trains. | **[9]** |
| **Turning Moments and Flywheels***<br>Introduction, Turning Moment Diagram for a Single Cylinder Double Acting SteamEngine- Turning Moment Diagram for a Four Stroke Internal Combustion Engine- Fluctuation of Energy- Determination of Maximum Fluctuation Energy- Co-efficient of Fluctuation of Energy-Flywheel: Co-efficient of Fluctuation of Speed-Energy Stored in a<br>Flywheel- Dimensions of the Flywheel Rim- Introduction to Governors and Gyroscope. | **[9]** |
| **Vibration and Balancing***<br>Free, Forced and Damped Vibrations of Single Degree of Freedom Systems, Critical Speed of Shaft - Logarithmic Decrement – Force Transmitted to Supports. Static and Dynamic Balancing - Balancing of Revolving Masses, Single and Multi-Cylinder Engines. Reciprocating Masses - Single Cylinder Engines. | **[9]** |
| **Total Hours:(Lecture – 45+Tutorial - 15)** | **60** |

**Text Book(s):**

| | |
|---|---|
| 1. | Khurmi R S and Gupta J K, "Theory of Machines", S. Chand and Company Ltd., New Delhi.2020. |
| 2. | Rattan S.S, "Theory of Machines", 4th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2019. |

**Reference(s):**

| | |
|---|---|
| 1. | Ballaney P. L, "Theory of Machines", Khanna Publishers, New Delhi, 2005. |
| 2. | Rao J.S. and Dukkipati R.V., "Mechanism and Machine Theory", Bohem press, 2007 |
| 3. | Sadhu Singh "Theory of Machines", Pearson Education, 2012. |
| 4. | John Joseph Uicker, G. R. Pennock, Joseph Edward Shigley "Theory of Machines and Mechanisms", Oxford University Press, 2017. |

*SDG 9 – Industry Innovation and Infrastructure

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Simple Mechanism** | |
| 1.1 | Introduction- Kinematic links, structure- comparison between machine and structure, joints | 1 |
| 1.2 | Kinematic pairs-classification | 1 |
| 1.3 | Types of constrained motion. Kinematic chain-classification | 1 |
| 1.4 | Degrees of freedom – Kutzbach criterion, | 1 |
| 1.5 | Gruebler's criterion – Grashof's law | 1 |
| 1.6 | Mechanism - Inversions of four bar and slider crank chain – Mechanical advantage | 1 |
| 1.7 | Description of common mechanisms | 1 |
| 1.8 | Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms | 2 |
| **2.0** | **Kinematic Analysis of Linkages and CAM** | |
| 2.1 | Displacement, velocity and acceleration analysis of simple mechanisms | 1 |
| 2.2 | Graphical method of velocity and acceleration diagram for four bar and slider crank chain. | 1 |
| 2.3 | CAM – Classification of cams and follower | 1 |
| 2.4 | Radial cam nomenclature – analysis of follower motion | 1 |
| 2.5 | Uniform velocity, simple harmonic motion | 1 |
| 2.6 | Uniform acceleration & retardation, Cycloidal motion | 2 |
| 2.8 | Construction of cam profile for a radial cam | 1 |
| 2.9 | Introduction to kinematic analysis software packages | 1 |
| **3.0** | **Gears and Gear Trains** | |
| 3.1 | Gear tooth profiles & action | 3 |
| 3.2 | Interference and undercutting | 2 |
| 3.3 | Requirement of minimum number of teeth in gears | 1 |
| 3.4 | Gear trains, Simple and compound gear trains | 2 |
| 3.5 | Determination of speed and torque in epicyclic gear trains | 1 |
| **4.0** | **Turning Moments and Flywheels** | |
| 4.1 | Introduction | 1 |
| 4.2 | Turning moment diagram for a single cylinder double acting steam engine | 1 |
| 4.3 | Turning moment diagram for a four-stroke internal combustion engine | 2 |
| 4.4 | Fluctuation of energy- determination of maximum fluctuation energy | 1 |
| 4.5 | Co-efficient of fluctuation of energy- | 1 |
| 4.6 | Flywheel: co-efficient of fluctuation of speed | 2 |
| 4.7 | Energy stored in a flywheel- Dimensions of the flywheel rim | 2 |
| 4.8 | Introduction to governors and gyroscope | 2 |
| **5.0** | **Vibration and Balancing** | |
| 5.1 | Free, forced and damped vibrations of single degree of freedom systems | 2 |
| 5.2 | Critical speed of shaft | 1 |
| 5.3 | Logarithmic decrement Force transmitted to supports | 1 |
| 5.4 | Static and dynamic balancing | 1 |
| 5.5 | Balancing of revolving masses masses, single and multi-cylinder engines. | 2 |
| 5.6 | Reciprocating masses - single cylinder engines | 2 |

**Course Designer(s)**

Dr.P.Mohanram - mohanram@ksrct.ac.in

| 60 HS 003 | Total Quality Management | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | HS | 3 | 0 | 0 | 3 |

## Objectives

- To facilitate the understanding of total quality management principles, tools and techniques.
- To equip the students to apply the TQM principles, tools and techniques in manufacturing sectors.
- To equip the students to apply the TQM principles, tools and techniques in service sectors.
- To impart knowledge on quality management principles, tools, techniques and quality standards for real life applications.
- To make the students understand the importance of standards in the quality assurance process and their impact on the final product.

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Recognize the need for quality concepts and its application in organizations | Understand |
| CO2 | Apply the TQM principles for survival and growth in world class competition | Apply |
| CO3 | Apply the traditional tools and new tools for quality improvement. | Apply |
| CO4 | Apply the tools and techniques like quality circle, QFD, TPM and FMEA for quality improvement. | Apply |
| CO5 | Apply QMS and EMS in organizations | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | - | - | 2 | 3 | 3 | 3 | 3 | 3 | - | 3 | - | - |
| CO2 | 3 | 2 | - | - | 2 | 3 | 3 | 3 | 3 | 3 | - | 3 | - | - |
| CO3 | - | 3 | - | - | - | 2 | 2 | - | - | 3 | - | - | - | - |
| CO4 | - | 3 | - | - | 3 | 2 | 2 | 3 | 2 | - | - | 3 | - | - |
| CO5 | 3 | - | - | - | 3 | 3 | - | 3 | 2 | 2 | - | - | - | - |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 10 | 10 | 20 |
| Understand | 20 | 20 | 40 |
| Apply | 30 | 30 | 40 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 HS 003-Total Quality Management** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| V | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to Fundamentals of Total Quality Management***<br>Introduction, Definitions of Quality, Need for Quality, Evolution of Quality, Dimensions of Quality, Product Quality and Service Quality; Basic Concepts of TQM, TQM Framework, Contributions of Deming, Juran and Crosby. Barriers to TQM; Quality Statements, Customer Focus, Customer Satisfaction, Customer Complaints, Customer Retention; Costs to Quality. | **[9]** |
| **Total Quality Management Principles***<br>TQM principles; leadership, strategic quality planning; Quality councils- employee involvement, motivation; Empowerment; Team and Teamwork; Quality circles, recognition and reward, performance appraisal; continuous process improvement; PDSA cycle, Kaizen, 5S & 7S ; Supplier partnership, Partnering, Supplier rating and selection. | **[9]** |
| **TQM Management Tools and Techniques***<br>The seven traditional tools of quality; New management tools - applications to manufacturing, service sector, Statistical Fundamentals, Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, control charts, process capability, concepts of six sigma, Bench marking - Reasons to benchmark, Benchmarking process. | **[9]** |
| **TQM Process based Tools and Techniques***<br>Quality circles, Quality Function Development (QFD), Taguchi quality loss function; TPM-concepts, improvement needs, performance, measures. FMEA- stages, types-Design FMEA and Process FMEA. | **[9]** |
| **Quality Management System***<br>Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards-Sector-Specific Standards - AS 9100, TS16949 and TL 9000 - ISO 9001, ISO 9001:2008 Requirements-Implementation-Documentation-Internal Audits-Registration-Environmental Management System: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001-Benefits of EMS | **[9]** |
| **Total Hours:** | **45** |

| | |
|---|---|
| **Text Book(s):** | |
| 1. | Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc.2003. (Indian reprint 2020). ISBN 81- 297-0260-6. |
| 2. | Janakiraman, B and Gopal, R.K, “Total Quality Management – Text and Cases”, Prentice Hall (India) Pvt. Ltd. 2016. |
| **Reference(s):** | |
| 1. | James R. Evans, James Robert Evans, William M. Lindsay , “The Management and Control of Quality”, 8th Edition, South-Western, 2019. |
| 2. | Joel.E. Ross, “Total Quality Management – Text and Cases”, 3rd Edition, Routledge, 2021. |
| 3. | International 1996. 5. Zeiri. “Total Quality Management for Engineers”, Wood Head Publishers, 2019 |
| 4. | Narayana V. and Sreenivasan, N.S. “Quality Management – Concepts and Tasks”,New Age 3rd Edition-2018 |

*SDG 9 – Industry Innovation and Infrastructure



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Mechatronics Engineering

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Introduction to Fundamentals of Total Quality Management** | |
| 1.1 | Introduction and Definition of Quality | 1 |
| 1.2 | Need and evolution of quality | 1 |
| 1.3 | Different Dimensions of Quality | 1 |
| 1.4 | Basic concepts of TQM and TQM framework | 1 |
| 1.5 | Deming, Juran and Crosby Philosophy of quality Management | 1 |
| 1.6 | Barriers to TQM Implementation | 1 |
| 1.7 | Quality Statements, Strategic Planning | 1 |
| 1.8 | Customer focus, customer satisfaction customer retention Techniques | 1 |
| 1.9 | Techniques for Quality Costs | 1 |
| **2.0** | **Total Quality Management Principles** | |
| 2.1 | Total Quality Management Principles | 1 |
| 2.2 | Strategic of quality planning and Quality councils | 1 |
| 2.3 | Motivation, Empowerment, Teams, Recognition and Reward | 1 |
| 2.4 | Performance Appraisal, Benefits, Continuous Process Improvement | 1 |
| 2.5 | Juran Trilogy, PDSA Cycle Continuous Process Improvement | 1 |
| 2.6 | 5S, Kaizen, Continuous Process and Supplier Partnership | 1 |
| 2.7 | Partnering, sourcing, Supplier Selection | 1 |
| 2.8 | Supplier Rating, Relationship Development, | 1 |
| 2.9 | Basic Concepts, Strategy, Performance Measure. | 1 |
| **3.0** | **TQM Management Tools and Techniques** | |
| 3.1 | The seven traditional management tools of quality | 1 |
| 3.2 | The New management tools | 1 |
| 3.3 | Management tools applications to manufacturing | 1 |
| 3.4 | Management tools applications to service sector | 1 |
| 3.5 | Statistical Fundamentals in management tools | 1 |
| 3.6 | Normal Curve, Control Charts for variables and attributes | 1 |
| 3.7 | Concepts of six sigma principles | 1 |
| 3.8 | Benchmarking tools and Reasons to benchmark | 1 |
| 3.9 | Benchmarking process tools | 1 |
| **4.0** | **TQM Process based Tools and Techniques** | |
| 4.1 | Quality circles | 1 |
| 4.2 | Quality Function Deployment (QFD | 1 |
| 4.3 | House of Quality, QFD Process | 1 |
| 4.4 | Benefits, Taguchi Quality Loss Function | 1 |
| 4.5 | Total Productive Maintenance (TPM | 1 |
| 4.6 | Concept, Improvement Needs | 1 |
| 4.7 | Performance measuring tools | 1 |
| 4.8 | Stages, types of FMEA | 1 |
| 4.9 | Process implementation of FMEA | 1 |
| **5.0** | **Quality Management System (QMS)** | |
| 5.1 | Need for ISO 9000 and Other Quality Systems | 1 |
| 5.2 | Benefits of ISO Registration | 1 |
| 5.3 | Sector-Specific Standards in ISO 9001 | 1 |
| 5.4 | AS 9100, TS16949 and TL 9000 - ISO 9001 | 1 |
| 5.5 | Documentation and Internal Audits Requirements | 1 |
| 5.6 | Environmental Management System | 1 |
| 5.7 | ISO 14000 Series Standards | 1 |

**Course Designer(s)**

Dr.G.Mylsami - mylsamig@ksrct.ac.in

| 60 MY 003 | Startups and Entrepreneurship | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | MY | 2 | 0 | 0 | 2* |

## Objectives

- To Learn basic concepts in entrepreneurship, develop mind-set and skills necessary to explore entrepreneurship
- To provide practical proven tools for transforming an idea into a product or service that creates value for others.
- To Comprehend the process of opportunity identification through design thinking, identify market potential and customers while developing a compelling value proposition solution and prototypes
- To create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture ideas & solutions built with domain expertise
- To Prepare and present an investible pitch deck of their practice venture to attract stakeholders

## Pre-requisites

- Basic knowledge of reading and writing in English.

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Develop an entrepreneurial mindset and appreciate the concepts of design thinking, entrepreneurship and innovation | Understand |
| CO2 | Apply process of problem -opportunity identification and validation through human centred approach to design thinking in building solutions | Apply |
| CO3 | Understand market types, conduct market estimation, identify customers, create customer persona, develop the skills to create a compelling value proposition and build a Minimum Viable Product | Apply |
| CO4 | Create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture | Apply |
| CO5 | Prepare and deliver an investible pitch deck of their practice venture to attract stakeholders | Create |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 2 | 1 | - | 2 | 2 | 3 | 3 |
| CO2 | 2 | 3 | 3 | 2 | 2 | - | 2 | 2 | 2 | - | 2 | 2 | 2 | 3 |
| CO3 | 3 | 2 | 3 | 1 | 2 | - | - | - | 1 | 3 | 1 | 3 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | - | 1 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 3 | 3 | 3 | - | - | 2 | - | - | 3 | 2 | 3 | 2 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | Pitch Deck final submission & Via voce |
|---|---|---|---|
| | Milestone 1 (25 Marks) | Milestone 2 & 3 (25 Marks) | |
| Remember | 10 | - | 50 |
| Understand | 05 | 10 | |
| Apply | 10 | 15 | |
| Analyse | - | - | |
| Evaluate | - | - | |
| Create | - | - | |
| Total | 25 | 25 | |



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**Syllabus**

<table>
<tr><td colspan="10">K.S.Rangasamy College of Technology – Autonomous R2022</td></tr>
<tr><td colspan="10">Common to all Branches</td></tr>
<tr><td colspan="10">60 MY 003 – Startups and Entrepreneurship</td></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours/Week</td><td rowspan="2">Total Hours</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>V</td><td>2</td><td>0</td><td>0</td><td>30</td><td>2*</td><td>100</td><td>--</td><td>100</td></tr>
</table>

| | |
|---|---|
| **Introduction to Entrepreneurship & Entrepreneur**<br>Meaning and concept of Entrepreneurship, the history of Entrepreneurship development, Myths of Entrepreneurship, role of Entrepreneurship in Economic Development, Agencies in Entrepreneurship Management and Future of Entrepreneurship. The Entrepreneur: Meaning, the skills required to be an entrepreneur, the entrepreneurial decision process, Role models, Mentors and Support system.Innovation and Creativity, types of innovations, Innovations in current scenari | **[6]** |
| **Problem-Opportunity Identification, Customers Discovery and competitive advantage**<br>Understanding the Problem and opportunity, define problem using Design thinking principles and validate problem. Exploring market types and estimating the market size, knowing your customer and consumer, Customer segmentation and creating customer personas. Importance of Value Proposition, Value Proposition Canvas, Developing Problem-solution fit, Competition analysis, Blue ocean strategy, Competitive positioning and understanding unique selling points. | **[6]** |
| **Business model and build your MVP**<br>Introduction to Business model and types, Lean approach, 9 block lean canvas model, riskiest assumptions to Business models. Prototyping, building a Minimum viable product, Hypothesis testing and MVP Validation, MVP Iteration-Importance of Build - Measure – Learn approach | **[6]** |
| **Business Plan, Financial feasibility and Managing growth**<br>Business planning: components of Business plan- Sales plan, People plan and financial plan, Preparing a business plan. Financial Planning: Types of costs, preparing the financial plan using financial template, understanding basics of Unit economics and analyzing Growth and the financial performance | **[6]** |
| **Go To Market Strategies and Funding**<br>Introduction to Go to market strategies, start-up branding and its elements, Selecting the Right Channel, creating digital presence, building customer acquisition strategy. Choosing a form of business organization specific to your venture, identifying sources of funds: Debt & Equity, Map the Start-up Lifecycle to Funding Options, Build an Investor ready pitch deck. | **[6]** |
| **Total Hours:** | **30** |

| | |
|---|---|
| **Text Book(s):** | |
| 1. | Stephen Key, "One Simple Idea for Startups and Entrepreneurs: Live Your Dreams and Create Your Own Profitable Company" 1st Edition, Tata Mc Grawhill Company, New Delhi, 2013. |
| 2. | Charles Bamford and Garry Bruton, "Entrepreneurship: The Art, Science, and Process for Success", 2nd Edition, Tata Mc Grawhill Company, New Delhi, 2016. |
| **Reference(s):** | |
| 1. | Philip Auerswald, "The Coming Prosperity: How Entrepreneurs Are Transforming the Global Economy", Oxford University Press, 2012. |
| 2. | Janet Kiholm Smith; Richard L. Smith Richard T. Bliss, "Entrepreneurial Finance: Strategy, Valuation and Deal Structure, Stanford Economics and Finance", 2011. |
| 3. | Edward D. Hess, "Growing an Entrepreneurial Business: Concepts and Cases", Stanford Business Books, 2011. |
| 4. | Ignite program, wadhwani platform, Entrepreneurship, NPTEL online course By Prof. C Bhaktavatsala Rao \| IIT Madras |



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| Course Contents and Lecture Schedule | | |
|---|---|---|
| S. No. | Topics | No. of hours |
| **1.0** | **Introduction to Entrepreneurship & Entrepreneur** | |
| 1.1 | Meaning and concept of Entrepreneurship and the history of Entrepreneurship Development | 1 |
| 1.2 | The Entrepreneur: Meaning, the skills required to be an entrepreneur, the entrepreneurial decision process, | 1 |
| 1.3 | Myths of Entrepreneurship, How to Become a Successful Entrepreneur - Dr Romesh Wadhwani (Platform on boarding) | 1 |
| 1.4 | Role models, Mentors and Support system- Masterclass on My Story - Joshua Salins | 1 |
| 1.5 | Role of Entrepreneurship in Economic Development, Agencies in Entrepreneurship Management and Future of Entrepreneurship | 1 |
| 1.6 | Innovation and Creativity, types of innovations, Innovations in current scenario, Concepts of Entrepreneurial Thinking, General Enterprising tendency test | 1 |
| **2.0** | **Problem-Opportunity Identification, Customers Discovery and competitive advantage** | |
| 2.1 | Understanding the Problem and opportunity, define problem using Design thinking principles and validate problem. Case study and Fireside chat – Desi Hangover | 1 |
| 2.2 | Identifying a problem for practice venture and filling Problem statement canvas (Handout week 1 - class activity) | 1 |
| 2.3 | Customer and markets discovery , knowing your customer and consumer, Customer segmentation and Exploring market types and estimating the market size. Case study and Fireside chat – Verloop | 1 |
| 2.4 | Creating customer personas & Market estimation (Handout week 2 - class activity) | 1 |
| 2.5 | Importance of Value Proposition, Introduce Value Proposition Canvas, Developing Problem-solution fit. Case study and Fireside chat – Honey Twigs | 1 |
| 2.6 | Competition analysis, Blue ocean strategy, Competitive positioning and understanding unique selling points. Case study and Fireside chat on Inzpira Fill Value Proposition Canvas (Handout week 3 - class activity) and Competition analysis framework (Handout week 5 - class activity). **Briefing on Assignment 1 - Milestone 1** | 1 |
| **3.0** | **Business model and Build your MVP** | |
| 3.1 | Introduction to Business model and types. Case study and Fireside chat – NUOS | 1 |
| 3.2 | Lean approach, 9 block lean canvas model, riskiest assumptions to Business Models | 1 |
| 3.3 | Class Activity- Fill Lean canvas for you idea and understand revenue model ( Handout week 6) | 1 |
| 3.4 | Prototyping, Meaning of MLP , Difference between MLP and MVP, How to build an MLP? Different types MLP that you can build. Case study and Fireside chat – KNORISH | 1 |
| 3.5 | Hypothesis testing and MVP Validation, MVP Iteration-Importance of Build - Measure – Learn approach | 1 |
| 3.6 | Class Activity- Fill MVP framework (Handout week 7) and learn validation | 1 |
| **4.0** | **Business Plan, Financial feasibility and Manging growth** | |
| 4.1 | Business planning: components of Business plan- Sales plan, People plan and financial plan, Preparing a business plan. Case study and Fireside chat – Bodh Gems | 1 |
| 4.2 | Financial Planning: Types of costs, preparing the financial plan using financial template (Handout week 9) | 1 |
| 4.3 | Class activity - starting up costs, COGS, Sales plan and people plan template. | 1 |
| 4.4 | Class activity - One year P&L projection, Breakeven Analysis, Five year projection | 1 |
| 4.5 | Understanding basics of Unit economics and analyzing Growth and the financial performance | 1 |

| | | |
|---|---|---|
| 4.6 | Class activity - Financial template - Unit economics (Handout week 12) | 1 |
| **5.0** | **Go To Market Strategies and Funding** | |
| 5.1 | Introduction to Go to market strategies, start-up branding and its elements, Selecting the Right Channel | 1 |
| 5.2 | Creating digital presence, building customer acquisition strategy. | 1 |
| 5.3 | Class activity: Handout week 10 - create your GTM strategy | 1 |
| 5.4 | Choosing a form of business organization specific to your venture | 1 |
| 5.5 | Identifying sources of funds: Debt & Equity, Map the Start-up Lifecycle to Funding Options | 1 |
| 5.6 | Class activity - Visit relevant GOI websites, other sites to help students explore funding opportunities and **briefing on final submission of the pitch deck** Build an Investor ready pitch deck, What Should You Cover in Your Pitch Deck?<br>Art of pitching and storytelling | 1 |

**Course Designer(s)**

Dr.N.Tiruvenkadam- tiruvenkadam@ksrct.ac.in

| 60 MC 5P1 | Microprocessors and Microcontrollers Laboratory | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 0 | 0 | 3 | 1.5 |

## Objectives

- To familiarize the architecture of 8085, 8086 Microprocessor and 8051 microcontrollers.
- To explore a basic knowledge of microprocessors and microcontrollers.
- To learn programming of microprocessors and microcontrollers.
- To design and develop interfacing concepts of microprocessors and microcontrollers.
- Ability to develop microprocessor and microcontroller based small applications.

## Pre-requisites

- Microprocessors and Microcontrollers

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Perform the basic arithmetic operations using 8085 microprocessors by developing assembly language programs... | Apply |
| CO2 | Develop an assembly language program to convert hexadecimal to decimal and decimal to hexadecimal and also perform sorting using 8085. | Apply |
| CO3 | Perform the basic programming operations using 8086 microprocessors. | Analyse |
| CO4 | Perform the basic arithmetic operations using 8051 microcontrollers by developing assembly language programs | Apply |
| CO5 | Demonstrate the interfacing of stepper motor and traffic light controller using 8051. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | - | - | 3 | - | 3 | - | - | 3 | - | 2 | 3 | 2 | 2 |
| CO2 | 3 | - | - | 3 | - | 3 | - | - | 3 | - | 2 | 3 | 2 | 2 |
| CO3 | 3 | - | - | 3 | - | 3 | - | - | 3 | - | 2 | 3 | 2 | 2 |
| CO4 | 3 | - | - | 3 | - | 3 | - | - | 3 | - | 2 | 3 | 3 | 2 |
| CO5 | 3 | - | - | 3 | - | 3 | - | - | 3 | - | 2 | 3 | 3 | 2 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Lab Experiments Assessment (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | Lab | Activity | | |
| Remember | - | - | - | - |
| Understand | - | - | - | - |
| Apply | 25 | 12 | 50 | 50 |
| Analyse | 25 | 13 | 50 | 50 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 50 | 25 | 100 | 100 |

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC 5P1 – Microprocessors and Microcontrollers Laboratory** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hrs** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| V | 0 | 0 | 3 | 45 | 1.5 | 60 | 40 | 100 |

**List of Experiments:**

**Programming with 8085 Microprocessors**

1. Arithmetic operations (addition, subtraction, multiplication, division) using 8085
2. Logical operations programs using 8085
3. Sorting numbers in ascending and descending order of 8085
4. 8-bit decimal to hexadecimal conversion of 8085
5. Hexadecimal number to decimal number conversion of 8085

**Programming with 8086 Microprocessors**

6. Basic Programming with 8086 Assembler

**Programming with 8051 Microcontrollers**

7. Arithmetic operations (addition, subtraction, multiplication, division) using 8051
8. Stepper motor interface using 8051
9. Interface Traffic light controller using 8051
10. ADC and DAC Interface

| **Lab Manual** | |
|---|---|
| 1. | "Microprocessors and Microcontrollers Lab Manual", Department of Mechatronics Engineering, KSRCT. |

*SDG 9 – Industry Innovation and Infrastructure

**Course Designer(s)**

Mrs.V.Indumathi–indumathi@ksrct.ac.in

w.e.f. 23/12/2023
Passed in the BoS Meeting Held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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| 60 MC 5P2 | Metrology and Dynamics laboratory | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 0 | 0 | 3 | 1.5 |

## Objectives

- To be familiar with different measurement equipment's and quality inspection for industrial applications.
- Identify and use reference materials to ensure good quality, accurate, traceable measurement results.
- To study the principles of gyroscope, Cam and measurement of surface finish.
- To calculate the moment of inertia of connecting rod.
- To analyze the natural frequency of different types of vibrations.

## Pre-requisites

- Theory of Machines

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Describe the basic concepts of Metrology and Understand the measuring concepts of microscope. | Understand |
| CO2 | Discriminatebetweenvariousscrewsbymeasuringtheirtaperangleandpitch. | Understand |
| CO3 | Measure the surface finish by using auto collimeter | Analyse |
| CO4 | Verify the laws of gyroscope and plot the profile of cam. | Apply |
| CO5 | Evaluate the natural frequency of spring mass system and moment of inertia of connecting rod. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | - | - | 3 | - | 3 | - | - | 3 | - | 2 | 3 | 2 | 2 |
| CO2 | 3 | - | - | 3 | - | 3 | - | - | 3 | - | 2 | 3 | 2 | 2 |
| CO3 | 3 | - | - | 3 | - | 3 | - | - | 3 | - | 2 | 3 | 2 | 2 |
| CO4 | 3 | - | - | 3 | - | 3 | - | - | 3 | - | 2 | 3 | 3 | 2 |
| CO5 | 3 | - | - | 3 | - | 3 | - | - | 3 | - | 2 | 3 | 3 | 2 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Lab Experiments Assessment (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | Lab | Activity | | |
| Remember | - | - | - | - |
| Understand | - | - | - | - |
| Apply | 25 | 12 | 50 | 50 |
| Analyse | 25 | 13 | 50 | 50 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 50 | 25 | 100 | 100 |

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Passed in the BoS Meeting Held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC 5P2- Metrology and Dynamics laboratory** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hrs** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| V | 0 | 0 | 3 | 45 | 1.5 | 60 | 40 | 100 |

**List of Experiments:**

1. Calibration of micrometer using slip gauges.
2. a) Study of Tool Makers Microscope.
   b) Measurement of taper angle and pitch by using tool maker's microscope.
3. a) Study of Gear Terminology.
   b) Measurement of various dimensions of the given component using profile projector.
4. Measurement of taper angle using sine bar.
5. a) Study of Screw thread terminology.
   b) Measurementofmajorandeffectivediameterofscrewthreadusing2wiremethods.
6. a) Study of various surface finish measurement techniques.
   b) Measurement of surface flatness by using autocollimator.
7. Determination of gyroscopic couple using Motorized Gyroscope.
8. Plot the profile of cam and study of jump phenomenon.
9. Determination of natural frequency and critical speed of given shaft.
10. Determination of natural frequency of given spring mass system.
11. Determination of torsional frequency of as inglerotor system.
12. Calculate the moment of inertia of connecting rod by oscillation method.

**Lab Manual**

| | |
|---|---|
| 1. | "Metrology and Dynamics lab Manual", Department of Mechatronics Engineering, KSRCT. |

*SDG 9 – Industry Innovation and Infrastructure

**Course Designer(s)**

Dr.M.Baskaran – baskaranm@ksrct.ac.in

| 60 MC 5P3 | Design Thinking and Innovation Laboratory | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 0 | 0 | 2 | 1 |

## Objectives

- Understand the principles of design thinking and their application in engineering innovation
- Identify real-world engineering problems through brainstorming and mind mapping
- Explore problem space using secondary research methods, including the 5Ws and 1H Matrix, and user participant mapping
- Conduct primary research from multiple perspectives to ensure a user-centered approach
- Define and analyze problem areas to develop clear and well-structured problem statements

## Pre-requisites

-Nil-

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Apply design thinking principles to promote innovation. | Apply |
| CO2 | Identify and articulate real-world engineering problems through brainstorming and mind map techniques. | Apply |
| CO3 | Perform secondary research using tools 5Ws and 1H Matrix and user participant mapping to explore problem spaces. | Apply |
| CO4 | Conduct primary research to gather insights from diverse perspectives, ensuring a user- centered approach in problem-solving. | Apply |
| CO5 | Define and analyze problem areas to create precise and actionable problem statements. | Analyse |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | - | - | - | - | - | 3 | 3 | 3 | - | - | 3 | 2 |
| CO2 | 3 | - | - | - | - | 3 | 3 | 3 | 3 | 3 | - | - | 3 | 2 |
| CO3 | 3 | - | - | - | - | - | - | 3 | 3 | 3 | - | - | 3 | 2 |
| CO4 | 3 | - | - | - | - | - | - | 3 | 3 | 3 | - | - | 3 | 2 |
| CO5 | 3 | 3 | - | - | - | - | - | 3 | 3 | 3 | - | - | 3 | 2 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Review I (CO1) | | | Review II (CO2, CO3, CO4) | | | Review III (CO5) | | | Total (R1+R2+R3) | Internal |
|---|---|---|---|---|---|---|---|---|---|---|
| Identification of Existing Problems and Solutions | Apply design thinking principles | Case study report | Selection of Problem | Secondary and Primary Research on Problem Space | Presentation | Analysis of Problem Space | OIOR | Presentation | Total | |
| 10 | 10 | 10 | 10 | 30 | 10 | 5 | 10 | 5 | 100 | 60 |

| Report and Presentation (CO1, CO2, CO3, CO4 & CO5) | | | External |
|---|---|---|---|
| Report | Presentation | Total | |
| 50 | 50 | 100 | 40 |

w.e.f. 23/12/2023
Passed in the BoS Meeting Held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC 5P3 – Design Thinking and Innovation Laboratory** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hrs** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| V | 0 | 0 | 2 | 30 | 1 | 60 | 40 | 100 |

| | |
|---|---|
| **Design Thinking and Innovation Process**<br>Introduction to Design Thinking and Innovation - Design, Design Thinking, Innovation - Stages of Design Thinking Process – Case Study: Analysis of Existing Problems and Solutions. | [8] |
| **Selection of Problem**<br>Identification and Selection of Problem to Solve, Tools - Brain-storming- Sorting & affinity-Links, Mind-mapping- affinity-Links. | [4] |
| **Secondary research on Problem Space**<br>Information Gathering: from past and existing - Secondary Research - Ask questions: Why, who, what, where, when, how, etc, 5Ws and 1H Matrix Table - User Participant Mapping. | [6] |
| **Primary research on Problem Space**<br>Understanding your Users environment - Primary research - Observation, Conversations, Questionnaires, Documentation - Conducting Contextual Inquiry. | [6] |
| **Analysis of Problem Space**<br>Identify, Classify, Compare, Prioritize, Cross-relate information - Personas Observations, Inference, Opportunities, Recommendations (OIOR) - Redefining the Problem Statement. | [6] |
| **Total Hours:** | 30 |

| **Reference** | |
|---|---|
| 1. | • NPTEL: Design Thinking and Innovation by Prof. Ravi Poovaiah, IDC School of Design, IIT Bombay. https://onlinecourses.swayam2.ac.in/aic23_ge17/preview, https://dsource.in/dti<br>• NPTEL: Design, Technology and Innovation by Prof. B. K. Chakravarthy, IDC School of Design, IIT Bombay. https://onlinecourses.nptel.ac.in/noc20_de03/preview<br>• NPTEL: Innovation by Design by Prof. B. K. Chakravarthy, IDC School of Design, IIT Bombay, https://onlinecourses.swayam2.ac.in/aic19_de02/preview.,<br>• www.dsource.in, The Resource for Design by e-Kalpa Design Team, IDC, IIT Bombay,DoD, IIT Guwahati & NID, Bengaluru. |

*SDG 9 – Industry Innovation and Infrastructure

**Course Designer(s)**

1. Dr.K.Raja – raja@ksrct.ac.in

| 60 CG 0P4 | Career Skill Development IV | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | CG | 0 | 0 | 2 | 1* |

## Objectives

- To help learners improve their vocabulary and enable them to use words appropriately in different academic and professional contexts.
- To help learners develop strategies that could be adopted while reading texts.
- To help learners acquire the ability to speak and write effectively in English in real life and career related situations.
- Improve listening, observational skills, and problem-solving capabilities
- Develop message generating and delivery skills

## Pre-requisites

- Basic knowledge of Arithmetic and Logical Reasoning

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Compare and contrast products and ideas in technical texts. | Analyze |
| CO2 | Identify cause and effects in events, industrial processes through technical texts | Analyze |
| CO3 | Analyze problems in order to arrive at feasible solutions and communicate them orally and in the written format. | Analyze |
| CO4 | Report events and the processes of technical and industrial nature. | Apply |
| CO5 | Articulate their opinions in a planned and logical manner, and draft effective résumés in context of job search. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | 1 | - |
| CO2 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | 2 | 2 |
| CO3 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | - | 1 |
| CO4 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | 2 | 2 |
| CO5 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

**Syllabus**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
| **Common to All Branches** | | | | | | | | |
| **60 CG 0P4 – Career Skill Development IV** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| V | 0 | 0 | 2 | 30 | 1 | 100 | 00 | 100 |

| | |
|---|---|
| **Verbal & Analytical Reasoning**<br>Seating Arrangements – Analytical Reasoning (PUZZELS) – Machin input and output - Coded Inequality – Eligibility Test | **[6]** |
| **Quantitative Aptitude - Part – 4**<br>Permutation and Combination - Probability - Quadratic equation - Geometry – Clock – Calendar – Logarithmic | **[6]** |
| **Non-Verbal Reasoning**<br>Series Completion of Figures – Classification – Courting of figure – Figure matrix – Embedded Figure – Complete Figure – Paper Cutting and Folding – Mirror images and Water Images | **[6]** |
| **Quantitative Aptitude - Part – 5**<br>Mensuration of Area, Volume and Surface area in 2D and 3D Shapes – 2D Shapes – Square, Rectangle, Triangle, Circle, etc. - 3D Shapes – Cube, Cuboid , Sphere, Cone, etc. | **[6]** |
| **Data Interpretation and Analysis**<br>Data interpretation Based on text - Data interpretation Based on Tabulation, Pie chart , Bar graph , And Line graph – Venn Diagram - Data sufficiency | **[6]** |
| **Total Hours:** | **30** |

**Reference(s):**


| | |
|---|---|
| 1. | Aggarwal, R.S. 'A Modern Approach to Verbal and Non-verbal Reasoning', Revised Edition 2008,Reprint 2009,S.Chand & Co Ltd., New Delhi. |
| 2. | Abhijit Guha, 'Quantitative Aptitude', McGraw Hill Education, 6th Edition, 2016 |
| 3. | Dinesh Khattar, 'Quantitative Aptitude For Competitive Examinations', Pearson Education 2020. |
| 4. | Anne Thomson, 'Critical Reasoning: A Practical Introduction' Lexicon Books, 3rd Edition, 2022. Warszaw |


SDG 4 – Quality Education
SDG 8 – Decent work and Economic growth
SDG 9 – Industry, innovation and Infrastructure

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Verbal & Analytical Reasoning** | |
| 1.1 | Seating Arrangements | 1 |
| 1.2 | Analytical Reasoning (PUZZELS) | 1 |
| 1.3 | Machin Input and Output | 1 |
| 1.4 | Coded Inequality | 1 |
| 1.5 | Eligibility Test | 2 |
| **2.0** | **Quantitative Aptitude - Part – 4S** | |
| 2.1 | Permutation and Combination | 1 |
| 2.2 | Probability | 1 |
| 2.3 | Quadratic Equation - Geometry | 1 |
| 2.4 | Clock – Calendar | 1 |
| 2.5 | Logarithmic | 2 |
| **3.0** | **Non-Verbal Reasoning** | |
| 3.1 | Series Completion of Figures – Classification | 1 |
| 3.2 | Courting of Figure – Figure Matrix | 1 |
| 3.3 | Embedded Figure – Complete Figure | 1 |
| 3.4 | Paper Cutting and Folding | 1 |
| 3.5 | Mirror Images and Water Images | 2 |
| **4.0** | **Quantitative Aptitude - Part – 5** | |
| 4.1 | Mensuration of Area, Volume | 1 |
| 4.2 | Mensuration of Volume | 1 |
| 4.3 | Surface Area in 2D and 3D Shapes | 1 |
| 4.4 | 2D Shapes – Square, Rectangle, Triangle, Circle, etc. | 1 |
| 4.5 | 3D Shapes – Cube, Cuboid, Sphere, Cone, etc. | 2 |
| **5.0** | **Data Interpretation and Analysis** | |
| 5.1 | Data Interpretation Based on Text | 1 |
| 5.2 | Data Interpretation Based on Tabulation, Pie Chart | 1 |
| 5.3 | Bar Graph, and Line Graph | 1 |
| 5.4 | Venn Diagram | 1 |
| 5.5 | Data Sufficiency | 2 |

**Course Designer(s)**

1. R. Poovarasan - poovarasan@ksrct.ac.in

**K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215**

(An Autonomous Institution affiliated to Anna University)

B.E. / B.Tech. Degree Programme

**SCHEME OF EXAMINATIONS**

(For the candidates admitted in 2022 –2023)

SIXTH SEMESTER

| S. No. | Course Code | Name of the Course | Duration of Internal Exam | Weightage of Marks | | | Minimum Marks for Pass in End Semester Exam | |
|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment* | End Semester Exam** | Max. Marks | End Semester Exam | Total |
| **THEORY** | | | | | | | | |
| 1 | 60 MC 601 | Industrial Automation Controllers | 2 | 40 | 60 | 100 | 45 | 100 |
| 2 | 60 MC 602 | Machine Design | 2 | 40 | 60 | 100 | 45 | 100 |
| 3 | 60 MC 603 | Computer Aided Design and Manufacturing | 2 | 40 | 60 | 100 | 45 | 100 |
| 4 | 60 MC E2* | Professional Elective-II | 2 | 40 | 60 | 100 | 45 | 100 |
| 5 | 60 MC E3* | Professional Elective-III | 2 | 40 | 60 | 100 | 45 | 100 |
| 6 | 60 OE L0* | Open Elective-III | 2 | 40 | 60 | 100 | 45 | 100 |
| **PRACTICAL** | | | | | | | | |
| 7 | 60 MC 6P1 | Computer Aided Manufacturing Laboratory | 3 | 60 | 40 | 100 | 45 | 100 |
| 8 | 60 MC 6P2 | Industrial Automation Laboratory | 3 | 60 | 40 | 100 | 45 | 100 |
| 9 | 60 MC 6P3 | Design Thinking and Product Development Laboratory | 3 | 60 | 40 | 100 | 45 | 100 |
| 10 | 60 CG 0P5 | Comprehension Test | 1 | 100 | - | 100 | - | 100 |
| 11 | 60 CG 0P6 | Internship | - | 100 | - | 100 | - | 100 |

*** CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.**

**** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for Theory End Semester Examination and 40 marks for Practical End Semester Examination.**

w.e.f. 23/12/2023
Passed in the BoS Meeting Held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

CHAIRMAN
Board Of Studies/
Mechatronics Engineering

| 60 MC 601 | Industrial Automation Controllers | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 1 | 0 | 4 |

## Objectives

- To gain the knowledge of various skills necessary for industrial applications of PLC.
- To provide the basic programming concepts and various logical instructions used in PLC.
- To familiarize the learners in data handling of PLC.
- To impart the knowledge of Supervisory Control and Data Acquisition (SCADA) System.
- To enable the students to troubleshoot and maintain the controller operation in industries.

## Pre-requisites

- Sensors and Instrumentation, Industrial Drives and Control, Digital electronics and Microprocessors

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Describe the main functional units in a PLC and its elements. | Remember |
| CO2 | Develop ladder logic programming for industrial applications. | Analyze |
| CO3 | Apply PLC data handling instructions for industrial automation | Understand |
| CO4 | Implement the Supervisory Control and Data Acquisition systems for particular applications. | Analyze |
| CO5 | Outline different industrial automation applications and troubleshooting procedure**.** | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 3 | 2 | - | - | - | 3 | 3 | 2 | 2 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 2 | 2 | - | - | 3 | - | - | - | - | 2 | 2 |
| CO5 | 3 | 2 | 2 | 2 | 2 | - | 3 | - | - | - | 2 | 2 | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 10 | 20 | 30 |
| Understand | 20 | 25 | 30 |
| Apply | 20 | 10 | 30 |
| Analyse | 10 | 5 | 10 |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |



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Board Of Studies/
Mechatronics Engineering

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC 601- Industrial Automation Controllers** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 |

| Content | Hours |
|---|---|
| **Fundamentals of PLC***<br>Introduction – Requirement, Architecture of Industrial Automation system – History & Architecture of PLC – Principle operation – PLC Input & Output modules –Selection criteria – PLCs versus computers – Programming devices – PLC programming: Ladder diagram, STL, Functional block diagram, Sequential flow chart, Instruction List. | **[9]** |
| **PLC Programming****<br>PLC Programming Symbols in ladder diagram – Boolean logic & relay logic– input and output field devices — Bit logic instructions — ladder diagram examples, interlocking, latching, inter dependency and logical functions – PLC Timer & Counter functions: ON-delay timer, OFF-delay timers, retentive timers, pulse timers, up-counter, down-counter and up down counter, industrial process examples using timer & counters. | **[9]** |
| **Data Handling Functions****<br>Data move instructions– FIFO & LIFO, FAL, ONS, CLR, SWEEP functions – Math instructions – Data manipulation &conversion functions – Program control and interrupts: SKIP and MCR functions, jumps, subroutine, and sequence control relay – Simple programs. | **[9]** |
| **Supervisory Control and Data Acquisition System***<br>Elements of SCADA-Functionalities of SCADA-Architecture: Hardware, Software: Development, Runtime mode Functions-Tools: Tag Database-Recipe database- Alarm Logging-Trends- Distributed Control System (DCS) - Introduction, Flow sheet symbols, Architecture- HMI, DCS programming- Different Network protocols - ASI, CAN, Device net, Industrial Ethernet, Profibus – PA -DP -FMS, Fieldbus, HART. | **[9]** |
| **PLC Maintenance and Case Studies***<br>PLC maintenance – internal & external PLC faults – programmed error – watch dogs – hardware safety circuits – Diagnostic Circuits- troubleshooting. Case Studies: Robot controller – FMS – Factory automation – Process control –Materials handling applications – Automatic control of power plant using SCADA. | **[9]** |
| **Total Hours:(Lecture – 45+Tutorial - 15)** | **60** |

**Text Book(s):**

| | |
|---|---|
| 1. | Frank D.Petruzella “Programmable Logic Controller”, Tata McGraw-Hill Publication, $6^{th}$ Edition, 2023. |
| 2. | M. P. Groover, Automation, Production Systems and Computer Integrated Manufacturing, Fourth Edition, Pearson Education, UK, 2016. |

**Reference(s):**

| | |
|---|---|
| 1. | Robert Radvanovsky, Jacob Brodsky, “Handbook of SCADA/Control Systems Security”, $2^{nd}$ Edition, CRC Press, 2016. |
| 2. | E.A. Parr “Programmable Controllers an Engineer’s Guide”, Elsevier Publication, $3^{rd}$ Edition, 2017. |
| 3. | Stuart A Boyer, “SCADA Supervisory Control and Data Acquisition”, ISA, $4^{th}$ Revised Edition, 2018. |
| 4. | Krishnakant, “Computer based Industrial Control”, PHI, New Delhi,$5^{th}$ Edition, 2017. |

*SDG 9– Industry Innovation and Infrastructure

**SDG 4 – Quality Education

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Fundamentals of PLC** | |
| 1.1 | Introduction | 1 |
| 1.2 | Requirement | 1 |
| 1.3 | Architecture of Industrial Automation system | 1 |
| 1.4 | History & Architecture of PLC | 1 |
| 1.5 | Principle operation | 1 |
| 1.6 | PLC Input & Output modules, Selection criteria | 2 |
| 1.7 | PLCs versus computers, Programming devices | 1 |
| 1.8 | PLC programming: Ladder diagram, STL, Functional block diagram, Sequential flow chart, Instruction List | 1 |
| | Tutorial | 3 |
| **2.0** | **PLC Programming** | |
| 2.1 | PLC Programming Symbols in ladder diagram | 1 |
| 2.2 | Boolean logic & relay logic | 1 |
| 2.3 | Input and output field devices | 1 |
| 2.4 | Bit logic instructions, ladder diagram examples | 1 |
| 2.5 | Interlocking, latching, inter dependency and logical functions | 1 |
| 2.6 | PLC Timer & Counter functions | 1 |
| 2.7 | ON-delay timer, OFF-delay timers, retentive timers, pulse timers, up-counter | 1 |
| 2.8 | Down-counter and up/down counter, | 1 |
| 2.9 | Sequential flow chart, Instruction List | 1 |
| | Tutorial | 3 |
| **3.0** | **Data Handling Functions** | |
| 3.1 | Data move instructions | 1 |
| 3.2 | FIFO & LIFO, FAL, ONS | 2 |
| 3.3 | CLR, SWEEP functions, Math instructions | 1 |
| 3.4 | Data manipulation &conversion functions | 1 |
| 3.5 | Program control and interrupts, SKIP and MCR functions | 2 |
| 3.6 | Jumps, subroutine, and sequence control relay | 1 |
| 3.7 | Simple programs | 1 |
| | Tutorial | 3 |
| **4.0** | **Supervisory Control and Data Acquisition System** | |
| 4.1 | Elements of SCADA | 1 |
| 4.2 | Functionalities of SCADA, Architecture | 1 |
| 4.3 | Hardware, Software, Development, Runtime mode Functions, | 1 |
| 4.4 | Tools, Tag Database | 1 |
| 4.5 | Recipe database, Alarm Logging, Trends | 2 |
| 4.6 | Distributed Control System (DCS) - Introduction | 1 |
| 4.7 | Flow sheet symbols, Architecture, HMI, DCS programming, Different Network protocols | 1 |
| 4.8 | ASI, CAN, Device net, Industrial Ethernet, Profibus – PA -DP -FMS, Fieldbus, HART | 1 |
| | Tutorial | 3 |
| **5.0** | **PLC Maintenance and Case Studies** | |
| 5.1 | PLC maintenance | 1 |
| 5.2 | Internal & external PLC faults, programmed error | 1 |
| 5.3 | Watch dogs, Hardware safety circuits | 1 |
| 5.4 | Troubleshooting. Case Studies | 1 |
| 5.5 | Robot controller, FMS, Factory automation | 1 |
| 5.6 | Process control, Materials handling applications | 2 |
| 5.7 | Automatic control of power plant using SCADA | 2 |
| | Tutorial | 3 |

**Course Designer(s)**

Mrs.V.Indumathi -indumathi@ksrct.ac.in

| 60 MC 602 | Machine Design | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 1 | 0 | 4 |

## Objectives

- To familiarize the various steps involved in the Design Process.
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data.
- To learn to use catalogues and standard machine components.
- To design the various machine components as per standard

## Pre-requisites

- Strength of Materials

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Analyze stresses and dimensions in machine elements at various loads | Apply |
| CO2 | Design the shaft, couplings, keys and knuckle joint for different applications. | Apply |
| CO3 | Design and analyze the springs and gears | Analyze |
| CO4 | Exhibit the design of bearings and connecting rod | Analyze |
| CO5 | Understand the threaded fasteners and ability to design of welded joints. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 1 | 3 | 1 | 1 | 1 | 2 | - | 2 | - | 2 | 3 | 2 | 2 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | - | 2 | - | 3 | - | 2 | - | 2 | 2 |
| CO3 | 2 | 3 | 1 | 3 | 2 | 1 | - | 1 | - | 1 | - | 3 | 2 | 2 |
| CO4 | 1 | 3 | 3 | 2 | 1 | - | 2 | 3 | - | 2 | 1 | 2 | 2 | 2 |
| CO5 | 2 | 1 | 1 | 1 | 2 | 2 | 3 | | - | - | 1 | 2 | 2 | 3 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 20 | 20 | 30 |
| Understand | 20 | 25 | 30 |
| Apply | 20 | 10 | 30 |
| Analyse | - | 5 | 10 |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC 602 – Machine Design** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 |

| | |
|---|---|
| **Variable Stresses in Machine Members***<br>Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties – Direct, Bending and torsional stress equations – eccentric loading – Design of curved beams – crane hook and 'C' frame - Factor of safety - theories of<br>failure – stress concentration – design for variable loading – Soder berg, Goodman and Gerber relations. | **[9]** |
| **Shafts and Couplings***<br>Design of shaft based on strength, rigidity and critical speed – Design of keys – Types - keyways - Design of rigid and flexible couplings - design of knuckle joints. | **[9]** |
| **Springs and Gears***<br>Springs –Types of Springs, Design of helical, leaf under constant loads and varying loads – Concentric torsion springs – Gears, types, terminologies-Design of spur and helical gears | **[9]** |
| **Bearings and Connecting Rod****<br>Study of bearings, Design of bearings – sliding contact and rolling contact types. – Cubic mean load – Design of journal bearings – Mckees equation – Lubrication in journal bearings – calculation of bearing dimensions – Design of connecting rod. | **[9]** |
| **Fasteners and Welded Joints****<br>Threaded fasteners - Design of bolted joints including eccentric loading – Design of welded joints - theory of bonded joints. | **[9]** |
| **Total Hours:(Theory-45+Tutorial-15)** | **60** |

| | |
|---|---|
| **Text Book(s):** | |
| 1. | Juvinall R.C, and Marshek K.M, "Fundamentals of Machine Component Design", John Wiley & Sons, Seventh Edition,2020. |
| 2. | J. K Gupta and R.S..Khurmi, "A Textbook of Machine Design", Eurasia Publishing House, 2019. |
| **Reference(s):** | |
| 1. | Bhandari V.B, "Design of Machine Elements", Tata McGraw-Hill Book Co, 2008 |
| 2. | Norton R.L, "Design of Machinery", Tata McGraw-Hill Book Co, 2004. |
| 3. | Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003. |
| 4. | Spotts M.F., Shoup T.E, "Design and Machine Elements" Pearson Education, 2004. |

*SDG 9 – Industry Innovation and Infrastructure
**SDG 4 – Quality Education



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Mechatronics Engineering

## Course Contents and Lecture Schedule

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Variable Stresses in Machine Members** | |
| 1.1 | Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties. | 1 |
| 1.2 | Mechanical properties – Direct, Bending and torsional stress equations. | 2 |
| 1.3 | Eccentric loading | 1 |
| 1.4 | Design of curved beams – crane hook and 'C' frame | 1 |
| 1.5 | Factor of safety - theories of failure | 1 |
| 1.6 | Stress concentration, design for variable loading – Soderberg | 1 |
| 1.7 | Design for variable loading – Goodman relations. | 1 |
| 1.8 | Design for variable loading – Gerber relations. | 1 |
| | Tutorial | 3 |
| **2.0** | **Shafts and Couplings** | |
| 2.1 | Design of solid shaft based on strength | 1 |
| 2.2 | Design of solid shaft based on rigidity | 2 |
| 2.3 | Design of solid shaft based on critical speed | 1 |
| 2.4 | Design of keys – Types - keyways | 1 |
| 2.5 | Design of rigid and flexible couplings | 2 |
| 2.6 | Design of knuckle joints. | 1 |
| 2.7 | Design of knuckle joints. | 1 |
| | Tutorial | 3 |
| **3.0** | **Electrical Installations** | |
| 3.1 | Springs –Types of Springs, Design of helical | 1 |
| 3.2 | Design of helical spring | 2 |
| 3.3 | Design of leaf spring | 2 |
| 3.4 | Concentric torsion springs | 1 |
| 3.5 | Gears, types, terminologies-Design of spur and helical gears | 1 |
| 3.6 | Gears, types, terminologies-Design of spur and helical gears | 2 |
| | Tutorial | 3 |
| **4.0** | **Bearings and Connecting Rod** | |
| 4.1 | Study of bearings, Design of bearings – sliding contact | 2 |
| 4.2 | Design of rolling contact types | 1 |
| 4.3 | Design of rolling contact types. Cubic mean load | 2 |
| 4.4 | Design of journal bearings, Mckees equation | 1 |
| 4.5 | Lubrication in journal bearings – calculation of bearing dimensions | 1 |
| 4.6 | Design of connecting rod | 2 |
| | Tutorial | 3 |
| **5.0** | **Fasteners and Welded Joints** | |
| 5.1 | Threaded fasteners | 2 |
| 5.2 | Design of bolted joints including eccentric loading | 2 |
| 5.3 | Design of welded joints for pressure vessels and structures | 3 |
| 5.4 | Theory of bonded joints | 2 |
| | Tutorial | 3 |

## Course Designer(s)

Mr.R.Vivek – vivekr@ksrct.ac.in

| 60 MC 603 | Computer Aided Design and Manufacturing | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

## Objectives

- To offer a sight into the utilization of computers in component design.
- To gain insight into the role of computer-aided design and analysis in the design process.
- To comprehend the fundamentals of pioneering manufacturing methodologies.
- To know the impressions of Part programming with computer assistance.
- To understand the Group Technology and Flexible Manufacturing System concepts.

## Pre-requisites

- Manufacturing Technology

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Obtain an understanding of the stages within the product life cycle, as well as the principles of 2D and 3D transformations and the basics of CAD/CAM | Apply |
| CO2 | Acquire knowledge regarding I/O devices, Boolean operations, and the concepts of Finite Element Analysis (FEA). | Remember |
| CO3 | Comprehend and elucidate the principles governing the latest advancements in manufacturing machinery. | Understand |
| CO4 | Utilize NC programming concepts to create part programs for both Lathe and Milling Machines | Apply |
| CO5 | Enumerate the functions of computers in the context of Group Technology (GT) and Flexible Manufacturing Systems (FMS). | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 3 | 2 | 3 | 2 | - | - | - | 2 | - | 3 | 3 | 2 |
| CO2 | 2 | 3 | 3 | 2 | 2 | 2 | - | - | - | 3 | - | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 2 | 3 | 2 | - | - | - | 2 | - | 2 | 3 | 2 |
| CO4 | 2 | 3 | 2 | 3 | 3 | 2 | - | - | - | 3 | - | 3 | 2 | 2 |
| CO5 | 2 | 3 | 3 | 2 | 3 | 2 | - | - | - | 2 | - | 2 | 2 | 3 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 10 | 10 | 20 |
| Understand | 20 | 20 | 30 |
| Apply | 30 | 30 | 50 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

w.e.f. 23/12/2023
Passed in the BoS Meeting Held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

CHAIRMAN
Board Of Studies/
Mechatronics Engineering

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC 603 - Computer Aided Design and Manufacturing** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Computer Aided Drawing***<br>Historical development of CAD technology - Product cycle, Design process (Shigley model) - CAD and its applications in various industries - Transformations: 2D & 3D transformations - translation, scaling, rotation and concatenation. Geometric modelling: Wire frame modelling. Surface modelling - types of surfaces - applications - Solid modelling - entities - advantages and disadvantages | **[9]** |
| **Computer Graphics***<br>Introduction to Computer Graphics - Input and Output devices. Graphical input techniques - Boolean operations - Boundary representation - Constructive Solid Geometry- Comparison. Graphics standard: Definition - Need - GKS - OpenGL - IGES - DXF. Finite Element Analysis: Introduction - development - basic steps - advantages | **[9]** |
| **Computer Aided Manufacturing***<br>Definition of automation, types of automation, Definition of NC, basic components of NC system, applications of numerical control. Process Planning: Introduction - Computer Assisted Process Planning (CAPP) - Types of CAPP - Variant type, Generative type - advantages of CAPP. AGV: Introduction - AGV - working principle - types - benefits. Concurrent Engineering: Definition - Sequential Vs Concurrent engineering - need of CE - benefits of CE | **[9]** |
| **CNC Part Programming***<br>Manual part programming - coordinate system - Datum points: machine zero, work zero, tool zero - reference points - NC dimensioning - G codes and M codes - linear interpolation and circular interpolation - CNC program procedure - sub-program - canned cycles - stock removal - thread cutting - mirroring - drilling cycle - pocketing | **[9]** |
| **Group Technology and Flexible Manufacturing Systems***<br>Group Technology: Part families - Parts classification and coding - Coding structure - Optiz Coding System, MICLASS System and CODE System. Flexible Manufacturing System - FMS Components and its types - Flexibility in FMS - FMS Control - FMS layout configuration - FMS Application and Benefits - Role of CAD/CAM in Industry 4.0 | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | P. N. Rao - ‘CAD/CAM, Principles and Applications’ - Tata McGraw Hill Publishers - 2017 |
| 2. | Mikell P. Groover and Emory W. Zimmers - ‘CAD/CAM’ - PHI Publishers - 2014 |

**Reference(s):**

| | |
|---|---|
| 1. | R. Radhakrishnan, S. Subramanian ‘CAD/CAM/CIM’, New Age International Pvt. Ltd., 3rd Edition |
| 2. | Ibrahim Zeid and R Sivasubramanian, “CAD/CAM: Theory and Practice”, Tata McGraw Hill Company, 2009**.** |
| 3. | Sadhu Singh, “Computer Aided Design and Manufacturing”, Khanna Publishers, New Delhi, 2011**.** |
| 4. | H.M.T. Production Technology: Hand book` - Tata McGraw-Hill Publishing Company Limited, 1990 |

*SDG 9 – Industry Innovation and Infrastructure



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Board Of Studies/
Mechatronics Engineering

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Computer Aided Drawing** | |
| 1.1 | Historical development of CAD technology | 1 |
| 1.2 | Product cycle, Design process (Shigley model) | 1 |
| 1.3 | CAD and its applications in various industries | 1 |
| 1.4 | Transformations: 2D & 3D transformations – translation and scaling | 1 |
| 1.5 | Transformations: 2D & 3D transformations - rotation and concatenation | 1 |
| 1.6 | Geometric modelling: Wire frame modelling | 1 |
| 1.7 | Surface modelling - types of surfaces - applications | 1 |
| 1.8 | Solid modelling - Entities | 1 |
| 1.9 | Solid modelling - advantages and disadvantages | 1 |
| **2.0** | **Computer Graphics** | |
| 2.1 | Introduction to Computer Graphics | 1 |
| 2.2 | Input and Output devices | 1 |
| 2.3 | Graphical input techniques | 1 |
| 2.4 | Boolean operations - Boundary representation | 1 |
| 2.5 | Constructive Solid Geometry | 1 |
| 2.6 | Graphics standard: Definition - Need - GKS | 1 |
| 2.7 | OpenGL - IGES - DXF | 1 |
| 2.8 | Finite Element Analysis: Introduction | 1 |
| 2.9 | Finite Element Analysis: Development - basic steps - advantages | 1 |
| **3.0** | **Computer Aided Manufacturing** | |
| 3.1 | Definition of automation, types of automation | 1 |
| 3.2 | Definition of NC, basic components of NC system, applications of numerical control | 1 |
| 3.3 | Process Planning: Introduction - Computer Assisted Process Planning (CAPP) | 1 |
| 3.4 | Types of CAPP - Variant type, | 1 |
| 3.5 | Generative type - advantages of CAPP | 1 |
| 3.6 | AGV: Introduction - AGV - working principle - types - benefits | 1 |
| 3.7 | Concurrent Engineering: Definition | 1 |
| 3.8 | Sequential vs Concurrent engineering | 1 |
| 3.9 | Need of CE - benefits of CE | 1 |
| **4.0** | **CNC Part Programming** | |
| 4.1 | Manual part programming - coordinate system | 1 |
| 4.2 | Datum points: machine zero, work zero, tool zero - reference points | 1 |
| 4.3 | NC dimensioning - G codes and M codes | 1 |
| 4.4 | Linear interpolation and circular interpolation | 1 |
| 4.5 | CNC program procedure - sub-program - canned cycles - stock removal | 1 |
| 4.6 | Thread Cutting | 1 |
| 4.7 | Mirroring | 1 |
| 4.8 | Drilling Cycle | 1 |
| 4.9 | Pocketing | 1 |
| **5.0** | **Group Technology and Flexible Manufacturing Systems** | |
| 5.1 | Group Technology: Part families - Parts classification and coding | 1 |
| 5.2 | Coding structure - Optiz Coding System | 1 |
| 5.3 | MICLASS System and CODE System | 1 |
| 5.4 | Flexible Manufacturing System | 1 |
| 5.5 | FMS Components and its types | 1 |
| 5.6 | Flexibility in FMS - FMS Control | 1 |
| 5.7 | FMS layout configuration | 1 |
| 5.8 | FMS Application and Benefits | 1 |
| 5.9 | Role of CAD/CAM in Industry 4.0 | 1 |

**Course Designer(s)**

Dr.A.Ramesh Kumar -rameshkumar@ksrct.ac.in

| 60 MC 6P1 | Computer Aided Manufacturing Laboratory | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 0 | 0 | 3 | 1.5 |

## Objectives

- Imparting an understanding of the construction and operation of Computer Numerical Control (CNC) Machines.
- Familiarizing individuals with the interfacing, communication, and control of CNC machine tools.
- Providing foundational knowledge in CNC manual part programming.
- Equipping individuals with the skills needed to program CNC turning centers and CNC machining centers.
- Facilitating hands-on experience in computer-assisted part programming.

## Pre-requisites

- Manufacturing Technology Laboratory

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Elaborate on the structure and functionality of CNC machine tools. | Apply |
| CO2 | Comprehend diverse aspects of CNC programming. | Apply |
| CO3 | Create programs for producing components on CNC turning centers. | Apply |
| CO4 | Develop programs for fabricating geometric components with CNC machining centers. | Apply |
| CO5 | Grasp the generation of NC code from CAD models within CAM software. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 2 | 2 | 3 | 2 |
| CO2 | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 2 | 2 | 2 | 2 |
| CO3 | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 2 | 2 | 3 | 2 |
| CO4 | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 2 | 2 | 2 | 2 |
| CO5 | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 2 | 2 | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Lab Experiments Assessment (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | Lab | Activity | | |
| Remember | - | 5 | - | - |
| Understand | 25 | 10 | 50 | 50 |
| Apply | 25 | 10 | 50 | 50 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 50 | 25 | 100 | 100 |

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC 6P1-Computer Aided Manufacturing Laboratory** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hrs** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 0 | 0 | 3 | 45 | 1.5 | 60 | 40 | 100 |

**List of Experiments:**

**Exploration of CNC Machinery and Programming***

1. Study on CNC Lathe, CNC Milling operations and G-Codes and M-Codes

**CNC Turning Operations***

2. Implementing Linear and Circular interpolation for step turning
3. Applying Contour Turning cycles to achieve taper turning
4. Utilizing Stock removal cycles for drilling and boring processes
5. Crafting a part program for grooving and thread cutting using canned cycles

**CNC Milling Techniques***

6. Developing a part program for drilling, tapping, and counter sinking with canned cycles
7. Generating a part program for contour milling using canned cycles
8. Creating part programs for drilling and peck drilling with the aid of canned cycles
9. Employing subprograms to achieve mirror imaging

**Computer-Aided Part Programming***

10. Generating CL Data for a given component using CAM Software

**Lab Manual**

| | |
|---|---|
| 1. | "Computer Aided Manufacturing Lab Manual", Department of Mechatronics Engineering, KSRCT. |

*SDG 9 – Industry Innovation and Infrastructure

**Course Designer(s)**

Dr.A.Ramesh Kumar - rameshkumar@ksrct.ac.in

| 60 MC 6P2 | Industrial Automation Laboratory | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 0 | 0 | 3 | 1.5 |

## Objectives

- To train the students to be familiar with the software and hardware of PLC using ladder logic codes.
- To familiarize the student to develop PLC programs for different applications.
- To facilitate knowledge on PLC Control Principles and Applications with Field Devices.
- To train the students to create ladder diagrams for process control descriptions.
- To impart knowledge on Configure communication between the PLC and PC.

## Pre-requisites

- Sensors and Instrumentation, Industrial Drives and Control, Microprocessors and Microcontrollers

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Write a PLC program for various industrial applications. | Understand |
| CO2 | Control the speed of AC motors using VFD. | Apply |
| CO3 | Interface the sensors for flow, pressure and level monitoring and control in process industries | Apply |
| CO4 | Design the of closed loop temperature controller | Apply |
| CO5 | Explore the concept of real-time monitoring and control using HMI | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 3 | 3 | - | - | - | 3 | 3 | 2 | 2 | 3 | 2 |
| CO2 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | - | - | - | 3 | 3 | 3 | 2 |
| CO4 | 3 | 3 | 2 | 2 | 3 | - | - | 3 | - | - | - | - | 3 | 2 |
| CO5 | 3 | 2 | 2 | 2 | 3 | - | - | - | - | - | 2 | 2 | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Lab Experiments Assessment (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | Lab | Activity | | |
| Remember | 10 | 05 | - | - |
| Understand | 20 | 10 | 50 | 50 |
| Apply | 20 | 10 | 50 | 50 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 50 | 25 | 100 | 100 |

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC 6P2- Industrial Automation Laboratory** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hrs** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 0 | 0 | 3 | 45 | 1.5 | 60 | 40 | 100 |

**List of Experiments:**

1. PLC Programming for simple control applications using logic Gates.
2. Demonstration of delay on timers and delay off timers using PLC.
3. Demonstration of count up and count down counter using PLC.
4. Demonstration of Master and Jump control in PLC ladder logic network.
5. Simulation of Automating car parking system using PLC.
6. PLC control of electro-pneumatic and electro-hydraulic systems.
7. Simulation of Lift Elevator system using PLC.
8. Controlling of a conveyor belt control using PLC.
9. Controlling and speed control of AC motors using PLC
10. Implementation of water level control system using HMI.
11. Demonstration of batch process reactor control system through PLC.
12. Measurement by multi touch position tracking using HMI
13. A PLC based experiment on Pressure Monitoring and Control in Industrial process.

**Lab Manual**

| | |
|---|---|
| 1. | "Industrial Automation Laboratory Manual", Department of Mechatronics Engineering, KSRCT. |

*SDG 9 – Industry Innovation and Infrastructure

**Course Designer(s)**

Mrs. V.Indumathi – indumathi@ksrct.ac.in

| 60 MC 6P3 | Design Thinking and Product Development Laboratory | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 0 | 0 | 2 | 1 |

## Objectives

- Ideate and develop innovative solutions for the given problem statement
- Develop soft prototype and visualize user scenarios for early-stage product validation
- Develop medium and hard prototype, integrating technical, ergonomic, and aesthetic considerations
- Conduct testing, gather user feedback, and apply iterative design processes
- Document, publish and present their solution

## Pre-requisites

- Design Thinking and Innovation Laboratory

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Generate innovative solutions to address specific problem statements. | Apply |
| CO2 | Create and evaluate soft prototype, including paper prototypes and storyboards, to test initial design concepts. | Create |
| CO3 | Create medium and hard prototype using 3D modelling and printing, incorporating human factors and system design. | Create |
| CO4 | Perform usability studies, analyze user feedback, and iterate their designs to finalize user-centered solutions. | Analyse |
| CO5 | Prepare professional documentation, and deliver a comprehensive project report and presentation. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | - | 2 | 3 | 3 | 3 | 3 | 3 | - | 3 | 3 | 2 |
| CO2 | 3 | 3 | 3 | - | - | - | - | 3 | 3 | 3 | - | - | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 | - | - | 3 | 3 | 3 | - | - | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | 3 | 3 | 2 |
| CO5 | 3 | - | - | - | - | - | - | 3 | 3 | 3 | 3 | - | 3 | |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Review I (CO1) | | | Review II (CO2, CO3) | | | Review III (CO4) | | | (R1+R2+R3) | Internal Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| Generating Creative ideas | Concept Maps and Evaluation | Presentation | Soft Prototyping | Hi-fidelity prototyping | Demonstration | User Studies & Feedback | Finalise solution | Presentation | **Total** | |
| 10 | 10 | 10 | 10 | 20 | 10 | 10 | 10 | 10 | **100** | **60** |

| Report and Presentation (CO1, CO2, CO3, CO4 & CO5) | | | | External Marks |
|---|---|---|---|---|
| Report | Presentation | Demonstration | **Total** | |
| 50 | 30 | 20 | **100** | **40** |

w.e.f. 23/12/2023
Passed in the BoS Meeting Held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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Board Of Studies/
Mechatronics Engineering

| K.S.Rangasamy College of Technology – Autonomous R 2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC 6P3 – Design Thinking and Product Development Laboratory** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hrs** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 0 | 0 | 2 | 30 | 1 | 60 | 40 | 100 |

| | |
|---|---|
| **Ideation**<br>Generating Creative ideas - Idea Sketching, Brainstorming for Ideas, SCAMPER, Creativity and Lateral thinking- Concept Maps and Evaluation | [8] |
| **Soft Prototyping**<br>Soft Prototyping - Paper Prototype (low-fidelity), Scenarios and Storyboarding, MVP (minimum Viable product). | [4] |
| **Final Prototyping**<br>Medium Prototyping - Proof of Concept (PoC), Info Architecture, Experience Design-Human Factors / Ergonomics - Systems Mapping – high prototyping - 3D Modelling & Printing. | [6] |
| **Usability Studies**<br>User Studies – Observation – Conversations - Think-aloud protocol – Feedback – Iterate - Finalise solution. | [8] |
| **Publish the solution**<br>Publish the ideas: Journal Publication & Intellectual Property Rights–Prepare project report and present the final solution. | [4] |
| **Total Hours:** | 30 |

**Reference(s):**


| | |
|---|---|
| 1. | NPTEL: Design Thinking and Innovation by Prof. Ravi Poovaiah, IDC School of Design, IIT Bombay. https://onlinecourses.swayam2.ac.in/aic23_ge17/preview, https://dsource.in/dti. |
| 2. | NPTEL: Innovation by Design by Prof. B. K. Chakravarthy, IDC School of Design, IIT Bombay, https://onlinecourses.swayam2.ac.in/aic19_de02/preview. |
| 3.. | www.dsource.in , The Resource for Design by e-Kalpa Design Team,IDC, IIT Bombay, DoD, IIT Guwahati & NID, Bengaluru |


SDG 9 – Industry Innovation and Infrastructure

**Course Designer(s)**


1. Dr.K.Raja – raja@ksrct.ac.in

| 60 CG 0P5 | Comprehension Test* | Category | L | T | P | C | CA | ES | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | CG | 0 | 0 | 2 | 1* | 100 | - | 100 |

**Objectives**

- To evaluate the knowledge gained in core courses relevant to the programme of study.
- To assess the technical skill in solving complex engineering problems.

**Prerequisite**

- Fundamental knowledge in all core subjects.

**Course Outcomes**

**On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1 | Infer knowledge in their respective programme domain. | Apply |
| CO2 | Attend interviews for career progression | Apply |
| CO3 | Exhibit professional standards to solve engineering problems | Apply |
| CO3 | Promote holistic approach to problem solving | Apply |
| CO5 | Examine the competency of graduates in specific programme domain | Apply |

**Mapping with Programme Outcomes**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | 2 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | 2 | 2 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | 2 | 2 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | 2 | 2 | 3 | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

**Assessment Pattern**

The overall knowledge of the candidate in various courses he/she studied shall be evaluated with multiple choice questions.

*SDG:4- Quality Education



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Mechatronics Engineering

**K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215**
(An Autonomous Institution affiliated to Anna University)
B.E. / B.Tech. Degree Programme
**SCHEME OF EXAMINATIONS**
(For the candidates admitted in 2022 –2023)

SEVENTH SEMESTER

| S. No. | Course Code | Name of the Course | Duration of Internal Exam | Weightage of Marks | | | Minimum Marks for Pass in End Semester Exam | |
|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment* | End Semester Exam** | Max. Marks | End Semester Exam | Total |
| **THEORY** | | | | | | | | |
| 1 | 60 MC 701 | Robotics Engineering | 2 | 40 | 60 | 100 | 45 | 100 |
| 2 | 60 MC 702 | Embedded System | 2 | 40 | 60 | 100 | 45 | 100 |
| 3 | 60 MC 703 | Automation in Automobiles | 2 | 40 | 60 | 100 | 45 | 100 |
| 4 | 60 MC E4* | Professional Elective-IV | 2 | 50 | 50 | 100 | 45 | 100 |
| 5 | 60 AC 001 | Research Skill Development | 2 | 100 | - | 100 | - | 100 |
| 6 | 60 AB 00* | NCC\NSS\NSO\YRC\RRC\ Yoga\Fine Arts% | 2 | 50 | 50 | 100 | 45 | 100 |
| **PRACTICAL** | | | | | | | | |
| 7 | 60 MC 7P1 | Embedded System Laboratory | 3 | 60 | 40 | 100 | 45 | 100 |
| 8 | 60 MC 7P2 | Robotics and Machine Vision Laboratory | 3 | 60 | 40 | 100 | 45 | 100 |
| 9 | 60 MC 7P3 | Project Work - Phase I | 3 | 100 | - | 100 | - | 100 |
| 10 | 60 CG 0P6 | Internship | - | 100 | - | 100 | - | 100 |

*** CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.**
**** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory courses, 50 marks for theory cum practical courses and 40 marks for Practical End Semester Examination.**

w.e.f.25/05/2024
Passed in the BoS Meeting Held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

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| 60 MC 701 | Robotics Engineering | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

## Objectives

- To develop the student's knowledge in various robot structures and their workspace.
- To develop student's skills in perform kinematics analysis of robot systems.
- To provide the student with knowledge of the singularity issues associated with the operation of robotic systems.
- To provide the student with some knowledge and analysis skills associated with robotic sensors.
- To provide the student with some knowledge and skills associated with Machine vision.

## Pre-requisites

- Sensors and Instrumentation, System Design and Control

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Express the basic concepts, laws, components and parameters of robots. | Remember |
| CO2 | Identify Types of End Effectors based on their designs and functionalities. | Understand |
| CO3 | Apply homogeneous transformation matrices to solve kinematic problems in robotics. | Apply |
| CO4 | Describe the key characteristics, basic principles of sensors and their importance in robotic systems | Understand |
| CO5 | Implement noise reduction methods to improve the quality of images and enhance the performance of machine vision systems. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 2 | 2 | 2 |
| CO2 | 2 | 2 | 2 | 2 | 1 | - | - | - | - | - | 2 | 3 | 2 | 3 |
| CO3 | 3 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 3 |
| CO4 | 2 | 1 | 2 | 3 | 1 | - | - | - | - | - | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 1 | 1 | 3 | - | - | - | - | - | - | 1 | 1 | 2 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 30 | 20 | 20 |
| Understand | 30 | 30 | 50 |
| Apply | - | 10 | 30 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

w.e.f.25/05/2024
Passed in the BoS Meeting Held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

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Mechatronics Engineering

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| B.E – Mechatronics Engineering | | | | | | | | |
| 60 MC 701 - Robotics Engineering | | | | | | | | |
| Semester | Hours/Week | | | Total Hours | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction and Robot Components**<br>Introduction – Basic Components of Robot – Laws of Robotics – Classification of Robot – Robot Motions Work Space – Precision of Movement – Power Transmission System – Gear Transmission - Belt Drives – Rotary to Linear Motion Conversion, Rack and Pinion Drives, Stepper Motors and Servo Motors. | **[9]** |
| **End Effectors**<br>Robot End Effectors – Introduction-Types of End Effectors – Mechanical Gripper – Types of Gripper Mechanism – Gripper Force Analysis – Other Types of Grippers – Special Purpose Grippers. | **[9]** |
| **Robot Mechanics***<br>Introduction- Matrix Representation - Rigid Motion - Homogeneous Transformation Matrices - Forward & Inverse Kinematics of Robot — Degeneracy and Dexterity-Introduction to USARSim Simulation of Robot Kinematics Using USARSim | **[9]** |
| **Actuators and Control**<br>Pneumatic Actuators- Hydraulic Actuators – Applications, Advantages and Disadvantages in Robots - Motion Control - Trajectory Planning - Motion Control Algorithms - Robot Control Architectures. | **[9]** |
| **Machine Vision System and Programming**<br>Introduction - Image Acquisition - Sampling and Quantization - Image Processing Techniques - Noise Reduction Methods - Edge Detection – Segmentation - Thresholding – Binary Morphology and Gray Morphology. Introduction - Procedures and Functions - Control Statements-On-line programming - Manual Input, Lead Through Programming. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**


| | |
|---|---|
| 1. | Saeed B. Niku, "Introduction to Robotics: Analysis, systems, Application", 2nd Edition, Pearson Education India, 2017. |
| 2. | Mikell P. Groover, "Industrial Robots - Technology, Programming and Applications", McGraw Hill, New York, 2008. |

**Reference(s):**

| | |
|---|---|
| 1. | John.J.Craig, " Introduction to Robotics: Mechanics & control" , Pearson Publication, 4th Edition, 2018. |
| 2. | Jazar, "Theory of Applied Robotics: Kinematics, Dynamics and Control", Springer, 2nd Edition, 2016. |
| 3. | Peter Corke, "Robotic Vision: Fundamental Algorithms in MATLAB", Springer International Publishing, 2022 |
| 4. | Ramesh Jain, Rangachari Kasturi, Brain G.Schunck," Machine Vision", Tata McGraw Hill, USA., 2nd Edition (India), 2012. |


*SDG 7 – Affordable and Clean Energy

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Introduction and Robot Components** | |
| 1.1 | Introduction, Basic Components of Robot | 1 |
| 1.2 | Laws of Robotics | 1 |
| 1.3 | Classification of Robot | 1 |
| 1.4 | Robot Motions Work Space | 1 |
| 1.5 | Precision of Movement | 1 |
| 1.6 | Power Transmission System | 1 |
| 1.7 | Gear Transmission, Belt Drives | 1 |
| 1.8 | Rotary to Linear Motion Conversion, Rack and Pinion Drives | 1 |
| 1.9 | Stepper Motors and Servo Motors | 1 |
| **2.0** | **End Effectors** | |
| 2.1 | Robot End Effectors | 1 |
| 2.2 | Introduction, Types of End Effectors | 2 |
| 2.3 | Mechanical Gripper | 2 |
| 2.4 | Types of Gripper Mechanism | 1 |
| 2.5 | Gripper Force Analysis | 1 |
| 2.6 | Other Types of Grippers | 1 |
| 2.7 | Special Purpose Grippers | 1 |
| **3.0** | **Robot Mechanics** | |
| 3.1 | Introduction, Matrix Representation | 2 |
| 3.2 | Rigid Motion | 2 |
| 3.3 | Homogeneous Transformation Matrices | 1 |
| 3.4 | Forward & Inverse Kinematics of Robot | 2 |
| 3.5 | Degeneracy and Dexterity | 1 |
| 3.6 | Introduction to USARSim Simulation of Robot Kinematics Using USARSim | 1 |
| **4.0** | **Actuators and Control** | |
| 4.1 | Pneumatic Actuators | 1 |
| 4.2 | Hydraulic Actuators | 1 |
| 4.3 | Applications, Advantages and Disadvantages in Robots | 1 |
| 4.4 | Motion Control | 2 |
| 4.5 | Trajectory Planning | 1 |
| 4.6 | Motion Control Algorithms | 1 |
| 4.7 | Robot Control Architectures | 2 |
| **5.0** | **Machine Vision System and Programming** | |
| 5.1 | Introduction, Image Acquisition | 1 |
| 5.2 | Sampling and quantization | 1 |
| 5.3 | Image Processing Techniques | 1 |
| 5.4 | Noise Reduction Methods, Edge Detection | 1 |
| 5.5 | Segmentation, Thresholding | 1 |
| 5.6 | Binary Morphology and Gray morphology. | 1 |
| 5.7 | Introduction, Procedures and Functions | 1 |
| 5.8 | Control Statements-On-line Programming | 1 |
| 5.9 | Manual Input, Lead Through Programming | 1 |

**Course Designer(s)**


1. Dr.M.Ravi-ravi@ksrct.ac.in
2. Mr.M.Sanjay- sanjaym@ksrct.ac.in

| 60 MC 702 | Embedded System | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

## Objectives

- Develop a comprehensive understanding of embedded systems, including their architecture, components, and applications in various domains.
- Gain proficiency in programming and interfacing with ARM microprocessors commonly used in embedded system design.
- Understand the principles and operation of real-time operating systems and their significance in managing tasks, scheduling, and resource allocation in embedded systems.
- Study popular communication protocols used in embedded systems and understand their implementation for data exchange and networking.
- Explore various design methodologies and learn to apply them to efficiently develop embedded systems from concept to implementation

## Pre-requisites

- Microprocessors & Microcontrollers

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Provide an overview of different blocks of an embedded Processor. | Understand |
| CO2 | Provide knowledge about the architecture of ARM Processors. | Understand |
| CO3 | Understand the concept of RTOS and its software tools. | Understand |
| CO4 | Bring out the various networks and buses, interfacing protocols with embedded system. | Apply |
| CO5 | Model hardware/software design approaches for real-time applications | Analyze |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 2 | 2 | 2 | - | 2 | - | 2 | 1 | 2 | 1 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 2 | - | 3 | 2 | 2 | 1 | 2 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | - | 3 | 2 | 2 | - | 3 | 3 |
| CO4 | 2 | 2 | 2 | 2 | 3 | - | 2 | 3 | 2 | 1 | - | 3 | 3 | 3 |
| CO5 | 3 | 2 | 3 | 2 | 3 | - | 3 | 1 | 3 | 2 | 3 | - | 3 | 2 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 20 | 10 | 30 |
| Understand | 40 | 25 | 30 |
| Apply | - | 25 | 30 |
| Analyse | - | - | 10 |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |



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**Syllabus**

**K.S.Rangasamy College of Technology – Autonomous R2022**

**B.E – Mechatronics Engineering**

**60 MC 702 – Embedded System**

| Semester | Hours/Week | | | Total Hours | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| VII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Typical Embedded System***<br>Definition of Embedded System, Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory According to the Type of Interface, Memory Shadowing, Memory Selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces. | **[9]** |
| **ARM Architecture***<br>ARM Design Philosophy, ARM Architecture, Registers, ARM Instruction Set, Thumb Instruction Set, Instruction Pipeline, Interrupts and Vector Table, ARM Processor Families, ARM Simple Programs. | **[9]** |
| **Real Time Operating Systems***<br>Brief History of OS, Defining RTOS, and Difference: RTOS v/s General Purpose OS, Types of RTOS, The Scheduler, Objects, Services, Characteristics of RTOS, Defining a Task, Tasks States and Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency. Defining Semaphores, Operations and Use, Defining Message Queue, Popular RTOS: Free RTOS or Micrium uC/OS | **[9]** |
| **Network Protocols***<br>Sockets, Ports, UDP, TCP/IP, HTTP, Telnet, Gopher,Client Server Model, Socket Programming, 802.11, Bluetooth, Zigbee, Firewalls, Network Security, $I^2C$, CAN, LIN and Flexray Communication Protocols. Wireless Sensor Networks – Introduction – Applications – Network Topology – Localization –Time Synchronization - Energy Efficient MAC Protocols | **[9]** |
| **Modelling with Hardware/Software Design Approaches***<br>Objective, Need, Different Phases & Modelling of the EDLC, Choice of Target Architectures for Embedded Application Development-For Control Dominated-Data Dominated Systems-Case Studies on Digital Camera, Adaptive Cruise Control in a Car, Mobile Phone Software for Key Inputs**.** | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Rajkamal P, "Embedded System – Architecture, Programming, Design", Tata McGraw Hill, 4th Edition, 2020. |
| 2. | Daniel W. Lewis "Fundamentals of Embedded Software", Prentice Hall of India, 2012. |

**Reference(s):**

| | |
|---|---|
| 1. | Wayne Wolf, "Computers as Components: Principles of Embedded Computing System Design", 2nd Edition, Morgan Kaufman Publishers, 2013. |
| 2. | Lyla B Das," Embedded Systems-An Integrated Approach", Pearson Education 2013 |
| 3. | ARM Systems Developer's Guides- Designing & Optimizing System Software – Andrew N. Sloss, Dominic Symes, Chris Wright, 2008, Elsevier. |
| 4. | Steve Furber,"ARM System-on-chip Architecture", 2nd Edition, Dorling Kindersley, 2007. |

*SDG 9: Industry, Innovation and Infrastructure

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Typical Embedded System** | |
| 1.1 | Introduction to Embedded System | 1 |
| 1.2 | Core of the Embedded System | 2 |
| 1.3 | Memory Shadowing | 2 |
| 1.4 | Memory Selection for Embedded Systems | 2 |
| 1.5 | Sensors and Actuators | 1 |
| 1.6 | Communication Interfaces | 1 |
| **2.0** | **ARM Architecture** | |
| 2.1 | ARM Design Philosophy | 1 |
| 2.2 | ARM Architecture | 2 |
| 2.3 | Instruction Pipeline | 2 |
| 2.4 | Interrupts | 1 |
| 2.5 | Interrupt Vector Table | 1 |
| 2.6 | Architecture Revision | 1 |
| 2.7 | ARM Processor Families | 1 |
| **3.0** | **Real Time Operating Systems** | |
| 3.1 | Introduction to RTOS | 1 |
| 3.2 | Architecture of RTOS | 1 |
| 3.3 | Tasks | 1 |
| 3.4 | Functions of RTOS | 2 |
| 3.5 | Semaphores | 1 |
| 3.6 | Message Queue | 1 |
| 3.7 | Popular RTOS | 2 |
| **4.0** | **Network Protocols** | |
| 4.1 | Sockets, Ports | 1 |
| 4.2 | UDP, TCP/IP, Comparison of UDP and TCP | 1 |
| 4.3 | Client Server Model, Socket Programming | 1 |
| 4.4 | 802.11,Bluetooth | 1 |
| 4.5 | ZigBee, Firewalls | 1 |
| 4.6 | Network Security,$I^2C$ (Inter Integrated Circuits) | 1 |
| 4.7 | CAN, LIN, Flexray Protocols | 1 |
| 4.8 | Wireless Sensor Networks | 1 |
| 4.9 | Energy Efficient MAC Protocols | 1 |
| **5.0** | **Modelling with Hardware/Software Design Approaches** | |
| 5.1 | EDLC, Objective, Needs, Different Phases ,Modelling | 1 |
| 5.2 | Target Architecture – Embedded Development | 2 |
| 5.3 | Case Study Digital Camera | 2 |
| 5.4 | Case Study Adaptive Cruise Control in a Car | 2 |
| 5.5 | Case Study Mobile Phone Software for key Inputs | 2 |

**Course Designer(s)**


1. Mr.T.Prabhu - prabhut@ksrct.ac.in

| 60 MC 703 | Automation in Automobiles | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

## Objectives

- To Understand the fundamentals of automation and its role in modern automobiles.
- To Explore different levels of vehicle automation and their functionalities.
- To Analyze the impact of automation on vehicle safety, efficiency, and user experience.
- To Evaluate case studies and real-world applications of automation in automotive engineering.
- To Predict future trends and advancements in automotive automation

## Pre-requisites

- Autonomous Vehicle

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Designate the Evolution of Automotive Automation and Differentiate Between Various Levels of Automation. | Remember |
| CO2 | Recognize Sensor Technologies, their Integration into Perception Systems, and Their Significance in Enhsmaart Ancing the Safety and Autonomy of Vehicles. | Understand |
| CO3 | Demonstrate Proficiency in Control System Design, Actuation Techniques, and Algorithm Implementation for Various Driver- Assistance Functionalities In Automated Vehicles. | Understand |
| CO4 | Analyze the Requirements for Different Levels of Autonomy, Design Autonomous Driving Systems, And Develop Algorithms. | Understand |
| CO5 | Understanding of the Connectivity Fundamentals Wireless Security Overview Connected Car Display Technology. | Understand |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 1 | 1 | - | 1 | - | - | - | - | - | 1 | 2 | 3 |
| CO2 | 3 | 2 | 1 | 1 | - | 1 | - | - | - | - | - | 1 | 2 | 3 |
| CO3 | 3 | 2 | 1 | 1 | - | 1 | - | - | - | - | - | 1 | 2 | 3 |
| CO4 | 3 | 2 | 1 | 1 | - | 1 | - | - | - | - | - | 1 | 2 | 3 |
| CO5 | 3 | 2 | 1 | 1 | - | 1 | - | - | - | - | - | 1 | 2 | 3 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 25 | 25 | 50 |
| Understand | 35 | 35 | 50 |
| Apply | - | - | - |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

w.e.f.25/05/2024
Passed in the BoS Meeting Held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

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**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E – Mechatronics Engineering** | | | | | | | | |
| **60 MC 703 – Automation in Automobiles** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to Automotive Automation**<br>Overview of Automation Concepts in the Automotive Industry, Historical Evolution and Milestones in Vehicle Automation, Levels of Automation (SAE J3016) and Their Definitions, Benefits and Challenges of Integrating Automation in Automobiles. | **[9]** |
| **Sensors and Perception Systems***<br>Types of Sensors Used in Automated Vehicles (Lidar, Radar, Cameras), Principles of Sensor Data Acquisition and Processing, Sensor Fusion Techniques for Enhanced Perception, Role of Perception Systems in Autonomous Driving and Driver-Assistance Features. | **[9]** |
| **Control Systems and Actuation***<br>Fundamentals of Control Systems in Automated Vehicles, Actuators and Their Applications in Vehicle Control (E.G., Motors, Solenoids), Control Algorithms for Adaptive Cruise Control, Lane-Keeping Assist, and Other Driver-Assistance Systems, Integration of Control Systems With Perception and Decision-Making Modules. | **[9]** |
| **Autonomous Driving Technologies**<br>Levels of Autonomy in Self-Driving Vehicles (Level 3 To Level 5), Components and Architecture of Autonomous Driving Systems, Perception, Planning, and Decision-Making Algorithms for Autonomous Vehicles, Simulation and Testing Methodologies for Validating Autonomous Driving Capabilities. | **[9]** |
| **Connected Car Technology**<br>Connectivity Fundamentals, Navigation and Other Applications, Vehicle-To-Vehicle Technology and Applications, Vehicle-To-Roadside and Vehicle-To-Infrastructure Applications, Wireless Security Overview Connected Car Display Technology- Center Console Technology, Gauge Cluster Technology, Heads-Up Display Technology, Warning Technology-Driver Notification. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Markus Maurer, J. Christian Gerdes, Barbara Lenz, Hermann Winner, “Autonomous Driving: Technical”, Legal and Social Aspects, Springer,2016 |
| 2. | “Autonomous Vehicle Technology: A Guide for Policymakers" by James M. Anderson and Nidhi Kalra 2019. |

**Reference(s):**

| | |
|---|---|
| 1. | "Automotive Control Systems: For Engine, Driveline, and Vehicle" by Uwe Kiencke and Lars Nielsen,2018. |
| 2. | "Introduction to Autonomous Robots: Mechanisms, Sensors, Actuators, and Algorithms" by Nikolaus Correll et al., 2009 |
| 3. | Parr E.A. “Programmable Controllers an Engineer’s Guide”, Elsevier Publication, 3rd Edition, 2017. |
| 4. | Michael E. McGrath, Autonomous Vehicles: Opportunities, Strategies,and disruptions, 2016 |

*SDG: 4 – Quality Education

**SDG: 15 – Sustainable Cities and Communites

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Introduction to Automotive Automation** | |
| 1.1 | Overview of Automation Concepts in The Automotive Industry | 1 |
| 1.2 | Historical Evolution Milestones in Vehicle Automation | 2 |
| 1.3 | Milestones in Vehicle Automation | 1 |
| 1.4 | Levels of Automation | 2 |
| 1.5 | (SAE J3016) and Their Definitions | 1 |
| 1.6 | Benefits and Challenges of Integrating Automation In Automobiles | 2 |
| **2.0** | **Sensors and Perception Systems** | |
| 2.1 | Types of Sensors Used in Automated Vehicles | 1 |
| 2.2 | Lidar, Radar, | 1 |
| 2.3 | Cameras | 2 |
| 2.4 | Principles of Sensor Data Acquisition and Processing | 2 |
| 2.5 | Sensor Fusion Techniques for Enhanced Perception | 1 |
| 2.6 | Role Of Perception Systems in Autonomous Driving and Driver-Assistance Features | 2 |
| **3.0** | **Control Systems and Actuation** | |
| 3.1 | Fundamentals of Control Systems in Automated Vehicles | 2 |
| 3.2 | Actuators and Their Applications in Vehicle Control (E.G., Motors, Solenoids) | 2 |
| 3.3 | Control Algorithms for Adaptive Cruise Control, Lane-Keeping Assist, and Other Driver-Assistance Systems | 1 |
| 3.4 | Integration of Control Systems with Perception | 2 |
| 3.5 | Decision-Making Modules | 2 |
| **4.0** | **Autonomous Driving Technologies** | |
| 4.1 | Levels of Autonomy in Self-Driving Vehicles (Level 3 To Level 5) | 2 |
| 4.2 | Components And Architecture of Autonomous Driving Systems | 1 |
| 4.3 | Perception, Planning | 2 |
| 4.4 | Decision-Making Algorithms for Autonomous Vehicles | 1 |
| 4.5 | Simulation | 1 |
| 4.6 | Testing Methodologies for Validating Autonomous Driving Capabilities | 2 |
| **5.0** | **Connected Car Technology** | |
| 5.1 | Connectivity Fundamentals, | 1 |
| 5.2 | Navigation and Other Applications, | 2 |
| 5.3 | Vehicle-To-Vehicle Technology and Applications, | 2 |
| 5.4 | Vehicle-To-Roadside and Vehicle-To-Infrastructure Applications, | 1 |
| 5.5 | Wireless Security Overview Connected Car Display Technology- Center Console Technology | 2 |
| 5.6 | Gauge Cluster Technology, | 2 |

**Course Designer(s)**

Mr.R.Vivek -vivekr@ksrct.ac.in

| 60 AC 001 | Research Skill Development | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | AC | 1 | 0 | 0 | 0 |

## Objectives

- To identify research problems, formulate hypotheses, collect data and test hypotheses
- To prepare and submit quality manuscripts and understand peer review process
- To utilize software tools for effective manuscript preparation and visualization of research data
- To familiarize different journal metrics and author-level quality indicators
- To protect creative works, inventions, and branding elements using IPR

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Develop structured scientific approach to plan and execute research work | Apply |
| CO2 | Understand the journal requirements to publish research findings effectively | Understand |
| CO3 | Apply various software tools during the manuscript preparation | Apply |
| CO4 | Select suitable journals to publish the work using different publication metrics | Analyse |
| CO5 | Apply the appropriate form of IP protection to a specific invention or creation | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 2 | 2 | 2 | 2 | - | 2 | 2 | 3 | 3 | 3 | - | 3 | - | - |
| CO2 | - | - | - | - | - | - | - | 3 | 3 | 3 | - | 3 | - | - |
| CO3 | - | - | - | - | 3 | - | - | 3 | 3 | 3 | - | 3 | - | - |
| CO4 | - | - | - | - | - | - | - | 3 | 3 | - | - | 3 | - | - |
| CO5 | - | - | 2 | 2 | - | - | - | 3 | 3 | 3 | - | 3 | - | - |

3 - Strong; 2 - Medium; 1 – Some

## Assessment Pattern

One review at end of the semester

| Parameters | Weightage (Marks) |
|---|---|
| Research Problem Identification (Research gap, SDG, Objectives) | 10 |
| Literature Review preparation (Clarity, Number and quality of sources) | 20 |
| Patent Draft/ Manuscript Preparation (Structure, Content) | 20 |
| Use of software tools (Plagiarism, Reference Management, etc.,) | 10 |
| Journal Identification (Aim & scope of the journal, journal metrics) | 10 |
| Presentation & Viva voce | 30 |
| **Total** | **100** |



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**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 60 AC 001 – Research Skill Development | | | | | | | | |
| Semester | Hours/Week | | | Total Hours | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VII | 1 | 0 | 0 | 15 | 0 | 100 | - | 100 |

| | |
|---|---|
| **Research - Scientific Approach***<br>Types of Research - Identification and Clarification of the problem — Problem analysis - Formulating hypothesis, Selection of sample and tools of data collection - Testing the hypothesis - Conclusion | **[3]** |
| **Manuscript Preparation***<br>Structure of a Manuscript - Types of Manuscript - Graphical Abstract - Highlights - Literature Review - Citation - Reference Style - Plagiarism – Journal Selection - Peer review Process | **[3]** |
| **Research Toolkit***<br>Software Tools for Writing Enhancement - Literature Review - Reference Management - Data Analysis and Visualization - Drawing - Plagiarism | **[3]** |
| **Research Publication Metrics***<br>Journal Index: Scopus - Web of Science - SCI - UGC Care - Q Journal; Journal Metrics: Impact Factor, Cite Score; Quality Indicators: h-index - i-10 index - Citations | **[3]** |
| **Intellectual Property Rights***<br>Patents - Industrial Designs - Copyright - Trademarks - Geographical Indications - Trade Secrets | **[3]** |
| **Total Hours:** | **15** |

**Reference(s):**


| | |
|---|---|
| 1. | Kothari, C.R. and Gaurav Garg, “Research Methodology: Methods and Techniques”, New Age International Publishers, 2023 |
| 2. | Chawla H S., “Introduction to Intellectual Property Rights”, CBS Publishers and Distributors Private Limited, 2019 |


*SDG 9 – Industry Innovation and Infrastructure

## Course Contents and Lecture Schedule

| S. No. | Topics | No. of hours |
|---|---|---|
| **1** | **Research - Scientific Approach** | |
| 1.1 | Types of Research - Identification and Clarification of the problem – Problem analysis - Formulating hypothesis | 2 |
| 1.2 | Selection of sample and tools of data collection - Testing the hypothesis - Conclusion | 1 |
| **2** | **Manuscript Preparation-*** | |
| 2.1 | Structure of a manuscript - Types of manuscript - Graphical Abstract - Highlights | 1 |
| 2.2 | Literature Review | 1 |
| 2.3 | Citation - Reference style – Plagiarism, Journal Selection - Peer Review Process | 1 |
| **3** | **Research Toolkit** | |
| 3.1 | Software Tools for Writing enhancement | 1 |
| 3.2 | Literature review, Reference management | 1 |
| 3.3 | Data analysis and visualization – Drawing, Plagiarism | 1 |
| **4** | **Research Publication Metrics** | |
| 4.1 | Journal Index: Scopus - Web of Science - SCI - UGC Care - Q Journal; | 1 |
| 4.2 | Journal Metrics: Impact Factor, Cite | 1 |
| 4.3 | ScoreQuality Indicators: h-Index - i-10 Index - Citations | 1 |
| **5** | **Intellectual Property Rights** | |
| 5.1 | Patents | 1 |
| 5.2 | Industrial Designs - Copyright | 1 |
| 5.3 | Trademarks - Geographical Indications - Trade Secrets | 1 |

## Course Designer

Dr.M.Kathirselvam - mkathirselvam@ksrct.ac.in

| 60 AB 001 | NCC STUDIES (AIR WING) – I | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | AB | 2 | 0 | 2 | 3* |

## Objective

- To designed especially for NCC Cadets to educate basic military knowledge
- To develop character, camaraderie, discipline, secular outlook
- To inculcate spirit of adventure, sportsman spirit
- To teach selfless service amongst cadets by working in teams
- To learning military subjects including weapon training and motivate them to join in tri-services

## Pre requisite

Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Display sense of patriotism, secular values and shall be transformed into motivated youth who will carry out nation building through national unity and social cohesion | Remember |
| CO2 | Demonstrate the sense of discipline with smartness and have basic knowledge of weapons and their use and handling | Remember |
| CO3 | Illustrate various forces and moments acting on aircraft | Understand |
| CO4 | Outline the concepts of aircraft engine and rocket propulsion | Understand |
| CO5 | Design, build and fly chuck gliders/model airplanes and display static models | Create |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | - | - | - | - | - | 3 | 3 | 3 | 3 | 3 | - | - | - | - |
| CO2 | - | - | - | - | 3 | - | - | - | - | - | - | - | - | - |
| CO3 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 3 | 2 |
| CO4 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 3 | 2 |
| CO5 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 3 | 2 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **60 AB 001 - NCC STUDIES (AIR WING) – I** | | | | | | | | | |
| **Common to ALL Branches** | | | | | | | | | |
| Semester | Hours/Week | | | Total Hrs | Credit | Maximum Marks | | | |
| | L | T | P | | C | CA | ES | Total | |
| VII | 2 | 0 | 2 | 60 | 3* | 50 | 50 | 100 | |
| Objective(s) | • To designed especially for NCC Cadets<br>• To develop character, camaraderie, discipline, secular outlook<br>• To inculcate spirit of adventure, sportsman spirit<br>• To teach selfless service amongst cadets by working in teams<br>• To learning military subjects including weapon training and motivate them to join in tri-services | | | | | | | | |
| **Course Outcomes** | **At the end of the course, the student will be able to**<br>1. Display sense of patriotism, secular values and shall be transformed into motivated youth who will carry out nation building through national unity and social cohesion.<br>2. Demonstrate the sense of discipline with smartness and have basic knowledge of weapons and their use and handling<br>3. Illustrate various forces and moments acting on aircraft<br>4. Outline the concepts of aircraft engine and rocket propulsion<br>5. Design, build and fly chuck gliders/model airplanes and display static models. | | | | | | | | |

Note: The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **NCC Organisation and National Integration**<br>NCC Organization – History of NCC- NCC Organization- NCC Training- NCC Uniform – Promotion of NCC Cadets – Aim and Advantages of NCC Training- NCC Badges of Rank-Honors" and Awards – Incentives for NCC Cadets by Central and State govt. History and Organization of IAF- Indo-Pak War-1971- Operation Safed Sagar. National Integration- Unity in diversity- C ontribution of youth in Nation Building- National Integration Council- Images and Slogans on National Integration. | **[12]** |
| **Drill and Weapon Training**<br>Basic Physical Training- Various Exercises for Fitness (with Demonstration)- Food- Hygiene and Cleanliness. Drill- Words ofCommands- Position and Commands- Sizing and Forming- Saluting-Marching- Turning on the March and Wheeling- Saluting on the March- Side Pace, Pace forward and to the rear- Marking time- Drill with Arms- Ceremonial Drill- Guard Mounting.( WITHDEMONSTRATION) | **[12]** |
| **Principles of Flight**<br>Laws of Motion- Forces Acting on Aircraft- Bernoulli"s Theorem- Stalling-Primary Control Surfaces- Secondary Control Surfaces- Aircraft Recognition. | **[12]** |
| **Aero Engines**<br>Introduction of Aero Engine- Types of Engine- Piston Engine- Jet Engines- Turboprop Engines-Basic Flight Instruments- Modern Trends. | **[12]** |
| **Aero Modeling**<br>History of Aero Modeling- Materials used in Aero Modeling- Types of Aero Models – Static Models- Gliders-Control line Models- Radio Control Models- Building and Flying of Aero Models. | **[12]** |
| **Total Hours** | **60** |

**Text Books:**

| | |
|---|---|
| 1. | "National Cadet Corps- A Concise handbook of NCC Cadets", Ramesh Publishing House, New Delhi, 2014. |

**Reference(s):**

| | |
|---|---|
| 1. | "Cadets Handbook – Common Subjects SD/SW", published by DG NCC, New Delhi. |
| 2. | "Cadets Handbook- Specialized Subjects SD/SW", published by DG NCC, New Delhi. |
| 3. | "NCC OTA Precise",published by DG NCC, New Delhi. |

| ASSESSMENT PATTERN - THEORY | | | | | |
|---|---|---|---|---|---|
| **Test / Bloom’sCategory*** | **Knowledge (K1) %** | **Apply (K2) %** | **Analyzing(K3) %** | **Creating(K4) %** | **Total %** |
| CAT1 | - | - | - | - | - |
| CAT2 | - | - | - | - | - |
| CAT3 | - | - | - | - | - |
| ESE | The examination and award of marks will be done by the Ministry of Defence, Government of India which includes all K1 to K4 knowledge levels. The maximum marks for the End Semester Examination is 500 marks. It will be converted to 100 marks. | | | | |

## Course Designers

1. Flt Lt V.R.SADASIVAM - sadasivam@ksrct.ac.in

w.e.f.25/05/2024
Passed in the BoS Meeting Held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

CHAIRMAN
Board Of Studies/
Mechatronics Engineering

| 60 AB 002 | National Cadet Corps (Army Wing) | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | HS | 2 | 0 | 2 | 3* |

## Objective

- Develop character, camaraderie
- Inculcate discipline, secular outlook
- Enrich the spirit of adventure, sportsman spirit
- Ideals of selfless service amongst cadets by working in teams
- Improve qualities such as self-discipline, self-confidence, self-reliance and dignity of labour in the cadets

## Prerequisite

NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Display sense of patriotism, secular values and shall be transformed into motivated youth who will carry out nation building through national unity and social cohesion. | Apply |
| CO2 | Demonstrate Health Exercises, the sense of discipline, improve bearing, smartness, turn out, develop the quality of immediate and implicit obedience of orders. | Apply |
| CO3 | Basic knowledge of weapons and their use and handling. | Understand |
| CO4 | Aware about social evils and shall inculcate sense of whistle blowing against such evils and ways to eradicate such evils | Analyse |
| CO5 | Acquaint, expose & provide knowledge about Army/Navy/ Air force and to acquire information about expansion of Armed Forces, service subjects and important battles | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | - | - | - | - | - | 1 | - | 3 | - | - | - | - | - | - |
| CO2 | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - |
| CO3 | - | - | - | - | - | 1 | - | 3 | - | - | - | - | - | - |
| CO4 | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - |
| CO5 | - | - | - | - | - | - | - | 3 | - | - | - | - | - | - |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

<table>
<tr><td colspan="9">K. S. Rangasamy College of Technology – Autonomous R2022</td></tr>
<tr><td colspan="9">60 AB 002 – National Cadet Corps (Army Wing)</td></tr>
<tr><td colspan="9">Common to all Branches</td></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td rowspan="2">Total hrs</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>VII</td><td>2</td><td>0</td><td>2</td><td>60</td><td>3*</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="8">NCC Organization & National Integration<br>NCC Organization — History of NCC- NCC Organization- NCC Training- NCC Uniform — Promotion of NCC Cadets — Aim and Advantages of NCC Training- NCC Badges of Rank- Honors' and Awards – Incentives for NCC Cadets by Central and State Govt. National Integration<br>- Unity in Diversity- Contribution of Youth in Nation Building- National Integration Council- Images and Slogans on National Integration.</td><td>[12]</td></tr>
<tr><td colspan="8">Basic Physical Training & Drill<br>Basic Physical Training – Various Exercises for Fitness (with Demonstration) -Food – Hygiene and Cleanliness. Drill- Words of Commands- Position and Commands- Sizing and Forming- Saluting- Marching- Turning on the March and Wheeling- Saluting on the March- Side Pace, Pace Forward and to the Rear- Marking Time- Drill with Arms- Ceremonial Drill- Guard Mounting. (WITH DEMONSTRATION)</td><td>[16]</td></tr>
<tr><td colspan="8">Weapon Training Main Parts of a Rifle<br>Characteristics of .303 rifle- Characteristics of .22 Rifle- loading and unloading – position and Holding, Safety Precautions – Range Procedure- MPI and Elevation- Group and Snap Shooting- Long/Short Range Firing (WITH PRACTICE SESSION) - Characteristics of 5.56mm Rifle- Characteristics of 7.62mm SLR- LMG- Carbine Machine Gun – Pistol.</td><td>[12]</td></tr>
<tr><td colspan="8">Social Awareness and Community Development<br>Aims of Social Service-Various Means and Ways of Social Services- Family Planning – HIV and AIDS- Cancer its Causes and Preventive Measures- NGO and their Activities- Drug Trafficking- Rural Development Program - MGNREGA-SGSYJGSY-NSAP-PMGSY-Terrorism and Counter Terrorism- Corruption – Female Foeticide -Dowry –Child Abuse-RTI Act- RTE Act- Protection of Children from Sexual Offences Act- Civic Sense and Responsibility</td><td>[12]</td></tr>
<tr><td colspan="8">Specialized Subject (ARMY)<br>Basic Structure of Armed Forces- Military History – War Heroes- battles of Indo-Pak War- Param Vir Chakra- Career in the Defence Forces- Service Tests and Interviews.</td><td>[08]</td></tr>
<tr><td colspan="8">Total Hours</td><td>60</td></tr>
<tr><td colspan="9">Text Book(s):</td></tr>
<tr><td>1.</td><td colspan="8">National Cadet Corps- A Concise handbook of NCC Cadets by Ramesh Publishing House, New Delhi, 2014</td></tr>
<tr><td>2</td><td colspan="8">Cadets Handbook- Specialized Subjects SD/SW published by DG NCC, New Delhi, 2014</td></tr>
<tr><td colspan="9">Reference(s):</td></tr>
<tr><td>1.</td><td colspan="8">"Cadets Handbook – Common Subjects SD/SW" by DG NCC, New Delhi, 2019.</td></tr>
<tr><td>2.</td><td colspan="8">"Cadets Handbook – Specialised Subjects SD/SW" by DG NCC, New Delhi, 2017.</td></tr>
</table>

## Course Contents and Lecture Schedule

| S.No | Topic | No. of Hours |
|---|---|---|
| **1** | **NCC Organization & National Integration** | |
| 1.1 | NCC Organization | 1 |
| 1.2 | History of NCC and NCC Organization | 1 |
| 1.3 | NCC Training and NCC Uniform | 1 |
| 1.4 | Promotion of NCC cadet, Aim and advantages of NCC Training | 1 |
| 1.5 | NCC badges of Rank, Honors' and Awards, Incentives for NCC cadets by central and state govt | 2 |
| 1.6 | National Integration, Unity in diversity | 1 |
| 1.7 | Contribution of youth in nation building | 2 |
| 1.8 | National integration council | 1 |
| 1.9 | Images and Slogans on National Integration | 2 |
| **2** | **Basic Physical Training & Drill** | |
| 2.1 | Basic physical Training – Various Exercises for Fitness ( with Demonstration)- | 3 |
| 2.2 | Food – Hygiene and Cleanliness . | 1 |
| 2.3 | Drill- Words of commands- position and commands- Sizing and Forming- | 3 |
| 2.4 | Saluting- Marching- Turning on the march and wheeling- | 3 |
| 2.5 | Saluting on the march- Side pace, pace forward and to the rear- Marking time- | 3 |
| 2.6 | Drill with Arms- Ceremonial Drill- Guard Mounting.( WITH DEMONSTRATION) | 3 |
| 3 | **Weapon Training Main Parts of a Rifle** | |
| 3.1 | Characteristics of .303 rifle | 1 |
| 3.2 | Characteristics of .22 rifle | 2 |
| 3.3 | Loading and unloading, position and holding safety precautions | 2 |
| 3.4 | Range procedure, MPI and Elevation- | 2 |
| 3.5 | Group and Snap shooting Long/Short range firing (WITH PRACTICE SESSION) | 3 |
| 3.6 | Characteristics of 5.56 mm rifle | 1 |
| 3.7 | Characteristics of 7.62mm | 1 |
| **4** | **Social Awareness and Community Development** | |
| 4.1 | Aims of Social service, Various Means and ways of social services | 1 |
| 4.2 | Family planning , HIV and AIDS | 1 |
| 4.3 | Cancer its causes and preventive measures | 1 |
| 4.4 | NGO and their activities, Drug trafficking | 1 |
| 4.5 | Rural development programmes | 1 |
| 4.6 | MGNREGA, SGSY, JGSY, NSAP, PMGSY | 2 |
| 4.7 | Terrorism and counter terrorism, Corruption | 1 |
| 4.8 | Female foeticide, dowry, child abuse | 1 |
| 4.9 | RTI Act, RTE Act | 1 |
| 4.10 | Protection of children from sexual offences act | 1 |
| 4.11 | Civic sense and responsibility | 1 |
| 5 | **Specialized Subject (ARMY)** | |
| 5.1 | Basic structure of Armed Forces | 1 |
| 5.2 | Military History, War heroes | 1 |
| 5.3 | Battles of Indo - Pak war | 1 |
| 5.4 | Param Vir Chakra, | 1 |
| 5.5 | Career in the Defence forces | 2 |
| 5.6 | Service tests and interviews. | 2 |
| | **Total** | 60 |

## Course Designers

Mr.E.Chandra Kumar - chandrakumar@ksrct.ac.in

| 60 MC 7P1 | Embedded System Laboratory | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 0 | 0 | 4 | 2 |

## Objectives

- Understand the programming concepts of Embedded Systems.
- Using Embedded C / Assembly Language using Keil IDE or Equivalent. Learn the working of Arm architecture in Atmel processor.
- To explore a basic knowledge of AT89X51ED2 Development board.
- To train the students for creating embedded control process for variety of applications.
- To conduct advanced fundamental and applied research in embedded systems

## Pre-requisites

- Microprocessors and Microcontrollers.

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Acquire the knowledge of basics of embedded system and Perform arithmetic operations in an embedded system with a combination of C and assemble language. | Apply |
| CO2 | Test the serial data communication of internal UART using Atmel processor. | Apply |
| CO3 | Demonstrate the dual slope ADC and 8 channel 12-bit ADC using Atmel processor. | Apply |
| CO4 | Demonstrate the concept of 7 segment display and real time clock. | Apply |
| CO5 | Interface the traffic light signal, stepper motor and position control of DC motor using ARM processor. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | 1 | 3 | - | - | 2 | - | 3 | - | - | 3 | 2 |
| CO2 | 3 | 2 | 3 | 3 | 3 | 1 | - | 2 | 1 | 3 | - | 2 | 3 | 3 |
| CO3 | 3 | 3 | 2 | - | 3 | 2 | - | 2 | 2 | 3 | - | 2 | 3 | 3 |
| CO4 | 3 | 2 | 3 | 3 | 3 | - | - | 2 | - | 3 | 2 | - | 2 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | - | - | 2 | - | 3 | - | - | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Lab Experiments Assessment (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | Lab | Activity | | |
| Remember | - | - | - | - |
| Understand | 25 | - | 50 | 50 |
| Apply | 25 | 25 | 50 | 50 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 50 | 25 | 100 | 100 |

w.e.f.25/05/2024
Passed in the BoS Meeting Held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

CHAIRMAN
Board Of Studies/
Mechatronics Engineering

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| B.E – Mechatronics Engineering | | | | | | | | |
| 60 MC 7P1 - Embedded System Laboratory | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| **VII** | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |

**List of Experiments:**

1. Real Time Operating System Solutions with KEIL Tools – Introduction
2. Program to Perform Arithmetic, Logical and Boolean Operations Using KEIL IDE.
3. Program to Perform Search and Replacement a Number Using KEIL IDE.
4. Program to Transmit a Message from Microcontroller to PC Serially Using UART Communication
5. Program to Check the Status of PORT1 (8051) Signal Using LEDS.
6. Interfacing and Programming of 8 Channel 12 Bit ADC
7. Interfacing and Programming of Dual Slope ADC
8. Interfacing and Programming of Seven Segment Display
9. Interfacing Real Time Clock and Serial Port
10. Program to Interface Traffic Light Controller
11. Program to Interface Stepper Motor to Rotate the Motor in Clockwise and Anticlockwise Directions
12. DC Motor Speed and Position Control Using ARM Processor
13. Mini Project – Application Using Arduino.* Open Ended Experiments**

1. Develop a Complex Embedded Systems Project Such as a Home Automation System, A Robotics Application, or an IOT Device.
2. Focus on Integrating Multiple Modules, Designing a User Interface, and Handling Different System

**Lab Manual**

| | |
|---|---|
| **1.** | "Embedded System Lab Manual", Department of Mechatronics Engineering, KSRCT. |

*SDG 3 – Good Health and Well Being
**SDG 7 – Affordable and Clean Energy

**Course Designer(s)**

Mr.T.Prabhu - prabhut@ksrct.ac.in

| 60 MC 7P2 | Robotics and Machine Vision Laboratory | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 0 | 0 | 4 | 2 |

## Objectives

- To introduce different types of robotics and demonstrate them to identify different parts and components
- To write programming for simple operations.
- The students will learn to design, build, program, control robotic devices and think of ways in machine vision system.
- To educate recent robotics concepts.
- To conduct advanced fundamental and applied research in robotics

## Pre-requisites

- Sensors and Instrumentation, System Design and Control

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Describe the different types of links, drives, joints and end effectors used in robots. | Remember |
| CO2 | Analyze the Signal conversion of sensing and digitizing the images using sampling and quantization | Apply |
| CO3 | Analyze the Threshold, connectivity, noise reduction and edge detection of theimage. | Apply |
| CO4 | Inspect the color to differentiate the components while doing the pick and place operation of the desired components. | Apply |
| CO5 | Develop the various methods of inspection and maintenance. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | - | - | 3 | - | - | - | - | - | - | - | 3 | 2 |
| CO2 | 2 | 2 | - | - | 3 | - | - | - | - | - | - | - | 2 | 3 |
| CO3 | 2 | 3 | - | - | 3 | - | - | 2 | - | - | - | - | 2 | 3 |
| CO4 | 3 | 2 | 2 | 2 | 3 | - | 3 | 2 | - | 3 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | - | 2 | 2 | 3 | 2 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Lab Experiments Assessment (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | Lab | Activity | | |
| Remember | 25 | 13 | - | 50 |
| Understand | - | - | - | - |
| Apply | 25 | 12 | 50 | 50 |
| Analyse | - | - | 50 | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 50 | 25 | 100 | 100 |

| Syllabus | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
| B.E – Mechatronics Engineering | | | | | | | | |
| 60 MC 7P2 – Robotics and Machine Vision Laboratory | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| **VII** | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |

**List of Experiments:**

1. Study of Different Types of Links and Joints Used in Robots, Components of Robots With Drive System and End Effectors, Classification of Robots Based on Configuration and Application.
2. Program for Loading and Unloading Operations on 6 Dof Articulated Robot
3. Simulate the Robot Motion for Various Inputs of the Joint Angular Value for Move Master CR3 Dobot Robotic Arm.
4. Robot Programming Exercises (Point-To-Point and Continuous Path Programming)
5. Robot Programming and Simulation for Pick and Place.
6. Robot Programming and Simulation for Colour Identification.
7. Robot Programming and Simulation for Shape Identification.
8. Robot Programming and Simulation for Any Industrial Process (Packaging, Assembly).
9. Depth and Volume Analysis of the Component in Feature Extraction Techniques to Pick the Component.
10. Template Matching Such as Pattern Matching and Geometric Matching Exercises for the Component Recognition to Pick the Component Using Grippers.

**Design Experiments:**

1. Develop an Object Detection and Graspiing System Using a Robotic Arm and a Camera
2. Design Autonomous Line Following Robot Using IR Sensors.

| Lab Manual | |
|---|---|
| 1. | "Robotics and Machine Vision Lab Manual", Department of Mechatronics Engineering, KSRCT. |
| *SDG 7 – Affordable and Clean Energy | |

**Course Designer(s)**

Dr.M.Ravi-ravi@ksrct.ac.in

| 60 MC 7P3 | Project Work - Phase I | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 0 | 0 | 4 | 2 |

**Objectives**

- To apply the knowledge / concepts acquired in the Previous semesters to create / design / implement project relevant to the field of Electrical / Electronics / Robotics / Automation / IoT / Electric Vehicle / Mechanical domains.
- To acquire collaborative skills through working in a team to achieve common goals.
- To search for related area in which the students are going to do their project.
- To identify suitable project work, acquiring knowledge on that area, making preliminary works towards project phase II.
- To acquire the skills to communicate effectively and to present ideas clearly and coherently to a specific audience in both the written and oral forms.

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Survey the literature and market for availability of resources | Analyse |
| CO2 | Select the title and collect relevant information related with selected title. | Analyse |
| CO3 | Collect the literature based on survey and do the partially design of the system. | Analyse |
| CO4 | Carryout partial design of the system | Analyse |
| CO5 | Prepare and present the project report | Analyse |

**Mapping with Programme Outcomes**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 2 | 2 | - | - | - | 3 | 3 | - | 3 | 2 | 2 | 2 | 2 | 1 |
| CO2 | 2 | 3 | - | - | - | 3 | 3 | - | 3 | 2 | 2 | 1 | 2 | - |
| CO3 | 2 | 2 | 3 | 1 | - | 3 | 3 | - | 3 | 2 | - | 1 | 3 | 2 |
| CO4 | 3 | 3 | 1 | 3 | 2 | 3 | 3 | - | 3 | 2 | - | 1 | 1 | 2 |
| CO5 | 3 | 3 | 1 | - | 2 | 3 | 3 | - | 3 | 2 | 2 | 2 | - | 2 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| B.E – Mechatronics Engineering | | | | | | | | |
| 60 MC 7P3 – Project Work - Phase I | | | | | | | | |
| Semester | Hours/Week | | | Total Hours | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VII | 0 | 0 | 4 | 60 | 2 | 100 | 0 | 100 |

**Methodology**

- Three reviews have to be conducted by the committee of minimum of three members oneof which must be the guide.
- Problem should be selected.
- Students have to collect around 25 papers related to their work.
- Report has to be prepared by the students as per the format available in CTCMS
- Preliminary implementation can be done if possible.
- Evaluation has to be done for 100 marks.



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**Project Work - Phase I**
**(Internal Assessment: 100 Marks)**

| Review I (R1) | | | Review II (R2) | | Review III (R3) | | | Total (R1+R2+R3) | Internal |
|---|---|---|---|---|---|---|---|---|---|
| Literature Survey | Topic Identification & Justification | Work Plan | Approach | Conclusion | Demo-Existing System | Presentation | Report | Total | |
| 10 | 10 | 10 | 20 | 20 | 10 | 10 | 10 | 100 | 100 |

**K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215**
(An Autonomous Institution affiliated to Anna University)
B.E. / B.Tech. Degree Programme
**SCHEME OF EXAMINATIONS**
(For the candidates admitted in 2022 –2023)

EIGHTH SEMESTER

| S. No. | Course Code | Name of the Course | Duration of Internal Exam | Weightage of Marks | | | Minimum Marks for Pass in End Semester Exam | |
|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment* | End Semester Exam** | Max. Marks | End Semester Exam | Total |
| **THEORY** | | | | | | | | |
| 1 | 60 MC E5* | Professional Elective-V | 2 | 40 | 60 | 100 | 45 | 100 |
| **PRACTICAL** | | | | | | | | |
| 2 | 60 MC 8P1 | Project Work – Phase - II | 3 | 60 | 40 | 100 | 45 | 100 |
| 3 | 60 CG 0P6 | Internship | - | 100 | - | 100 | - | 100 |

*** CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.**

**** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for Theory End Semester Examination and 40 marks for Project End Semester Examination.**

w.e.f.25/05/2024
Passed in the BoS Meeting Held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

CHAIRMAN
Board Of Studies/
Mechatronics Engineering

| 60 MC 8P1 | Project Work - Phase II | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 0 | 0 | 16 | 8 |

**Objectives**

- To enable the students in convenient groups of not more than 3 members on a projectinvolving theoretical and experimental studies related to the branch of study.
- To have guidance for every project team, by the faculty member of the concerneddepartment.
- To receive the directions from the guide, on library reading, laboratory work, computeranalysis or field work as assigned by the guide.
- To present in periodical seminars on the progress made in the project
- To produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Make links across different areas of knowledge and to generate, develop and evaluateideas and information | Create |
| CO2 | Apply these skills to the project | Create |
| CO3 | Design the project work. | Create |
| CO4 | Model and fabricate the project work | Create |
| CO5 | Prepare and present the project work along with report | Create |

**Mapping with Programme Outcomes**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 2 | 2 | - | - | - | 3 | 3 | - | 3 | 2 | 2 | 2 | 2 | 1 |
| CO2 | 2 | 3 | - | - | - | 3 | 3 | - | 3 | 2 | 2 | 1 | 2 | - |
| CO3 | 2 | 2 | 3 | 1 | - | 3 | 3 | - | 3 | 2 | - | 1 | 3 | 2 |
| CO4 | 3 | 3 | 1 | 3 | 2 | 3 | 3 | - | 3 | 2 | - | 1 | 1 | 2 |
| CO5 | 3 | 3 | 1 | - | 2 | 3 | 3 | - | 3 | 2 | 2 | 2 | - | 2 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| B.E – Mechatronics Engineering | | | | | | | | |
| 60 MC 8P1– Project Work - Phase II | | | | | | | | |
| Semester | Hours/Week | | | Total Hours | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VIII | 0 | 0 | 16 | 240 | 8 | 60 | 40 | 100 |

**Methodology**

- Three reviews have to be conducted by the committee of minimum of three members oneof which should be their project guide.
- Progress of project has to be monitored by the project guide and committee regularly.
- Each review has to be evaluated for 100 marks.
- Attendance is compulsory for all reviews. If a student fails to attend review for some valid reasons, one more chance may be given.
- Final review will be carried out by the committee that consists of minimum of three members one of which should be their project guide (if possible include one externalexpert examiner within the college).
- The project report should be submitted by the students around at the first week of April.

**Project Work - Phase II**
**(Internal Assessment: 60 Marks + End Semester Examination: 40 Marks)**

| Internal Assessment (60) | | | | | End Semester (40) |
|---|---|---|---|---|---|
| Items | Review 1 | Review 2 | Review 3 | Publication | |
| Marks | 5 | 10 | 15 | 30 | 40 |
| | Total Internal Marks 60 | | | | |



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Board Of Studies/
Mechatronics Engineering

| 60 MC E11 | Mobile Robotics | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

## Objectives

- To broaden the importance of Robot Locomotion
- To learn the knowledge of mobile Robot kinematics and dynamics
- To broaden the importance of GPS and sensors
- To enhance the knowledge about Localization, Planning and Navigation
- To make the student design, fabricate, motion planning, and control of intelligent mobile robotic systems.

## Pre-requisites

- Robotics Engineering

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Discuss about the Robot Locomotion. | Apply |
| CO2 | Differentiate the Kinematics and the Dynamics of Mobile Robots | Apply |
| CO3 | Illustrate the Sensors and GPS. | Understand |
| CO4 | Apply the Localization and Planning of Robots | Apply |
| CO5 | Summarize the knowledge on Navigation | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 3 |
| CO2 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 1 | 2 | 3 | 3 | 1 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 2 |
| CO4 | 2 | 2 | 3 | 3 | 1 | 2 | 1 | 2 | 3 | 1 | 2 | 1 | 2 | 2 |
| CO5 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 3 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 20 | 20 | 30 |
| Understand | 20 | 20 | 40 |
| Apply | 20 | 20 | 30 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC E11 - Mobile Robotics** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| V | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Robot Locomotion***<br>Types of Locomotion, Hopping Robots, Legged Robots, Wheeled Robots, Stability, Maneuverability, Controllability. | **[9]** |
| **Mobile Robot kinematics and dynamics****<br>Forward and Inverse Kinematics - Holonomic and Non-Holonomic Constraints - Kinematic Models of Simple Car and Legged Robots - Dynamics Simulation of Mobile Robots. | **[9]** |
| **Perception****<br>Proprioceptive / Exteroceptive and Passive/Active Sensors, Performance Measures of Sensors, Sensors for Mobile Robots Like Global Positioning System (GPS), Doppler Effect-Based Sensors, Vision-Based Sensors, Uncertainty in Sensing, Filtering. | **[9]** |
| **Localization***<br>Odometric Position Estimation, Belief Representation, Probabilistic Mapping, Markov Localization, Bayesian Localization, Kalman Localization, Positioning Beacon Systems. | **[9]** |
| **Introduction to Planning and Navigation***<br>Path Planning Algorithms Based on A-Star, Dijkstra, Voronoi Diagrams, Probabilistic Roadmaps (PRM), Rapidly Exploring Random Trees (RRT), Markov Decision Processes (MDP), Stochastic Dynamic Programming (SDP). | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Siegwart R,Nourbakhsh I R,"Introduction to Autonomous Mobile Robots", The MIT Press,2017. |
| 2. | Peter Corke, Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Springer Tracts in Advanced Robotics,2018. |

**Reference(s):**

| | |
|---|---|
| 1. | LaValle S M,"Planning Algorithms',Cambridge University Press,2016.(Available online http://planning.cs.uiuc.edu/) |
| 2. | Thrun,S.,Burgard,W.,and Fox,D.,Probabilistic Robotics.MIT Press, Cambridge, MA, 2017.. |
| 3. | Melgar, E.R., Diez,C.C., Arduino and Kinect Projects: Design,Build, BlowTheir Minds, 2016. |
| 4. | H.Choset,K.M.Lynch,S.Hutchinson,G.Kantor,W.Burgard,L.E.Kavraki,andS.Thrun, Principles of Robot Motion: Theory, Algorithms and Implementations, PHILtd., 2017. |

*SDG 9 – Industry Innovation and Infrastructure

**SDG 4 – Quality Education



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Board Of Studies/
Mechatronics Engineering

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Types of Locomotion** | |
| 1.1 | Hopping Robots | 1 |
| 1.2 | Legged Robots | 2 |
| 1.3 | Wheeled Robots | 2 |
| 1.4 | Stability, Maneuverability | 2 |
| 1.5 | Controllability | 2 |
| **2.0** | **Mobile Robot kinematics and Dynamics** | |
| 2.1 | Forward and Inverse kinematics | 3 |
| 2.2 | Holonomic and No Holonomic Constraints | 2 |
| 2.3 | Kinematic Models of Simple Car and Legged Robots | 2 |
| 2.4 | Dynamics Simulation of Mobile Robots | 2 |
| **3.0** | **Perception** | |
| 3.1 | Proprioceptive/ Exteroceptive and Passive/Active Sensors | 2 |
| 3.2 | Performance Measures of Sensors | 1 |
| 3.3 | Sensors for Mobile Robots like Global Positioning System (GPS) | 2 |
| 3.4 | Doppler Effect-Based Sensors | 1 |
| 3.5 | Doppler Effect-Based Sensors, Vision-Based Sensors | 2 |
| 3.6 | Uncertainty in Sensing, Filtering | 1 |
| **4.0** | **Localization** | |
| 4.1 | Odometric Position Estimation | 2 |
| 4.2 | Belief Representation | 2 |
| 4.3 | Probabilistic Mapping | 1 |
| 4.4 | Markov Localization, Bayesian Localization | 2 |
| 4.5 | Kalman Localization, Positioning Beacon Systems. | 2 |
| **5.0** | **Introduction to Planning and Navigation** | |
| 5.1 | Path Planning Algorithms Based on A-Star | 1 |
| 5.2 | Dijkstra, Voronoi Diagrams | 2 |
| 5.3 | Probabilistic Roadmaps (PRM) | 2 |
| 5.4 | Rapidly Exploring Random Trees (RRT), Markov Decision Processes (MDP) | 2 |
| 5.5 | Stochastic Dynamic Programming (SDP). | 2 |

**Course Designer(s)**

Dr.M.Ravi - ravi@ksrct.ac.in

| 60 MC E12 | Electric Vehicle | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To understand the concept of electric vehicles.
- To study about the motors & drives for electric vehicles.
- To understand the concept of BMS.
- To understand the concept of hybrid vehicles.
- To study about fuel cell for electric vehicles.

## Pre-requisites

- Thermal Engineering

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand about working principle of electric vehicles. | Understand |
| CO2 | Understand the construction and working principle of various motors used in electric vehicles. | Understand |
| CO3 | Understand about working principle of BMS | Understand |
| CO4 | Understand the different types and working principle of hybrid vehicles. | Understand |
| CO5 | Understand the various types and working principle of fuel cells. | Understand |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 2 | 3 | 2 | 2 | - | 2 | - | - | - | - | 2 | 1 | 2 | - |
| CO2 | 3 | 3 | 3 | 2 | - | - | - | 3 | - | - | 2 | 2 | 2 | 2 |
| CO3 | 3 | 3 | 2 | 3 | - | 2 | - | - | - | 3 | 1 | 2 | 2 | 3 |
| CO4 | 2 | 2 | - | 2 | 3 | - | - | 2 | - | - | 2 | 3 | - | 2 |
| CO5 | 2 | 2 | 2 | 3 | 2 | - | - | - | - | - | 3 | 3 | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 30 | 35 | 40 |
| Understand | 30 | 25 | 60 |
| Apply | - | - | - |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

w.e.f.23/12/2023
Passed in the BoS Meeting Held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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Board Of Studies/
Mechatronics Engineering

**Syllabus**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC E12 - Electric Vehicle** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| V | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to Electric Vehicles***<br>Electric Vehicle –Cost and Emissions – Electric Vehicle Technology – Layouts, Cables, Components, Controls. Batteries – Overview and its Types. Battery Plug-in and Life. Ultra-Capacitor, Charging – Methods and Standards. Alternate Charging Sources – Wireless & Solar. | **[9]** |
| **Electric Vehicle Motors***<br>Motors (DC, Induction, BLDC) – Types, Principle, Construction, Control. Electric Drive Trains (EDT) – Series HEDT (Electrical Coupling) – Power Rating Design, Peak Power Source (PPS); Parallel HEDT (Mechanical Coupling) – Torque Coupling and Speed Coupling – Switched Reluctance Motors (SRM) Drives | **[9]** |
| **Battery Management System (BMS)***<br>Need of BMS, BMS Topology-BMS Controller and BMS Communication System-Cell balancing-State of Charge (SoC), State of Health (SoH), Rule Based Control and Optimization-Based Control, Software-Based High-Level Supervisory Control. | **[9]** |
| **Hybrid Vehicles***<br>Hybrid Electric Vehicles – Classification – Micro, Mild, Full, Plug-in, EV. Layout and Architecture – Series, Parallel and Series-Parallel Hybrid, Propulsion Systems and Components. Regenerative Braking, Economy, Vibration and Noise Reduction. Hybrid Electric Vehicles System – Analysis and its Types, Controls. | **[9]** |
| **Fuel Cells for Electric Vehicles****<br>Fuel Cell – Introduction, Technologies & Types, Obstacles. Operation Principles, Potential and I-V Curve, Fuel and Oxidation Consumption, Fuel Cell Characteristics – Efficiency, Durability, Specific Power, Factors Affecting, Power Design of Fuel Cell Vehicle and Freeze Capacity. Lifetime Cost of Fuel Cell Vehicle – System, Components, Maintenance. | **[9]** |
| **Total Hours:** | **45** |

| | |
|---|---|
| **Text Book(s):** | |
| 1. | Electric and Hybrid Vehicles, Tom Denton, Taylor & Francis, 2020. |
| 2. | Electric and Hybrid Vehicles Power Sources, Models, Sustainability, Infrastructure and the Market Gianfranco Pistoia Consultant, Rome, Italy, Elsevier Publications, 2019. |
| **Reference(s):** | |
| 1. | Hybrid Electric Vehicles – Teresa Donateo, Published by ExLi4EvA, 2017. |
| 2. | Hybrid Electric Vehicle System Modeling and Control - Wei Liu, General Motors, USA, John Wiley & Sons, Inc., 2017 |
| 3. | Jack Erjavec and Jeff Arias, “Alternative Fuel Technology – Electric, Hybrid and Fuel Cell Vehicles”, Cengage Learning Pvt. Ltd., New Delhi, 2017 |
| 4. | Jack Erjavec and Jeff Arias, “Hybrid, Electric and Fuel Cell Vehicles”, Cengage Learning, 2012. |

*SDG 9 – Industry Innovation and Infrastructure
**SDG 7 – Affordable and Clean Energy

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Introduction to Electric Vehicles** | |
| 1.1 | Electric Vehicle | 1 |
| 1.2 | Cost and Emissions | 1 |
| 1.3 | Electric Vehicle Technology | 1 |
| 1.4 | Layouts, Cables, Components, Controls | 1 |
| 1.5 | Batteries | 1 |
| 1.6 | Overview and its Types | 1 |
| 1.7 | Battery Plug-in and Life | 1 |
| 1.8 | Ultra-Capacitor, Charging | 1 |
| 1.9 | Methods and Standards. | 1 |
| 1.10 | Alternate Charging Sources – Wireless & Solar. | 1 |
| **2.0** | **Electric Vehicle Motors** | |
| 2.1 | Motors (DC, Induction, BLDC) | 2 |
| 2.2 | Types, Principle, Construction, Control | 1 |
| 2.3 | Electric Drive Trains (EDT) | 1 |
| 2.4 | Series HEDT (Electrical Coupling) | 1 |
| 2.5 | Power Rating Design, Peak Power Source (PPS) | 1 |
| 2.6 | Parallel HEDT (Mechanical Coupling) | 1 |
| 2.7 | Torque Coupling and Speed Coupling. | 1 |
| 2.8 | Switched Reluctance Motors (SRM) Drives | 1 |
| **3.0** | **Battery Management System** | |
| 3.1 | Need of BMS, BMS Topology | 2 |
| 3.2 | BMS Controller and BMS Communication system | 2 |
| 3.3 | Cell Balancing | 1 |
| 3.4 | State of Charge (SoC), State of Health (SoH) | 1 |
| 3.5 | Rule Based Control and Optimization-Based Control | 2 |
| 3.6 | Software-Based High-Level Supervisory Control. | 1 |
| **4.0** | **Hybrid Vehicles** | |
| 4.1 | Hybrid Electric Vehicles | 1 |
| 4.2 | Classification – Micro, Mild, Full, Plug-in, EV | 1 |
| 4.3 | Layout and Architecture | 1 |
| 4.4 | Series, Parallel and Series-Parallel Hybrid | 1 |
| 4.5 | Propulsion Systems and Components | 2 |
| 4.6 | Regenerative Braking, Economy, Vibration and Noise Reduction | 1 |
| 4.7 | Hybrid Electric Vehicles System | 1 |
| 4.8 | Analysis and its Types, Controls. | 1 |
| **5.0** | **Fuel Cells for Electric Vehicles** | |
| 5.1 | Fuel Cell | 1 |
| 5.2 | Introduction, Technologies & Types | 2 |
| 5.3 | Fuel and Oxidation Consumption, Fuel Cell Characteristics | 1 |
| 5.4 | Efficiency, Durability, Specific Power | 1 |
| 5.5 | Factors Affecting, Power Design of Fuel Cell Vehicle and Freeze Capacity | 2 |
| 5.6 | Lifetime Cost of Fuel Cell Vehicle | 1 |
| 5.7 | System, Components, Maintenance. | 1 |

**Course Designer(s)**

Mr.S.HariPrasadh -hariprasadh@ksrct.ac.in

| 60 MC E13 | Aircraft Mechatronics | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To familiarize the basic concept on Aircraft Aerodynamics
- To facilitate the various types of aircraft propulsion and their uses
- To gain knowledge on navigation and guidance system of aircraft
- To provide exposure on the functions of various primary flight controls
- To familiarize the use of various applications of mechatronics in aviation

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Recognize the Basics in aerodynamics, aircraft propulsion, materials and controls | Understand |
| CO2 | Understand the various concepts used in aerodynamics | Understand |
| CO3 | Apply the techniques to develop the aero system | Apply |
| CO4 | Design the aircraft with the use of concepts in aerodynamics, aircraft propulsion, materials and controls | Analyze |
| CO5 | Apply this aircraft system in various applications | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 2 | 3 | - | 2 | 2 | - | - | - | - | - | 2 | 1 | 3 | 2 |
| CO2 | 3 | 3 | 3 | - | 3 | - | - | - | - | - | 2 | 2 | 2 | 2 |
| CO3 | 3 | 3 | 2 | 3 | 2 | 2 | - | - | - | - | 1 | 2 | 3 | 2 |
| CO4 | 2 | 2 | - | - | 3 | - | - | - | - | - | 2 | 3 | 2 | 2 |
| CO5 | 2 | 2 | 2 | 3 | 2 | - | - | - | - | - | 3 | 3 | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 10 | 20 | 30 |
| Understand | 20 | 25 | 30 |
| Apply | 20 | 10 | 30 |
| Analyse | 10 | 5 | 10 |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC E13 - Aircraft Mechatronics** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| V | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Aircraft Aerodynamics*** <br> Types of Wing Plan Forms, Aerodynamic Features Aerofoil Pressure Distribution-Aerodynamic Forces and Moments Lift and Drag- Drag Polar, L/D Ratio, High Lift Devices, Airplane Performance, Thrust/Power Available, Climb and Glide — Maximum Range and Endurance, Take off and Landings. | **[9]** |
| **Aircraft Propulsion**** <br> Requirement of Power- Various Means of Producing Power – Brief Description of Thermo Dynamics of Engines – Piston Engines, Jet Engines – Airplane Structure, Materials and Production – Structural Arrangement of Earlier Airplane- Developments Leading to all Metal Aircraft – Strength to Weight Ratio Choice of Aircraft Materials for Different Parts. | **[9]** |
| **Navigation and Guidance System of Aircraft*** <br> Flight Control System –Path Planning- Way Point Navigation System - Obstacle's Avoidance Techniques – Functional Block of Lateral and Longitudinal Guidance- GPS – GCS-Telemetry –Transmitter & Receiver. | **[9]** |
| **Primary Flight Controls**** <br> Ailerons – Aileron Control System of a Commercial Aircraft – Elevators – Elevator Control System of a Commercial Aircraft – Rudders- Rudder Control System. | **[9]** |
| **Applications of Mechatronics in Aviation*** <br> Flaps and Actuator Drive Unit-Pilot Static System-Fly by Wire Control System-Yaw Damper-Primary Flight Control System-Internal Navigation System-Under Carriage-Measurement of Motor Rpm-Measurement of air Flow Velocity-Altitude Measurement Sensor. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Middleton, D.H., Ed., "Avionics systems, Longman Scientific and Technical", Longman Group UK Ltd., England, 2021 |
| 2. | Pallet. E.H.J., "Aircraft Instruments and Integrated Systems", Pearsons, Indian edition 2020.. |

**Reference(s):**

| | |
|---|---|
| 1. | Spitzer, C.R. "Digital Avionics Systems", Prentice-Hall, Englewood Cliffs, N.J.,U.S.A. 2019. |
| 2. | Spitzer. C.R. "The Avionics Hand Book", CRC Press, 2019 |
| 3. | Mirosaw Adamski, "Power units and power supply systems in UAV", New Edition, Taylor and Francis Group publishers, 2019. |
| 4. | Droneprep, "Unmanned Aircraft Systems Logbook for Drone Pilots & Operators", Create Space Independent Publishing Platform, Latest Edition, 2019 |

*SDG 9 – Industry Innovation and Infrastructure
**SDG 4 – Quality Education

## Course Contents and Lecture Schedule

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Aircraft Aerodynamics** | |
| 1.1 | Nomenclature used in Aerodynamics | 1 |
| 1.2 | Different Parts of Airplane | 1 |
| 1.3 | Wing as Lifting Surface | 1 |
| 1.4 | Aerodynamic Features | 1 |
| 1.5 | Aerofoil Pressure Distribution | 1 |
| 1.6 | Aerodynamic Forces and Moments Lift and Drag | 1 |
| 1.7 | Drag polar, L/D Ratio, High Lift Devices | 1 |
| 1.8 | Airplane Performance, Thrust/Power Available, Climb and Glide | 1 |
| 1.9 | Maximum Range and Endurance, Take off and Landings | 1 |
| **2.0** | **Aircraft Propulsion** | |
| 2.1 | Requirement of Power | 1 |
| 2.2 | Various Means of Producing Power | 1 |
| 2.3 | Brief Description of Thermo Dynamics of Engines | 1 |
| 2.4 | Piston Engines, Jet Engines | 1 |
| 2.5 | Airplane Structure, Materials and Production | 1 |
| 2.6 | Structural Arrangement of Earlier Airplane | 1 |
| 2.7 | Developments Leading to all Metal Aircraft | 1 |
| 2.8 | Strength to Weight Ratio Choice of Aircraft Materials for Different Parts. | 2 |
| **3.0** | **Navigation and Guidance System of Aircraft** | |
| 3.1 | Flight Control System | 1 |
| 3.2 | Path Planning- Way Point Navigation System | 2 |
| 3.3 | Obstacle’s Avoidance Techniques | 1 |
| 3.4 | Functional Block of Lateral and Longitudinal Guidance | 1 |
| 3.5 | GPS,GCS | 2 |
| 3.6 | Telemetry | 1 |
| 3.7 | Transmitter & Receiver | 1 |
| **4.0** | **Primary Flight Controls** | |
| 4.1 | Ailerons | 2 |
| 4.2 | Aileron Control System of a Commercial Aircraft | 2 |
| 4.3 | Elevators | 1 |
| 4.4 | Elevator Control System of a Commercial Aircraft | 2 |
| 4.5 | Rudders- Rudder Control System | 2 |
| **5.0** | **Applications of Mechatronics in Aviation** | |
| 5.1 | Flaps and Actuator Drive Unit | 1 |
| 5.2 | Pilot Static System | 1 |
| 5.3 | Fly by Wire Control System | 1 |
| 5.4 | Yaw Damper | 1 |
| 5.5 | Primary Flight Control System | 1 |
| 5.6 | Internal Navigation system | 1 |
| 5.7 | Under Carriage-Measurement of Motor Rpm | 1 |
| 5.8 | Measurement of Air Flow Velocity | 1 |
| 5.9 | Altitude Measurement Sensor-Air Speed | 1 |

## Course Designer(s)

Mr.S.Hari Prasadh -hariprasadh@ksrct.ac.in

| 60 MC E14 | Applied Materials Technology | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To impart knowledge on the structure and properties of alloys.
- To understand heat treatment processes and hardening techniques.
- To acquire knowledge in ferrous and non-ferrous materials.
- To impart knowledge on Powder metallurgy processes and applications.
- To identity and select suitable characterization techniques for material testing.

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the various types of alloy structures using iron carbide equilibrium diagram and phase changes of various structures. | Remember |
| CO2 | Identify heat treatment process for engineering applications and case hardening process -carburizing, nitriding and cyaniding. | Apply |
| CO3 | Predicttheeffectofalloyingadditionsonferrousandnon-ferrousmetals. | Apply |
| CO4 | Comply the properties of ceramic materials and powder metallurgy for engineering applications and production of different metal powders. | Apply |
| CO5 | Utilize the mechanism of plastic deformation process, testing of mechanical properties and metallographic procedures. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | - | - | 2 | - | 2 | - | - | - | - | - | 3 | 2 | 2 |
| CO2 | 3 | - | - | 2 | - | 2 | - | - | - | - | - | 3 | 2 | 3 |
| CO3 | 3 | - | - | 2 | - | 2 | - | - | - | - | - | 3 | 2 | 2 |
| CO4 | 3 | - | - | 2 | - | 2 | - | - | - | - | - | 3 | 2 | 3 |
| CO5 | 3 | - | - | 2 | - | 2 | - | - | - | - | - | 3 | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 10 | 10 | 30 |
| Understand | 30 | 30 | 30 |
| Apply | 20 | 20 | 40 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

w.e.f.23/12/2023
Passed in the BoS Meeting Held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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**Syllabus**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC E14- Applied Materials Technology** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| V | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Constitution of Alloys and Phase Diagrams***<br>Constitution of Alloys – Solid Solutions, Substitutional and Interstitial – Phase Diagrams, Types and Construction of Phase Diagrams ,Iron–Iron Carbide Equilibrium Diagram, Eutectic, Peritectic, Eutectoid and Peritectoid Reactions. | **[9]** |
| **Heat Treatment***<br>Definition – Full Annealing, Stress Relief and Recrystallization –Normalizing, Hardening and Tempering of Steel ,Austempering, Martempering - TTT Diagrams -Hardenability, Jiminy End Quench Test – Case Hardening ,Carburising ,Nitriding ,Cyaniding ,Flame and Induction Hardening. | **[9]** |
| **Ferrous and Non Ferrous Metals***<br>Classification of Steel and Cast Iron- Effect of Alloying Additions on Steel (Mn, Si, Cr, Mo, V, Ti& W) - Stainless and Tool Steels ─ HSLA - Gray, White, Malleable - Alloy Cast Irons - Copper and Copper Alloys – Aluminium and Aluminium Alloys–Bearing Alloys,Ni-Based Super Alloys and Titanium Alloys. | **[9]** |
| **Non-Metallic Materials and Powder Metallurgy***<br>Engineering Ceramics–Properties and Applications of Al2O3, SiC-Powder Metallurgy Process-Steps Involved-Characteristics of Metal Powders - Advantages and Limitations, Major Applications: Aerospace, Nuclear, Metal Cutting and Auto mobile Industries. | **[9]** |
| **Mechanical Properties and Testing***<br>Mechanism of Plastic Deformation - Slip and Twinning - Types of Fracture - Destructive Testing: Testing of Materials Under Tension, Compression and Shear Loads - Hardness Tests: Brinell, Vickers and Rockwell - Impact Test: Izodand Charpy - Fatigue and Creep Test ─ Metallography - Preparation of Specimen, Metallurgical Microscope and Scanning Electron Microscope. | **[9]** |
| **Total Hours:** | **45** |

| | |
|---|---|
| **Text Book(s):** | |
| 1. | KhannaO.P,“A Text Book of Material Science and Metallurgy”,Dhanpat Rai Publishers,2016. |
| 2. | SidneyH.Avner “Introduction to Physical Metallurgy ”TataMcGraw-Hill CompaniesInc., NewDelhi,2012. |
| **Reference(s):** | |
| 1. | William D. Callister, “Material Science and Engineering: An Introduction”, Wiley India Pvt Ltd, NewDelhi,2012. |
| 2. | Raghavan.V., “Materials Science and Engineering: A First Course”,5$^{th}$ Edition, Prentice Hall of India Pvt.Ltd.,NewDelhi,2009 |
| 3. | GeorgeE.Dieter,“Mechanical Metallurgy”,TataMcGraw-HillCompaniesInc.,NewDelhi,2013 |
| 4. | Balasubramaniam R,“Callister’s Materials Science and Engineering”, Second edition, Wiley,2 014. |

*SDG 9 – Industry Innovation and Infrastructure

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Constitution of Alloys and Phase Diagrams** | |
| 1.1 | Constitution of Alloys | 1 |
| 1.2 | Solid Solutions, Substitutional and Interstitial | 2 |
| 1.3 | Phase Diagrams, Types and Construction of Phase Diagrams, Iron | 2 |
| 1.4 | Iron Carbide Equilibrium Diagram | 1 |
| 1.5 | Eutectic | 1 |
| 1.6 | Peritectic | 1 |
| 1.7 | Eutectoid and Peritectoid Reactions | 1 |
| **2.0** | **Heat Treatment** | |
| 2.1 | Definition | 1 |
| 2.2 | Full Annealing, Stress Relief and Recrystallization | 1 |
| 2.3 | Normalizing, Hardening and Tempering of Steel | 1 |
| 2.4 | Austempering, Martempering | 1 |
| 2.5 | TTT Diagrams | 1 |
| 2.6 | Hardenability, Jiminy end Quench Test | 1 |
| 2.7 | Case Hardening, Carburising | 1 |
| 2.8 | Nitriding, Cyaniding | 1 |
| 2.9 | Flame and Induction Hardening. | 1 |
| **3.0** | **Ferrous and Non Ferrous Metals** | |
| 3.1 | Classification of Steel and Cast Iron | 1 |
| 3.2 | Effect of Alloying Additions on Steel (Mn, Si, Cr, Mo, V, Ti& W) | 2 |
| 3.3 | Stainless and Tool Steels | 1 |
| 3.4 | HSLA ,Gray, White, Malleable | 1 |
| 3.5 | Alloy Cast Irons, Copper and Copper alloys | 1 |
| 3.6 | Aluminium and Aluminium Alloys | 1 |
| 3.7 | Bearing Alloys | 1 |
| 3.8 | Ni-Based Super Alloys and Titanium Alloys. | 1 |
| **4.0** | **Non-Metallic Materials and Powder Metallurgy** | |
| 4.1 | Engineering Ceramics | 1 |
| 4.2 | Properties and Applications of Al2O3,SiC | 2 |
| 4.3 | Powder Metallurgy Process | 1 |
| 4.4 | Steps Involved | 1 |
| 4.5 | Characteristics of Metal Powders | 1 |
| 4.6 | Advantages and Limitations | 1 |
| 4.7 | Major Applications: Aerospace, Nuclear | 1 |
| 4.8 | Metal Cutting and Automobile Industries | 1 |
| **5.0** | **Mechanical Properties and Testing** | |
| 5.1 | Mechanism of Plastic Deformation | 1 |
| 5.2 | Slip and Twinning, Types of Fracture | 1 |
| 5.3 | Destructive Testing: Testing of Material Sunder Tension, Compression and Shear Loads | 2 |
| 5.4 | Hardness Tests: Brinell, Vickers and Rockwell | 1 |
| 5.5 | Impact Test: Izodand Charpy, Fatigue and Creep Test | 2 |
| 5.6 | Metallography, Preparation of Specimen | 1 |
| 5.7 | Metallurgical Microscope and Scanning Electron Microscope | 1 |

**Course Designer(s)**

Dr.M.Baskaran -baskaranm@ksrct.ac.in

| 60 MC E15 | Design of Experiments | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

## Objectives

- To impart knowledge on various types of experimental designs conduct of experiments
- To understand the different data analysis techniques
- To Understand the importance of Design of Experiments
- Be able to allocate observations using Single Factor Experiments
- To Learn the factorial design of experiments

## Pre-requisites

- Statistics and Numerical Methods

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Apply experimental techniques to practical problems to improve quality of processes | Apply |
| CO2 | Analyze the variance and apply the single factor variance | Analyze |
| CO3 | Learn the factorial design of experiments | Apply |
| CO4 | Design and learn Special Experimental Design | Analyze |
| CO5 | Focuses on design efficient, reliable products using Taguchi method. | Analyze |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 10 | 20 | 30 |
| Understand | 20 | 25 | 30 |
| Apply | 20 | 10 | 30 |
| Analyse | 10 | 5 | 10 |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

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Approved in Academic Council Meeting held on 23/12/2023

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Mechatronics Engineering

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC E15-Design of Experiments** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| V | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Fundamentals of Experimental Designs*** Hypothesis Testing – Single Mean, Two Means, Dependant/ Correlated Samples – C0onfidence Intervals, Experimentation – Need, Conventional Test strategies, Analysis of Variance, F-test, Terminology, Basic Principles of Design, Steps in Experimentation. Market-Standard Design Analysis – Choice of Sample Size –Normal and Half Normal Probability Plot – Simple Linear and Multiple Linear Regression Testing Using Analysis of Variance. | **[9]** |
| **Single Factor Experiments*** Completely Randomized Design- Effect of Coding the Observations- Model Adequacy Checking- Estimation of Model Parameters, Residuals Analysis- Treatment Comparison Methods-Duncan's Multiple Range Test, Newman-Keuel's Test, Fisher's LSD Test, Tukey's Test-Testing Using Contrasts- Randomized Block Design – Latin Square Design- Graeco Latin Square Design – Applications. | **[9]** |
| **Factorial Designs*** Main and Interaction Effects - Two and Three Factor Full Factorial Designs- Fixed Effects and Random Effects Model - Rule for Sum of Squares and Expected Mean Squares- 2K Design with Two and Three Factors- Yate's Algorithm- Fitting Regression Model- Randomized Block Factorial Design - Practical Applications. | **[9]** |
| **Special Experimental Design*** Blocking and Confounding in 2K Designs- Blocking in Replicated Design- 2K Factorial Design in Two Blocks- Complete and Partial Confounding- Confounding 2K Design in Four Blocks- Two Level Fractional Factorial Designs- One-Half Fraction of 2K Design, Design Resolution, Construction of One-Half Fraction with Highest Design Resolution, One-Quarter Fraction of 2K Design. | **[9]** |
| **Taguchi Methods*** Design of Experiments Using Orthogonal Arrays, Data Analysis From Orthogonal Experiments-Response Graph Method, ANOVA- Attribute Data Analysis- Robust Design- Noise Factors, Signal to Noise Ratios, Inner/Outer OA Design. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**


| | |
|---|---|
| 1. | Krishnaiah K, and Shahabudeen P, "Applied Design of Experiments and Taguchi Methods", PHI, India, 2011 |
| 2. | Douglas C. Montgomery, Design and Analysis of Experiments, John Wiley and sons, 2012. |


**Reference(s):**


| | |
|---|---|
| 1. | Box, G. E., Hunter,W.G., Hunter, J.S., Hunter,W.G., Statistics for Experimenters: Design, Innovation, and Discovery, 2nd Edition, Wiley, 2005. |
| 2. | Phillip J. Ross, Taguchi Techniques for Quality Engineering, Tata McGraw-Hill, India, 2005. |
| 3. | George E. P. Box, J. Stuart Hunter and William G. Hunter "Statistics for Experimenters: Design, Innovation and Discovery"' Wiley-Interscience, 2nd edition, 2005 |
| 4. | Jiju Antony "Design of Experiments for Engineers and Scientists" Elsevier; 3rd edition, 2003 |


*SDG 9 – Industry Innovation and Infrastructure

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Fundamentals of Experimental Designs** | |
| 1.1 | Hypothesis Testing – Single Mean, Two Means, Dependant/ Correlated Samples | 1 |
| 1.2 | Confidence Intervals | 1 |
| 1.3 | Experimentation – Need, Conventional Test Strategies | 1 |
| 1.4 | Analysis of Variance, F-test, Terminology | 1 |
| 1.5 | Basic Principles of Design, Steps in Experimentation | 1 |
| 1.6 | Market-standard Design Analysis | **1** |
| 1.7 | Coice of Sample Size | 1 |
| 1.8 | Normal and Half Normal Probability | 1 |
| 1.9 | Simple Llinear and Multiple Linear Regression Testing Using Analysis of variance | 1 |
| **2.0** | **Single Factor Experiments** | |
| 2.1 | Completely Randomized Design- Effect of Coding the Observations | 1 |
| 2.2 | Model Adequacy Checking- Estimation of Model Parameters | 1 |
| 2.3 | Residuals Analysis- Treatment Comparison Methods | 1 |
| 2.4 | Duncan's Multiple Range Test | 1 |
| 2.5 | Newman-Keuel's Test | 1 |
| 2.6 | Fisher's LSD Test, Tukey's Test-Testing Using Contrasts | 1 |
| 2.7 | Randomized Block Design | 1 |
| 2.8 | Latin Square Design | 1 |
| 2.9 | Graeco Latin Square Design – Applications. | 1 |
| **3.0** | **Factorial Designs** | |
| 3.1 | Main and Interaction Effects | 1 |
| 3.2 | Two and Three Factor Full Factorial Designs | 1 |
| 3.3 | Fixed Effects and Random Effects Model | 1 |
| 3.4 | Rule for Sum of Squares and Expected Mean Squares | 1 |
| 3.5 | 2K Design with Two and Three Factors | 1 |
| 3.6 | Yate's Algorithm | 1 |
| 3.7 | Fitting Regression Model | 1 |
| 3.8 | Randomized Block Factorial Design - Practical Applications | 2 |
| **4.0** | **Special Experimental Design** | |
| 4.1 | Blocking and Confounding in 2K Designs | 1 |
| 4.2 | Blocking in Replicated Design- 2K Factorial Design in Two Blocks | 1 |
| 4.3 | Complete and Partial Confounding | 1 |
| 4.4 | Confounding 2K Design in Four Blocks | 1 |
| 4.5 | Two Level Fractional Factorial Designs | 1 |
| 4.6 | One-Half Fraction of 2K Design | 1 |
| 4.7 | Design Resolution, | 1 |
| 4.8 | Construction of One-Half Fraction with Highest Design Resolution | 1 |
| 4.9 | One-Quarter Fraction of 2K Design | 1 |
| **5.0** | **Taguchi Methods** | |
| 5.1 | Design of Experiments Using Orthogonal Arrays | 2 |
| 5.2 | Data Analysis from Orthogonal Experiments-Response Graph Method | 2 |
| 5.3 | ANOVA- Attribute Data Analysis | 1 |
| 5.4 | Robust Design | 1 |
| 5.5 | Noise Factors, Signal to Noise Ratios | 1 |
| 5.6 | Inner/outer OA Design | 2 |

**Course Designer(s)**

Dr.P.Mohanram – mohanram@ksrct.ac.in

w.e.f.23/12/2023
Passed in the BoS Meeting Held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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| 60 MC E16 | Automation in Process Industries | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To introduce the importance of automation techniques manufacturing and process industries.
- To impart the role of PLC in industry automation.
- To expose to various sensors employed in process automation.
- To develop safety and control strategies in automation system.
- To expose to various control techniques employed in process automation using PLC

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand automation techniques manufacturing and process industries. | Apply |
| CO2 | Understand the automated material handling equipment | Analyze |
| CO3 | Apply various control sensors employed in process automation. | Understand |
| CO4 | Develop the safety and control strategies in industrial standard | Understand |
| CO5 | Understand various control techniques employed in process automation using IOT. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 3 | 2 |
| CO2 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 1 | 2 | 3 | 3 | 1 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 3 | 2 |
| CO4 | 2 | 2 | 3 | 3 | 1 | 2 | 1 | 2 | 3 | 1 | 2 | 1 | 2 | 2 |
| CO5 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 10 | 20 | 30 |
| Understand | 20 | 25 | 30 |
| Apply | 20 | 10 | 30 |
| Analyse | 10 | 5 | 10 |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |



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**Syllabus**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC E16 – Automation in Process Industries** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| V | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Automation in Manufacturing Industries***<br>Introduction-Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations, Automated Flow Lines and Transfer Mechanisms, Analysis of Transfer Lines Without Storage, Automated Flow lines with storage buffers. | **[9]** |
| **Material handling****<br>Material handling and identification technologies -Overview of material handling systems, Types of material handling equipment, Design of the system, Conveyor system, Automated guided vehicle system, Automated storage and retrievel systems, Interfacing handling and storage with manufacturing. | **[9]** |
| **Sensors and Actuators in Process Automation****<br>Types of Sensors -Temperature, Pressure, Flow, Level- Selection and Calibration of Sensors- Actuators: Motors, Valves, and Drives- Integration of Sensors and Actuators in Control Systems | **[9]** |
| **Safety and control Strategies in Automation***<br>Safety Instrumented Systems (SIS)- Risk Assessment and Safety Standards- Cybersecurity in Industrial Automation-Best Practices for Securing Industrial Control Systems (ICS)- Advanced Control Strategies (PID, Model Predictive Control)- Cascade and Feedforward Control-Batch Processing and Sequential Control-Optimization Techniques in Industrial Processes. | **[9]** |
| **Industrial Automation In IoT***<br>Press and Fork lift control using IoT - Fluid powered Assembling, Feeding, Metalworking, materials handling and plastics working application with IoT. | **[9]** |
| **Total Hours:** | **45** |

| | |
|---|---|
| **Text Book(s):** | |
| 1. | M.P.Groover,"Automation, Production Systems and Computer Integrated Manufacturing", 5th Edition, Pearson Education, 2009. |
| 2. | John W. Webb and Ronald A. Reis, "Programmable Logic Controllers: Principles and Applications", 5th Edition, Prentice Hall Inc., New Jersey, 2003. |
| **Reference(s):** | |
| 1. | Curtis D. Johnson, "Process Control Instrumentation Technology", 8th Edition, Pearson New International, 2013. |
| 2. | N. Viswanandham, Y. Narahari, "Performance Modeling of Automated Manufacturing Systems", 1st Edition, 2009 |
| 3. | Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", Apress 1st Edition, 2017. |
| 4. | Lucas M.P, Distributed Control Systems, Van Nostrand Reinhold Company, Newyork, 2007. |

*SDG 9 – Industry Innovation and Infrastructure
**SDG 4– Quality Education

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Automation in production system** | |
| 1.1 | Principles and Strategies of Automation | 1 |
| 1.2 | Basic Elements of an Automated System | 2 |
| 1.3 | Advanced Automation Functions, Levels of Automations | 2 |
| 1.4 | Automated Flow Lines and Transfer Mechanisms | 2 |
| 1.5 | Analysis of Transfer Lines Without Storage, Automated Flow lines with Storage Buffers. | 2 |
| **2.0** | **Material Handling** | |
| 2.1 | Material Handling and Identification Technologies | 2 |
| 2.2 | Overview of Material Handling Systems | 1 |
| 2.3 | Types of Material Handling Equipment, Design of the System | 2 |
| 2.4 | Conveyor System, Automated Guided Vehicle System, Automated Storage Systems | 2 |
| 2.5 | Interfacing handling and storage with manufacturing ,Overview of Automatic Identification Methods | 2 |
| **3.0** | **Sensors and Actuators in Process Automation** | |
| 3.1 | Types of Sensors | 1 |
| 3.2 | Temperature, Pressure, Flow, Level sensors | 2 |
| 3.3 | Selection and Calibration of Sensors | 2 |
| 3.4 | Actuators: Motors, Valves, and Drives | 2 |
| 3.5 | Integration of Sensors | 1 |
| 3.6 | Actuators in Control Systems | 1 |
| **4.0** | **Safety and control Strategies in Automation** | |
| 4.1 | Safety Instrumented Systems (SIS) | 2 |
| 4.2 | Risk Assessment and Safety Standards, Cybersecurity in Industrial Automation | 2 |
| 4.3 | Best Practices for Securing Industrial Control Systems (ICS). | 1 |
| 4.4 | Advanced Control Strategies (PID, Model Predictive Control),Cascade and Feedforward Control | 2 |
| 4.5 | Batch Processing and Sequential Control, Optimization Techniques in Industrial Processes | 2 |
| **5.0** | **Industrial Automation in IoT** | |
| 5.1 | Press and Fork lift control using IoT | 1 |
| 5.2 | Fluid powered Assembling | 2 |
| 5.3 | Feeding, Metalworking | 2 |
| 5.4 | Materials Handling | 2 |
| 5.5 | Plastics working application with IoT | 2 |

**Course Designer(s)**

Dr.M.Ravi – ravi@ksrct.ac.in

| 60 MC E17 | Medical Robotics | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- Identify and describe different types of medical robots and their potential applications
- Know basic concepts in kinematics, dynamics, and control relevant to surgical manipulators
- Develop the analytical and experimental skills necessary to design and implement Motion control and force control in medical robotics
- Be familiar with the state of the art in applied medical robotics and Haptic Tele manipulation.
- Understand the various roles that robotics can play in Minimally Invasive Surgery.

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Classify the different types design of control architectures | Understand |
| CO2 | Identify the function of -assisted minimally invasive surgery. | Understand |
| CO3 | Design of control architectures for robotic-assisted tele-medicine. Evaluation of medical robots | Apply |
| CO4 | Describe the haptic tele manipulation and control strategies | Apply |
| CO5 | Discuss the different techniques minimal invasive surgery | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO2 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO3 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO4 | 3 | 3 | - | - | - | 3 | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO5 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 20 | 10 | 20 |
| Understand | 40 | 30 | 50 |
| Apply | - | 20 | 30 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

w.e.f. 23/12/2023
Passed in the BoS Meeting Held on 24/112023
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Board Of Studies/
Mechatronics Engineering

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E – Mechatronics Engineering** | | | | | | | | |
| **60 MC E17- Medical Robotics** | | | | | | | | |
| **Semester** | | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| V | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to Medical Robots**<br>Introduction to medical robotics-Assistive technologies - rehabilitation robotics - surgical robotics- robotics for diagnosis -s Historical perspective. | **[09]** |
| **Design of Surgical Manipulators**<br>Security issues-Manipulators with serial and parallel configurations-European directives-Minimally invasive surgery-Passive and active joints-Remote rotation center-Master-slave mechatronic system - Da Vinci system. | **[09]** |
| **Motion control and force control in medical robotics**<br>Motion Control: Joint space control and task space control - Force Control: Indirect force control (compliant control, impedance control) - direct force control (hybrid position/force control, external force control) - Kalman Active Observers - Design of null space / task space controllers for minimally invasive surgery. | **[09]** |
| **Haptic Tele manipulation**<br>Haptic control architectures- Tele presence - stability and robustness analysis - Contact parameterestimation. | **[09]** |
| **Minimally Invasive Surgery**<br>Human-machine interfaces - Teleoperation - Cooperative manipulation - Port placement for MIS - Robot design concepts - Video images in MIS - Augmented reality | **[09]** |
| **Total Hours:** | **45** |

**Text Book(s):**

1. Khalil, W, Dombre E, Modeling, Identification and Control of Robots, HPS 2022
2. Ciavicco and Siciliano, Modeling and Control of Robot Manipulators, Springer.2020

**Reference(s):**

1. Cortesao, R., Medical Robotics Course, DEEC-FCTUC.(2018)
2. Anandanatarajan.R., “Biomedical robots”, PHI Learning Private Limited, New Delhi ,2011.
3. Cromwell, Leslie, Weibell. Fred J. and Pfeiffer. Erich A., “Bio-Medical and electronics ”, Second Edition,Pearson Education, New Delhi, 2012.
4. Khandpur R.S., “Handbook of Bio-Medical instrumentation”, Tata McGraw-Hill Publishing Co Ltd., NewDelhi, 2014.

*SDG 3 – Good Health and Well Being

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Introduction to Medical Robots** | |
| 1.1 | Introduction to medical robotics | 2 |
| 1.2 | Assistive technologies | 1 |
| 1.3 | Surgical robotics, - roboticsfor diagnosis | 3 |
| 1.4 | Historical perspective. | 3 |
| **2.0** | **Design of Surgical Manipulators** | |
| 2.1 | Security issues-Manipulators with serial and parallel configuration | 1 |
| 2.2 | European directives- | 2 |
| 2.3 | Minimally invasive surgery, Passive and active joints | 2 |
| 2.4 | Remote rotation center-Master, slave mechatronic system | 2 |
| 2.5 | Da Vinci system. | 2 |
| **3.0** | **Motion control and force control in medical robotics** | |
| 3.1 | Motion Control: Joint space control and task space control | 2 |
| 3.2 | Force Control: Indirect force control (compliant control, impedance control) | 2 |
| 3.3 | Direct force control (hybrid position/force control | 2 |
| 3.4 | External force control), Kalman Active Observers | 2 |
| 3.5 | Design of null space / task space controllers for minimally invasive surgery. | 1 |
| **4.0** | **Haptic Tele manipulation** | |
| 4.1 | Haptic control architectures | 2 |
| 4.2 | Tele presence | 3 |
| 4.3 | Stability and robustness analysis | 2 |
| 4.4 | Contact parameter, estimation. | 2 |
| **5.0** | **Minimally Invasive Surgery** | |
| 5.1 | Human-machine interfaces | 1 |
| 5.2 | Teleoperation - Cooperative manipulation | 2 |
| 5.3 | Port placement for MIS | 2 |
| 5.4 | Robot design concepts | 2 |
| 5.5 | Video images in MIS - Augmented reality | 2 |

**Course Designer(s)**

1. Dr.M.Ravi-ravi@ksrct.ac.in

| 60 MC E18 | AI for Robotics | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- Impart artificial intelligence principles, techniques and its history.
- Assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving engineering
- Enable robots to navigate complex environments without human intervention
- Learn from their experiences, adapt to new tasks, or improve their performance over time
- Develop intelligent systems by assembling solutions to concrete computational problems

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the Artificial Intelligence (AI) methods and describe their foundations. | Understand |
| CO2 | Understand the basic principles of AI in solutions that require problem-solving, inference, perception, knowledge representation and learning. | Understand |
| CO3 | Demonstrate knowledge of reasoning, uncertainty, and knowledge representation for solving real-world problems | Apply |
| CO4 | Illustrate how search algorithms play a vital role in problem-solving | Understand |
| CO5 | Apply intuitive ways for humans to communicate and collaborate with robots | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO2 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO3 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO4 | 3 | 3 | - | - | - | 3 | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO5 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 20 | 10 | 20 |
| Understand | 40 | 30 | 60 |
| Apply | - | 20 | 20 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E – Mechatronics Engineering** | | | | | | | | |
| **60 MC E18 - AI for Robotics** | | | | | | | | |
| Semester | | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| V | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction**<br>Introduction- Evolution of AI, State of Art -Different Types of Artificial Intelligence Applications of AI-Subfields of AI-Intelligent Agents- Structure of Intelligent Agents Environments | **[09]** |
| **Problem Solving based on Searching**<br>Introduction to Problem Solving by searching Methods-State Space search, Uninformed Search Methods – Uniform Cost Search, Breadth First Search- Depth First Search-Depth limited search, Iterativedeepening depth-first, Informed Search Methods- Best First Search, A* Search | **[09]** |
| **Logic and Reasoning**<br>Introduction to Logic and Reasoning -Propositional Logic-First Order Logic-Inference in First Order Logic- Unification, Forward Chaining, Backward Chaining, Resolution. | **[09]** |
| **Planning**<br>Classical planning, Planning as State-space search, Forward search, backward search, Planning graphs, Hierarchical Planning, Planning and acting in Nondeterministic domains – Sensor-less Planning, Multiagent planning | **[09]** |
| **Communicating, Perceiving and Acting**<br>Communication-Fundamentals of Language -Probabilistic Language Processing - Information Retrieval- Information Extraction-Perception-Image Formation- Object Recognition. | **[09]** |
| **Total Hours:** | **45** |

| | |
|---|---|
| **Text Book(s):** | |
| 1. | Russell, S. and Norvig, P.,” Artificial Intelligence - A Modern Approach”, 3rd Edition, Prentice Hall,2015. |
| 2. | Robin R Murphy, ”Artificial Intelligence for Robotics”, 2nd Edition, Bradford books,2019. |
| **Reference(s):** | |
| 1. | K. R. Chowdhary, “Fundamentals of Artificial Intelligence”, Springer, 2020. |
| 2. | Alpaydin, E, “ Introduction to Machine Learning”, 2nd Edition, MIT Press,2010 |
| 3. | Francis X. Govers,” Artificial Intelligence for Robotics”, Packt Publishing ltd,2018 |

*SDG 3 – Good Health and Well Being

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Introduction** | |
| 1.1 | Introduction- Evolution of AI, State of Art | 2 |
| 1.2 | Different Types of Artificial Intelligence | 2 |
| 1.3 | Applications of AI Subfields of AI-Intelligent Agents | 2 |
| 1.4 | Structure of Intelligent Agents Environments | 3 |
| **2.0** | **Problem Solving based on Searching** | |
| 2.1 | Introduction to Problem Solving by searching Methods-State Space search | 1 |
| 2.2 | Uninformed Search Methods | 2 |
| 2.3 | Uniform Cost Search, Breadth First Search | 2 |
| 2.4 | Depth First Search-Depth limited search | 2 |
| 2.5 | Iterativedeepening depth-first | 2 |
| **3.0** | Informed Search Methods- Best First Search, A* Search | |
| 3.1 | **Logic and Reasoning** | 2 |
| 3.2 | Introduction to Logic and Reasoning | 2 |
| 3.3 | Propositional Logic-First Order Logic-Inference in First Order Logic | 2 |
| 3.4 | Unification, Forward Chaining | 2 |
| 3.5 | Backward Chaining, Resolution | 1 |
| **4.0** | **Planning** | |
| 4.1 | Classical planning, Planning as State-space search | 3 |
| 4.2 | Forward search, backward search | 2 |
| 4.3 | Planning graphs Hierarchical Planning Planning, Sensor-less Planning | 2 |
| 4.4 | and acting in Nondeterministic domains, Multiagent planning | 2 |
| **5.0** | **Communicating, Perceiving and Acting** | |
| 5.1 | Communication-Fundamentals of Language | 2 |
| 5.2 | Probabilistic Language Processing , Information Retrieval | 2 |
| 5.3 | Information Extraction-Perception | 2 |
| 5.4 | Image Formation | 2 |
| 5.5 | Object Recognition | 1 |

**Course Designer(s)**

1. Dr.M.Ravi-ravi@ksrct.ac.in



CHAIRMAN
Board Of Studies/
Mechatronics Engineering

| 60 MC E21 | Agricultural Robotics and Automation | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- Recognize the areas in agricultural process where robotics can be applied.
- Integrate sensor and system for a required specific process in agricultural applications.
- Apply Mechanics to the design various robot parameters
- Convert various mechanisms into robot by providing actuation at specific links and joints of the mechanism.
- Develop suitable robotic system for specific agricultural tasks.

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Know the basics of automation in agriculture. . | Remember |
| CO2 | Recognize the concepts of Precision agricultural systems and trends | Understand |
| CO3 | understand importance of automation in Irrigation systems | Understand |
| CO4 | Realize the various Automation Practices in agriculture through case Studies | Understand |
| CO5 | Apply concepts in material handling and packaging industries | Remember |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 3 | 2 |
| CO2 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 1 | 2 | 3 | 3 | 1 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 3 | 2 |
| CO4 | 2 | 2 | 3 | 3 | 1 | 2 | 1 | 2 | 3 | 1 | 2 | 1 | 2 | 3 |
| CO5 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 30 | 20 | 30 |
| Understand | 30 | 20 | 50 |
| Apply | - | 20 | 20 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

w.e.f. 23/12/2023
Passed in the BoS Meeting Held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

CHAIRMAN
Board Of Studies/
Mechatronics Engineering

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC E21 - Agricultural Robotics and Automation** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction***<br>History of Mechanized Agriculture – Farming Operations and Related Machines – Tillage-Planting Cultivation and Harvesting-Agricultural Automation – Agricultural Vehicle Robot. | **[9]** |
| **Precision Agriculture***<br>Sensors – Types and Agricultural Applications- Global Positioning System (GPS) – GPS for Civilian use- Differential GPS- Carrier-Phase GPS- Real-Time Kinematic GPS-Military GPS- Geographic Information System- Variable Rate Applications and Controller Area Networks. | **[9]** |
| **Traction and Testing***<br>Hitching- Principles of Hitching- Types of Hitches- Hitching and Weight Transfer- Control of Hitches- Tires and Traction Models-Traction Predictor Spread Sheet- Soil Compaction-Traction Aids- Tractor Testing. | **[9]** |
| **Soil Tillage and Weed Management***<br>Tillage Methods and Equipment – Mechanics of Tillage Tools – Performance of Tillage Implements- Hitching of Tillage Implements-Weed Management — Conventional Cropping Systems- Tools- Crop Rotation- Mechanical Cultivation**.** | **[9]** |
| **Robotics and Greenhouse Automation****<br>Robotic Applications in Tasks Such as Pruning, Sorting, and Packing-Climate Control Systems-Automation of Irrigation and Nutrient Delivery-Monitoring and Control of Greenhouse Environments-Sustainable Practices in Controlled Environments. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Ajit K. Srivastava, Carroll E. Goering, Roger P. Rohrbach, Dennis R. Buckmaster, “Engineering Principles of Agricultural Machines”, ASABE Publication, 2019. |
| 2. | Qin Zhang, Francis J. Pierce, "Agricultural Automation Fundamentals and Practices", CRC Press, 2016. |

**Reference(s):**

| | |
|---|---|
| 1. | Prof PålJohan,Prof John Billingsley, “Robotics and Automation for Improving Agriculture, BurleighDodds Series in Agricultural Science”, 2019 |
| 2. | Stephen L Young, Francis J. Pierce, "Automation: The Future of Weed Control in Cropping Systems", Springer, Dordrecht Heidelberg New York London, 2014. |
| 3. | Kepner R.A., Roy Bainer, E.L. Barger, "Principles of Farm Machinery", 3rd Edition, CBS Publishers, New Delhi, 2015. |

*SDG 9 – Industry Innovation and Infrastructure
**SDG 12 – Responsible Production & Consumption

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **History of Mechanized Agriculture** | |
| 1.1 | Farming Operations and Related Machines | 1 |
| 1.2 | Tillage | 2 |
| 1.3 | Planting Cultivation and Harvesting | 2 |
| 1.4 | Agricultural Automation | 2 |
| 1.5 | Agricultural Vehicle Robot. | 2 |
| **2.0** | **Precision Agriculture** | |
| 2.1 | Sensors ,types and agricultural applications | 2 |
| 2.2 | Global Positioning System (GPS) | 1 |
| 2.3 | GPS for civilian use- Differential GPS, Carrier, phase GPS, Real-time kinematic GPS, Military GPS | 2 |
| 2.4 | Geographic Information System | 2 |
| 2.5 | Variable Rate Applications and Controller Area Networks | 2 |
| **3.0** | **Traction and Testing** | |
| 3.1 | Hitching, Principles of hitching, Types of hitches | 2 |
| 3.2 | Hitching and weight transfer | 1 |
| 3.3 | Control of hitches, Tires and Traction Models | 2 |
| 3.4 | Traction Predictor Spread Sheet | 1 |
| 3.5 | Soil Compaction, Traction Aids | 2 |
| 3.6 | Tractor Testing | 1 |
| **4.0** | **Soil Tillage and Weed Management** | |
| 4.1 | Tillage Methods and Equipment | 2 |
| 4.2 | Mechanics of Tillage Tools ,Performance of Tillage Implements ,Hitching of Tillage Implements | 2 |
| 4.3 | Weed Management | 1 |
| 4.4 | Conventional Cropping Systems, Tools | 2 |
| 4.5 | Crop Rotation ,Mechanical Cultivation | 2 |
| **5.0** | **Robotics and Greenhouse Automation** | |
| 5.1 | Robotic Applications in Tasks such as Pruning, Sorting, and Packing | 2 |
| 5.2 | Climate Control Systems | 1 |
| 5.3 | Automation of Irrigation and Nutrient Delivery. | 2 |
| 5.4 | Monitoring and Control of Greenhouse Environments | 2 |
| 5.5 | Sustainable Practices in Controlled Environments | 2 |

**Course Designer(s)**

Dr.M.Ravi – ravi@ksrct.ac.in

| 60 MC E22 | Design of Transmission Systems | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To learn about the and design process for mechanical power transmission components.
- To understand the standard procedure available for Design of Transmission of Mechanical elements
- To learn to use standard data and catalogues.
- To select and design drive systems for a wide variety of driven loads to a given performance specification.
- To design a power transmission component with quality assurance.

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Apply the concepts of design to belts, chains and rope drives. | Apply |
| CO2 | Apply the concepts of design to spur, helical gears. | Apply |
| CO3 | Apply the concepts of design to worm and bevel gears. | Apply |
| CO4 | Apply the concepts of design to gear boxes. | Apply |
| CO5 | Apply the concepts of design to cams, brakes and clutches. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | 3 |
| CO2 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | 3 |
| CO3 | 2 | 2 | 3 | - | - | 2 | - | - | - | - | - | - | 3 | 3 |
| CO4 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | 3 |
| CO5 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 10 | 10 | 30 |
| Understand | 20 | 20 | 40 |
| Apply | 30 | 30 | 30 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC E22 - Design of Transmission Systems** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Design of Flexible Elements***<br>Design of Flat Belts and Pulleys - Selection of V belts and Pulleys – Selection of Hoisting Wire Ropes and Pulleys – Design of Transmission Chains and Sprockets. | **[9]** |
| **Spur Gears and Parallel Axis Helical Gears***<br>Speed Ratios and Number of Teeth-Force Analysis -Tooth Stresses - Dynamic Effects – Fatigue Strength - Factor of Safety - Gear Materials – Design of Straight Tooth Spur & Helical Gears Based on Strength and Wear Considerations – Pressure Angle in the Normal and Transverse Plane- Equivalent Number of Teeth-Forces for Helical Gears. | **[9]** |
| **Bevel, Worm and Cross Helical Gears***<br>Straight Bevel Gear: Tooth Terminology, Tooth Forces and Stresses, Equivalent Number of Teeth. Estimating the Dimensions of Pair of Straight Bevel Gears. Herringbone Gears and Hypoid Gears. Worm Gear: Merits and Demerits Terminology. Thermal Capacity, Materials-Forces and Stresses, Efficiency, Estimating the Size of the Worm Gear Pair. Cross Helical: Terminology-Helix Angles-Estimating the Size of the Pair of Cross Helical Gears. Ball & Screw Mechanisms. | **[9]** |
| **Gear Boxes***<br>Geometric Progression - Standard Step Ratio - Ray Diagram, Kinematics layout -Design of Sliding Mesh Gear Box - Design of Multi Speed Gear Box for Machine Tool Applications - Constant Mesh Gear Box - Speed Reducer Unit. – Variable Speed Gear Box, Fluid Couplings, Torque Converters for Automotive Applications - Gearboxes in Vehicles | **[9]** |
| **CAMs, Clutches and Brakes***<br>Cam Design: Types-Pressure Angle and Under Cutting Base Circle Determination-Forces and Surface Stresses. Design of Plate Clutches –Axial Clutches-Cone Clutches-Internal Expanding Rim Clutches- Electromagnetic Clutches. Braking Methods - Advantages & Disadvantages- Band and Block Brakes - External Shoe Brakes – Internal Expanding Shoe | **[9]** |
| **Total Hours:** | **45** |

| **Text Book(s):** | |
|---|---|
| 1. | Bhandari V, "Design of Machine Elements", 4th Edition, Tata McGraw-Hill Book Co, 2016. |
| 2. | Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill, 2008 |
| **Reference(s):** | |
| 1. | Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 4 th Edition, Wiley, 2005 |
| 2. | Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, "Design of Machine Elements" 8th Edition, Printice Hall, 2003 |
| 3. | Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003 |
| 4. | Sundararajamoorthy T. V, Shanmugam. N, "Machine Design", Anuradha Publications, Chennai, 2003. |

*SDG 9 – Industry Innovation and Infrastructure

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Design of Flexible Elements** | |
| 1.1 | Design of Flat belts | 1 |
| 1.2 | Design of Pulleys | 1 |
| 1.3 | Selection of V Belts and Pulleys | 1 |
| 1.4 | Selection of Pulleys | 1 |
| 1.5 | Selection of Hoisting Wire Ropes | 2 |
| 1.6 | Design of Transmission Chains | 2 |
| 1.7 | Design of Sprockets. | 1 |
| **2.0** | **Spur Gears and Parallel Axis Helical Gears** | |
| 2.1 | Speed Ratios and Number of Teeth-Force Analysis | 2 |
| 2.2 | Tooth Stresses - Dynamic Effects | 1 |
| 2.3 | Fatigue Strength - Factor of Safety | 1 |
| 2.4 | Design of Straight Tooth Spur & Helical Gears Based on Strength and Wear Considerations | 2 |
| 2.5 | Pressure Angle in the Normal and Transverse Plane | 1 |
| 2.6 | Equivalent Number of Teeth-Forces for Helical Gears. | 2 |
| **3.0** | **Bevel, Worm and Cross Helical Gears** | |
| 3.1 | Straight Bevel Gear: Tooth Terminology, Tooth Forces and Stresses | 2 |
| 3.2 | Estimating the Dimensions of Pair of Straight Bevel Gears. | 1 |
| 3.3 | Herringbone Gears and Hypoid Gears | 1 |
| 3.4 | Worm Gear: Merits and Demerits Terminology, Materials-Forces and Stresses | 2 |
| 3.5 | Cross helical: Terminology-Helix Angles | 1 |
| 3.6 | Estimating the Size of the Pair of Cross Helical Gears | 1 |
| 3.7 | Ball & Screw Mechanisms | 1 |
| **4.0** | **Gear Boxes** | |
| 4.1 | Geometric Progression - Standard Step Ratio | 1 |
| 4.2 | Ray Diagram, Kinematics Layout | 1 |
| 4.3 | Design of Sliding Mesh Gear Box | 1 |
| 4.4 | Design of Multi Speed Gear Box for Machine Tool Applications | 2 |
| 4.5 | Constant Mesh Gear Box - Speed Reducer unit. | 1 |
| 4.6 | Variable Speed Gear Box, Fluid Couplings | 1 |
| 4.7 | Torque Converters for Automotive Applications | 1 |
| 4.8 | GEARBOXES in Vehicles | 1 |
| **5.0** | **CAMs, Clutches and Brakes** | |
| 5.1 | Cam Design: Types-Pressure Angle and Under Cutting Base Circle Determination | 2 |
| 5.2 | Forces and Surface Stresses | 1 |
| 5.3 | Design of Plate Clutches –Axial Clutches-Cone Clutches | 1 |
| 5.4 | Internal Expanding rim Clutches- Electromagnetic Clutches. | 2 |
| 5.5 | Braking Methods - Advantages & Disadvantages | 1 |
| 5.6 | Band and Block Brakes | 1 |
| 5.7 | External Shoe Brakes – Internal Expanding Shoe Brake | 1 |

**Course Designer(s)**

Dr.R.Senthilmurugan-senthilmurugan@ksrct.ac.in

| 60 MC E23 | Navigation and Communication Systems | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To familiarize the basic concept on inertial navigation systems
- To facilitate the various types of radio navigation & satellite navigation and their uses
- To gain knowledge on navigation system and guidance system of aircraft
- To provide exposure on the functions of various aircraft communication systems
- To familiarize the use of various principles of weather radar system and DME

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the advanced concepts of Aircraft Navigation | Understand |
| CO2 | Understand the necessary mathematical knowledge those are needed in modelling the navigation process and methods. | Understand |
| CO3 | Apply exposure on various Navigation systems such as Inertial Measurement systems, Radio Navigation Systems, Satellite Navigation and GPS | Apply |
| CO4 | Design Landing aids and will be able to deploy these skills effectively in the analysis and understanding of navigation systems in an aircraft. | Analyze |
| CO5 | Apply the principles of Radar and its related components. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 2 | 3 | - | 2 | - | - | 2 | - | - | - | 2 | 1 | 2 | 3 |
| CO2 | 3 | 3 | - | - | - | - | 3 | - | - | - | 2 | 2 | 2 | 2 |
| CO3 | 3 | 3 | 2 | 3 | - | 2 | - | - | - | - | 1 | 2 | 2 | 2 |
| CO4 | 2 | 2 | - | - | - | - | - | - | - | - | 2 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | - | - | - | - | - | - | 3 | 3 | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 30 | 20 | 30 |
| Understand | 30 | 20 | 30 |
| Apply | - | 10 | 30 |
| Analyse | - | 10 | 10 |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

| Syllabus | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC E23 - Navigation and Communication Systems** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Inertial Navigation Systems***<br>Introduction to Navigation – Types INS Components- Transfer Function and Errors – Earth in Inertial Space – Coriolis Effect – INS Mechanization. Platform and Strap Down – Navigation Algorithms | **[9]** |
| **Radio Naviation & Satellite Navigation***<br>Different Types of Radio Navigation- ADF, VOR, DME – Doppler – Hyperbolic Navigations -LORAN, DECCA and Omega – TACAN. Introduction to GPS -System Description -Basic Principles | **[9]** |
| **Navigation Concepts***<br>Fundamentals of Navigation Systems and Position Fixing – Categories of Navigation – Geometric Concepts of Navigation – The Earth in Inertial Space – Different Coordinate Systems – Coordinate Transformation – Euler Angle Formulations – Direction Cosine Matrices Formulation – Quaternion | **[9]** |
| **Aircraft Communication Systems***<br>Basics of Aircraft Communication System-Types Very High Frequency Communication system- Description, Principle, Operation of VHF Communication System - Layout on Aircraft, High Frequency Communication System. | **[9]** |
| **Weather Radar System and DME***<br>TCAS, ATC Transponders, Weather Radar System, Radio Altimeter, Arinc Communication & Reporting. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Navigation and Communication system “Aircraft Communications and Navigation systems” ,Longman Group UK Ltd., England, 2022. |
| 2. | Paul. D. Groves. Principles of GNSS, Inertial, and Multi sensor Integrated Navigation Systems, Artech House, 2020. |

**Reference(s):**

| | |
|---|---|
| 1. | Maxwell Noton, Spacecraft navigation and guidance, Springer (London, New York), 2015 |
| 2. | Albert D. Helfrick, Modern Aviation Electronics, Second Edition, Prentice Hall Career & Technology, 2016 |
| 3. | Albert Helfrick, Practical Aircraft Electronic Systems, Prentice Hall Education, Career & Technology, 2013 |
| 4. | George M Siouris, Aerospace Avionics System; A Modern Synthesis, Academic Press Inc., 2010 |

*SDG 9 – Industry Innovation and Infrastructure

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Aircraft Aerodynamics** | |
| 1.1 | Introduction to Navigation | 1 |
| 1.2 | Types INS Components | 1 |
| 1.3 | Transfer Function and Errors | 1 |
| 1.4 | Earth in inertial Space | 2 |
| 1.5 | Coriolis Effect | 1 |
| 1.6 | INS Mechanization. Platform and Strap Down | 2 |
| 1.7 | Navigation Algorithms | 1 |
| **2.0** | **Aircraft Propulsion** | |
| 2.1 | Different Types of Radio Navigation | 2 |
| 2.2 | ADF, VOR, DME& Doppler | 1 |
| 2.3 | Hyperbolic Navigations | 2 |
| 2.4 | LORAN, DECCA and Omega | 1 |
| 2.5 | Introduction to GPS ,System Description | 2 |
| 2.6 | Basic Principles | 1 |
| **3.0** | **Navigation AND Guidance System of Aircraft** | |
| 3.1 | Fundamentals of Navigation Systems and Position Fixing | 1 |
| 3.2 | Categories of Navigation | 2 |
| 3.3 | Geometric Concepts of Navigation | 1 |
| 3.4 | The Earth in Inertial Space | 1 |
| 3.5 | Different Coordinate Systems | 1 |
| 3.6 | Telementry Coordinate Transformation & Euler angle Formulations | 1 |
| 3.7 | Direction Cosine Matrices Formulation & Quaternion Formulation | 2 |
| **4.0** | **Aircraft Communication Systems** | |
| 4.1 | Basics of Aircraft Communication System | 2 |
| 4.2 | Types Very High Frequency Communication System | 2 |
| 4.3 | Description, Principle, Operation of VHF Communication System | 2 |
| 4.4 | layout on Aircraft. | 1 |
| 4.5 | High Frequency Communication System | 2 |
| **5.0** | **Weather Radar System and DME** | |
| 5.1 | TCAS | 2 |
| 5.2 | ATC Transponders | 2 |
| 5.3 | Weather Radar System | 2 |
| 5.4 | Radio Altimeter | 1 |
| 5.5 | Arinc Communication & Reporting, | 2 |

**Course Designer(s)**

Mr.S.HariPrasadh -hariprasadh@ksrct.ac.in

| 60 MC E24 | Non-Destructive Testing | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To learn the fundamentals of NDT Techniques
- To understand the basic principle so f various NDT methods
- To be aware of applications and limitations of the NDT techniques
- To know the different type of service and process defects.
- To learn the NDT method(s) best suite do evaluate the manufactured products.

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the fundamentals of NDT techniques and testing equipment. | Remember |
| CO2 | Understand the eddy current testing procedures for non-destructive testing | Apply |
| CO3 | Apply principles of magnetism to investigate the service and processing defects | Apply |
| CO4 | Select appropriate radio graphic techniques and X-Rays for evaluation | Apply |
| CO5 | Utilize ultrasonic testing as an NDT technique to investigate defects. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | - | - | - | - | 2 | 2 | 2 | - | - | - | 3 | 2 | 2 |
| CO2 | 3 | - | - | - | - | 2 | 2 | 2 | - | - | - | 3 | 2 | 2 |
| CO3 | 3 | - | - | - | - | 2 | 2 | 2 | - | - | - | 3 | 2 | 2 |
| CO4 | 3 | - | - | - | - | 2 | 2 | 2 | - | - | - | 3 | 2 | 2 |
| CO5 | 3 | - | - | - | - | 2 | 2 | 2 | - | - | - | 3 | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 10 | 10 | 40 |
| Understand | 20 | 20 | 30 |
| Apply | 30 | 30 | 30 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

w.e.f. 23/12/2023
Passed in the BoS Meeting Held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

CHAIRMAN
Board Of Studies/
Mechatronics Engineering

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC E24- Non Destructive Testing** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Visual Inspection and Liquid Penetrant Testing***<br>Introduction to Non Destructive Testing (NDT), Scope and Advantages of NDT, Comparison of NDT and Destructive Testing (DT), Classifications of NDT. Equipment Used for Visual Inspection-Magnifying Glass ,Magnifying Mirror, Microscope ,Borescope and Endoscope .Liquid Penetration Testing: Introduction, Principle, Procedures, Hazards Precautions, Advantages, Limitations and Applications. | **[9]** |
| **Eddy Current Testing***<br>Principle of Eddy Current Testing, Advantages, Disadvantages, Factors Affecting Eddy Current Response-Material Conductivity, Permeability, Frequency, Geometry and Proximity (Lift off)-Faraday's Law - Lenz's law - Types of Probes. | **[9]** |
| **Magnetic Particle Testing***<br>Principle of Magnetic Particle Testing-Different Methods to Generate Magnetic Fields-Magnetic Particle Testing Equipment and Testing Procedures - Methods of De-Magnetization- Magnetic Particle Medium-Evaluation of Test Indication Sand Acceptance Standards. | **[9]** |
| **Radio graphic Testing***<br>Radiography Principle- Electromagnetic Radiation Sources- X-ray Films, Exposure-Penetrometer radi graph Cimaging-Inspection Standards and Techniques–Neutronradiography–Radiography Applications, Limitations and Safety. | **[9]** |
| **Ultrasonic Testing****<br>Principle of Operation, Types of Ultrasonic Propagation- Ultrasonic Probes - Ultrasonic Transducers -Ultrasonic Testing Techniques. Method for Evaluating Discontinuities - Applications In Inspection Of Castings, Forgings, Extruded Steel Parts, Bars ,Pipes, Rails And Dimensions Measurements. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | J Prasad, CGK Nair, “Non-Destructive Testing and Evaluation of Materials”, TataMcGrawHill Education Private Limited, 2017. |
| 2. | PrakashRavi, ”Non destructive Testing Techniques”, New Age International publishers, 1st Revised Edition, 2010. |

**Reference(s):**

| | |
|---|---|
| 1. | Baldev Raj, Jayakumar.T, Thavasimuthu.M, “Practical Non Destructive Testing”, Narosa Publishing House, New Delhi, 3rd Edition, 2009. |
| 2. | American Society for Metals ,“Non Destructive Evaluation and Quality Control”: Metals Hand Book, Vol.17,9th Edition, Metals Park,1992. |
| 3. | PaulEMix, Wiley, “Introduction to Non-destructive Testing: A Training Guide”, 2nd Edition NewJersey,2005. |
| 4. | Y. Kong, C.J. Bennett,C.J. Hyde, “A Review of Non-Destructive Testing Techniques for the in-sit investigation off retting fatigue cracks “, Materials andDesign ,Vol.196, Elsevier, 2020. |

*SDG 9 – Industry Innovation and Infrastructure

**SDG 12–Responsible Production & Consumption

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Visual Inspection and Liquid Penetrant Testing** | |
| 1.1 | Introduction to Non Destructive Testing (NDT), Scope and Advantages of NDT | 1 |
| 1.2 | Comparison of NDT and Destructive Testing (DT) | 1 |
| 1.3 | Classifications of NDT, Equipment Used for Visual Inspection | 2 |
| 1.4 | Magnifying Glass, Magnifying Mirror, | 1 |
| 1.5 | Microscope, Borescope and Endoscope. | 1 |
| 1.6 | Liquid Penetration Testing: | 1 |
| 1.7 | Introduction, Principle, Procedures, Hazards Precautions, Advantages, Limitations and Applications. | 2 |
| **2.0** | **Eddy Current Testing** | |
| 2.1 | Principle of Eddy Current Testing | 1 |
| 2.2 | Advantages, Disadvantages | 1 |
| 2.3 | Factors affecting Eddy Current Response | 2 |
| 2.4 | Material Conductivity, Permeability | 1 |
| 2.5 | Frequency, Geometry and Proximity (Lift off) | 2 |
| 2.6 | Faraday's Law - Lenz's law | 1 |
| 2.7 | Types of Probes | 1 |
| **3.0** | **Magnetic Particle Testing** | |
| 3.1 | Principle of Magnetic Particle Testing | 2 |
| 3.2 | Different Methods to Generate Magnetic Fields | 1 |
| 3.3 | Magnetic Particle Testing Equipment and Testing Procedures | 2 |
| 3.4 | Methods of De-Magnetization | 1 |
| 3.5 | Magnetic Particle Medium | 1 |
| 3.6 | Evaluation of test indications and Acceptance Standards. | 2 |
| **4.0** | **Radiographic Testing** | |
| 4.1 | Radiography Principle | 1 |
| 4.2 | Electromagnetic Radiation Sources | 1 |
| 4.3 | X-ray Films, Exposure | 1 |
| 4.4 | Penetrometer Radiographic Imaging | 2 |
| 4.5 | Inspection Standards and Techniques | 1 |
| 4.6 | Neutron Radiography | 1 |
| 4.7 | Radiography Applications | 1 |
| 4.8 | limitations and Safety. | 1 |
| **5.0** | **Ultrasonic Testing** | |
| 5.1 | Principle of Operation | 1 |
| 5.2 | Types of Ultrasonic Propagation | 1 |
| 5.3 | Ultrasonic Probes - Ultrasonic Transducers | 1 |
| 5.4 | Ultrasonic Testing Techniques | 2 |
| 5.5 | Method for Evaluating Discontinuities | 1 |
| 5.6 | Applications in Inspection of Castings, Forgings, Extruded Steel Parts | 2 |
| 5.7 | Bars, Pipes, Rails and Dimensions Measurements | 1 |

**Course Designer(s)**

Dr.M.Baskaran -baskaranm@ksrct.ac.in

| 60 MC E25 | Optimization Techniques | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To impart knowledge about Operations Research techniques and enable students to take effective engineering and managerial decisions
- To equip students to find the optimum solution for transportation problems and assignment problems
- To train students to apply simulation techniques to solve Inventory and queuing problems
- To train students to apply Operations Research techniques for the effective utilization of available resources in engineering and business
- To impart knowledge about network models and train students to apply these concepts to solve the real world problems

## Pre-requisites

- Statistics and Numerical method

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Form the Linear Programming models and solve them. | Apply |
| CO2 | Apply transportation models and Assignment models to solve real world problems. | Apply |
| CO3 | Apply Inventory models to solve inventory problems | Apply |
| CO4 | Apply Queuing models to solve problems and analyze them using simulation techniques | Apply |
| CO5 | Construct Networks and find optimum solution | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 2 | 3 | - | 2 | - | - | - | - | - | - | 3 | 2 | 3 | - |
| CO2 | 3 | 2 | 3 | 2 | - | - | - | - | - | - | 3 | 2 | 2 | - |
| CO3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 2 | 3 | - | 3 |
| CO4 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | - | 2 |
| CO5 | 2 | 2 | - | 2 | - | - | - | - | - | - | 3 | 2 | 3 | - |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 10 | 20 | 30 |
| Understand | 20 | 25 | 45 |
| Apply | 30 | 15 | 25 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

**Syllabus**

<table>
<tr><td colspan="9" align="center">K.S.Rangasamy College of Technology – Autonomous R2022</td></tr>
<tr><td colspan="9" align="center">B.E - Mechatronics Engineering</td></tr>
<tr><td colspan="9" align="center">50 MC E25 - Optimization Techniques</td></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours/Week</td><td rowspan="2">Total Hours</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>VI</td><td>3</td><td>0</td><td>0</td><td>45</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="8">Formulation of Linear Programming*<br>Optimization Techniques- Definition, Phases & Models, Mathematical Formulation of Linear Programming –Graphical Solution - Simplex Method - Big M Method - Introduction to Duality Theory.</td><td>[9]</td></tr>
<tr><td colspan="8">Transportation Model*<br>Transportation Problems- Balanced and Unbalanced TP- Basic Feasible Solution, Degeneracy, Production Problems. Assignment Problems - Hungarian Method – Balanced Assignment Problems-, Travelling Salesman Problem.</td><td>[9]</td></tr>
<tr><td colspan="8">Inventory Models*<br>Types of inventory Models - Inventory Cost - Deterministic Inventory models - Economic Order Quantity (EOQ) - Purchase and Production Models Without Shortages - Determination of Buffer Stock and re-order Levels - ABC, VED & SDE Analysis in Inventory - Introduction to Stochastic Inventory.</td><td>[9]</td></tr>
<tr><td colspan="8">Queuing Theory and Simulation*<br>Queuing System - Terminologies of Queuing Problem - Applications of Queuing Model - Poisson Distribution and Exponential Distribution –Single Server Queuing Models – Simulation - Need for Simulation – Advantages, Disadvantages And Applications of Simulation - Random Number Generation – Monte Carlo Technique</td><td>[9]</td></tr>
<tr><td colspan="8">Network Models and Project Management*<br>Shortest Route Model- Minimal Spanning Tree Model - Maximum Flow Model – Project Network Construction – Network Logic - Fulkerson's Rule - Critical Path Method (CPM) and Project Evaluation and Review Technique (PERT) – Probability of Completing a Project in a Scheduled Date.</td><td>[9]</td></tr>
<tr><td colspan="8" align="right">Total Hours:</td><td>45</td></tr>
<tr><td colspan="8">Text Book(s):</td><td></td></tr>
<tr><td>1.</td><td colspan="8">Hamdy A. Taha, “Operation Research - An Introduction”, 9th Edition, Pearson India Education Services Pvt. Ltd., New Delhi, 2019.</td></tr>
<tr><td>2.</td><td colspan="8">Panneerselvam, R., “Operations Research” 2nd Edition, Prentice Hall of India Private Ltd, New Delhi, 2016.</td></tr>
<tr><td colspan="9">Reference(s):</td></tr>
<tr><td>1.</td><td colspan="8">Wayne L. Winston, “Operations Research – Applications and Algorithms”, 4th Edition, Cengage Learning, 2003 India Private Limited, New Delhi, 2011.</td></tr>
<tr><td>2.</td><td colspan="8">Perm Kumar Gupta, D.S. Hira, “Operations Research”, S. Chand and Company Ltd., 2008.</td></tr>
<tr><td>3.</td><td colspan="8">Srinivasan G, “Operations Research Principles and Applications”, 3rd Edition EEE PHI, 2017.</td></tr>
<tr><td>4.</td><td colspan="8">Sharma J K, “Operations Research Theory and Applications”, 5th Edition, Macmillan India, 2013.</td></tr>
</table>

*SDG 9 – Industry Innovation and Infrastructure

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | Formulation of Linear Programming | |
| 1.1 | Optimization techniques- Definition, Phases & Models | 1 |
| 1.2 | Mathematical Formulation of linear Programming | 1 |
| 1.3 | Graphical Solution | 2 |
| 1.4 | Simplex Method | 2 |
| 1.5 | Big M Method | 1 |
| 1.6 | Introduction to Duality Theory | 1 |
| 1.7 | Formulation of Linear Programming | 1 |
| **2.0** | Transportation Model | |
| 2.1 | Transportation | 1 |
| 2.2 | Balanced and Unbalanced TP | 2 |
| 2.3 | Basic Feasible Solution | 1 |
| 2.4 | Degeneracy, Production problems | 2 |
| 2.5 | Assignment Problems - Hungarian Method - Balanced Assignment Problems | 2 |
| 2.6 | Travelling Salesman Problem | 1 |
| **3.0** | Inventory Models | |
| 3.1 | Types of Inventory Models - Inventory Cost | 1 |
| 3.2 | Deterministic Inventory Models | 2 |
| 3.3 | Economic Order Quantity (EOQ) | 1 |
| 3.4 | Purchase and Production Models Without Shortages | 2 |
| 3.5 | Determination of Buffer Stock and re-Order levels | 1 |
| 3.6 | ABC, VED & SDE analysis in Inventory - Introduction to Stochastic inventory | 2 |
| **4.0** | Queuing Theory and Simulation | |
| 4.1 | Queuing System - Terminologies of Queuing Problem | 1 |
| 4.2 | Applications of Queuing Model | 1 |
| 4.3 | Poisson Distribution and Exponential Distribution | 2 |
| 4.4 | Single Server Queuing Models | 1 |
| 4.5 | Simulation - Need for Simulation, Advantages, Disadvantages and Applications of Simulation | 2 |
| 4.6 | Random Number Generation – Monte Carlo Technique | 2 |
| **5.0** | Network Models and Project Management | |
| 5.1 | Shortest Route Model | 1 |
| 5.2 | Minimal Spanning Tree Model | 1 |
| 5.3 | Maximum Flow Model | 1 |
| 5.4 | Project Network Construction – Network Logic | 2 |
| 5.5 | Fulkerson's Rule | 1 |
| 5.6 | Critical Path Method (CPM) | 2 |
| 5.7 | Project Evaluation and Review Technique (PERT) | 1 |

**Course Designer(s)**

Dr.P.Mohanram - mohanram@ksrct.ac.in

| 60 MC E26 | Supply Chain Management | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To provide an insight on the fundamentals of supply chain networks, tools and techniques.
- To describe the increasing significance of logistics and its impact on both costs and service in business and commerce.
- To incorporate and learn the critical elements of logistics and supply-chain management processes based on the most relevant application in forward-thinking companies.
- To develop a sound understanding of the important role of supply chain management in today's business environment
- To incorporate a meaningful focus on the rate of change occurring in business today, and more specifically, in business logistics.

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand fundamental supply chain management concepts. | Understand |
| CO2 | Understand the foundational role of logistics in transportation system. | Understand |
| CO3 | Integrating and optimizing the total logistics and supply-chain design. | Understand |
| CO4 | Co-ordinate the efficient handling and movement of goods, services, materials and related information within and between supply chains | Apply |
| CO5 | Learn and apply computer-based supply chain management | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 2 | - | 3 | - | - | - | - | - | - | - | 2 | - | 2 | 1 |
| CO2 | 2 | - | 3 | - | - | - | - | - | - | - | 2 | - | 2 | 1 |
| CO3 | 2 | - | 3 | - | - | - | - | - | - | - | 2 | - | 3 | 1 |
| CO4 | 2 | - | 3 | - | - | - | - | - | - | - | 2 | - | 3 | 1 |
| CO5 | 2 | - | 3 | - | - | - | - | - | - | - | 2 | - | 2 | 1 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 10 | 10 | 20 |
| Understand | 50 | 30 | 60 |
| Apply | - | 20 | 20 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

**Syllabus**

<table>
<tr><td colspan="9">K.S.Rangasamy College of Technology – Autonomous R2022</td></tr>
<tr><td colspan="9">B.E - Mechatronics Engineering</td></tr>
<tr><td colspan="9">60 MC E26 - Supply Chain Management</td></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours/Week</td><td rowspan="2">Total Hours</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>VI</td><td>3</td><td>0</td><td>0</td><td>45</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="8">Introduction*<br>Role of Logistics and Supply chain Management: 5 Basic Steps of Supply Chain Management -Scope and Importance- Evolution of Supply Chain - Decision Phases in Supply Chain - Competitive and Supply Chain Strategies — Drivers of Supply Chain Performance and Obstacles.</td><td>[9]</td></tr>
<tr><td colspan="8">Logistics in Supply Chain**<br>Role of Transportation in Supply Chain – Factors Affecting Transportations Decision – Design Option for Transportation Network – Tailored Transportation- Third-Party Logistics - Logistics Intelligence.</td><td>[9]</td></tr>
<tr><td colspan="8">Coordinated Product and Supply Chain Design*<br>General Framework - Design for logistics – Reverse logistics- Supplier Integration into the new Product Development - Mass Customization - Value-Added Services-Differential Pricing- Dynamic Pricing.</td><td>[9]</td></tr>
<tr><td colspan="8">Sourcing and Coordination in Supply Chain*<br>Role of Sourcing Supply Chain Supplier Selection Assessment and Contracts- Design collaboration - Sourcing Planning and Analysis - Planning Demand and Supply- Planning and Managing Inventories - Production Planning & Control-Supply Chain co-Ordination - Bull Whip Effect –Effect of lack of co-ordination in Supply Chain and Obstacles — Building Strategic Partnerships and Trust Within a Supply Chain.</td><td>[9]</td></tr>
<tr><td colspan="8">Supply Chain and Information Technology**<br>The Role IT in Supply Chain- The Supply Chain IT Frame work Customer Relationship Management — Internal Supply Chain Management — Supplier Relationship Management.</td><td>[9]</td></tr>
<tr><td colspan="8" align="right">Total Hours:</td><td>45</td></tr>
<tr><td colspan="8">Text Book(s):</td><td></td></tr>
<tr><td>1.</td><td colspan="8">Sunil Chopra, Peter Meindl and Kalra, “Supply Chain Management, Strategy, Planning, and Operation”, Pearson Education, 2010.</td></tr>
<tr><td>2.</td><td colspan="8">David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, "Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies", McGraw Hill, India, Fourth edition, 2022.</td></tr>
<tr><td colspan="9">Reference(s):</td></tr>
<tr><td>1.</td><td colspan="8">Srinivasan G.S, “Quantitative models in Operations and Supply Chain Management, PHI, 2010</td></tr>
<tr><td>2.</td><td colspan="8">David J.Bloomberg , Stephen Lemay and Joe B.Hanna, “Logistics”, PHI 2002</td></tr>
<tr><td>3.</td><td colspan="8">Jeremy F.Shapiro, “Modeling the Supply Chain”, Thomson Duxbury, 2002.</td></tr>
<tr><td>4.</td><td colspan="8">James B.Ayers, “Handbook of Supply Chain Management”, St.Lucle press, 2000.</td></tr>
</table>

*SDG 9 – Industry Innovation and Infrastructure

**SDG 12 – Responsible Consumption and Production

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Introduction** | |
| 1.1 | Role of Logistics and Supply Chain Management: | 1 |
| 1.2 | 5 basic Steps of Supply Chain Management | 1 |
| 1.3 | Scope and Importance of Supply Chain Management | 1 |
| 1.4 | Evolution of Supply Chain | 1 |
| 1.5 | Decision Phases in Supply Chain | 1 |
| 1.6 | Competitive and Supply chain Strategies | 2 |
| 1.7 | Drivers of Supply Chain Performance and Obstacles | 2 |
| **2.0** | **Logistics in Supply Chain** | |
| 2.1 | Role of Transportation in Supply Chain | 1 |
| 2.2 | Factors Affecting Transportations Decision | 1 |
| 2.3 | Design Option for Transportation Network | 1 |
| 2.4 | Tailored Transportation | 2 |
| 2.5 | Third-party Logistics | 2 |
| 2.6 | Logistics Intelligence | 2 |
| **3.0** | **Coordinated Product and Supply Chain Design** | |
| 3.1 | General Framework - Design for logistics | 2 |
| 3.2 | Reverse logistics | 1 |
| 3.3 | Supplier Integration into the new Product Development | 2 |
| 3.4 | Mass Customization | 1 |
| 3.5 | Value-Added Services | 1 |
| 3.6 | Differential Pricing- Dynamic Pricing | 2 |
| **4.0** | **Sourcing and Coordination in Supply Chain** | |
| 4.1 | Role of Sourcing Supply Chain Supplier Selection Assessment and Contracts | 2 |
| 4.2 | Design Collaboration - Sourcing Planning and Analysis | 1 |
| 4.3 | Planning Demand and Supply- Planning and Managing Inventories | 2 |
| 4.4 | Production Planning & Control - Supply Chain co-ordination | 1 |
| 4.5 | Bull whip Effect –Effect of lack of co-ordination in Supply Chain and obstacles | 1 |
| 4.6 | Building Strategic Partnerships and trust within a Supply Chain. | 2 |
| **5.0** | **Supply Chain and Information Technology** | |
| 5.1 | The role IT in Supply Chain | 1 |
| 5.2 | The supply Chain IT Frame Work | 2 |
| 5.3 | Customer Relationship Management | 2 |
| 5.4 | Internal Supply Chain Management | 2 |
| 5.5 | Supplier Relationship Management. | 2 |

**Course Designer(s)**

Dr.M.Baskaran – baskaran@ksrct.ac.in

| 60 MC E27 | Robot Kinematics and Dynamics | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- Provide a mathematical and geometrical description of robotic manipulators
- To retain the best traditions of traditional calculus.
- Derive from first principles robot dynamics and know how to simulate them
- Understand basic robot control architectures
- Articulate scientific results to your peers

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Impart knowledge about kinematic and dynamic analysis of robot manipulators. | Understand |
| CO2 | Understand the Control both the position and orientation of the tool in the three dimensional space. | Understand |
| CO3 | Apply the relationship between the joint variables and the position and the orientation of the tool. | Apply |
| CO4 | Apply the Planning trajectories for the tool to follow on order to perform meaningful tasks. | Apply |
| CO5 | Apply the precise control of the high speed motion of the system. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO2 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO3 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO4 | 3 | 3 | - | - | - | 3 | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO5 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 10 | 20 | 20 |
| Understand | 50 | 20 | 60 |
| Apply | - | 20 | 20 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

w.e.f. 23/12/2023
Passed in the BoS Meeting Held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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Mechatronics Engineering

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E – Mechatronics Engineering** | | | | | | | | |
| **60 MC E27 - Robot Kinematics and Dynamics** | | | | | | | | |
| **Semester** | | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction**<br>Introduction, position and orientation of objects, objects coordinate frame Rotation matrix, Euler angles Roll, pitch and yaw angles coordinate Transformations, Joint variables and position of end effector, Dot and cross products, coordinate frames, Rotations, Homogeneous coordinates. | **[09]** |
| **Direct Kinematics**<br>Link coordinates D-H Representation, The ARM equation. Direct kinematic analysis for Four axis, SCARA Robot and three, five and six axis Articulated Robots. | **[09]** |
| **Inverse Kinematics**<br>The inverse kinematics problem, General properties of solutions. Tool configuration, Inverse kinematics of four axis SCARA robot and three and five axis, Articulated robot. | **[09]** |
| **Workspace Analysis and Trajectory Planning**<br>Workspace Analysis, work envelope of a Four axis SCARA robot and five axis articulated robot workspacefixtures, the pick and place operations, Joint space technique - continuous path motion, Interpolated motion, straight line motion and Cartesian space technique in trajectory planning. | **[09]** |
| **Manipulator Dynamics**<br>Introduction, Lagrange's equation kinetic and potential energy. Link inertia Tensor, link Jacobian Manipulator inertia tensor. Gravity, Generalized forces, Lagrange-Euler Dynamic model, Dynamic modelof a Two-axis planar robot, Newton Euler formulation, Lagrange Euler formulation, problems. | **[09]** |
| **Total Hours:** | **45** |

| | |
|---|---|
| **Text Book(s):** | |
| 1. | Robert J. Schilling, Fundamentals of Robotics Analysis and Control, PHI Learning, 2009. |
| 2. | Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, Robotics Engineering an Integrated Approach, Phi Learning., 2009. |
| **Reference(s):** | |
| 1. | John J. Craig, Introduction to Robotics Mechanics and Control, Third Edition, Pearson, 2008. |
| 2. | Tsuneo Yohikwa, Foundations ofRobotics Analysis and Control, MIT Press., 2003. |
| 3. | Bijay K. Ghosh, Ning Xi, T.J. Tam, Control in Robtics and Automation Sensor - Based integration, Academic Press, 1999. |
| 4. | Bernard Hodges, Industrial Robotics, Second Edition, Jaico Publishing house, 1993. |

*SDG 3 – Good Health and Well Being



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## Course Contents and Lecture Schedule

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Introduction** | |
| 1.1 | Position and orientation of objects, objects coordinate | 2 |
| 1.2 | Frame Rotation matrix, Euler angles | 1 |
| 1.3 | Roll, pitch and yaw angles coordinate Transformations | 2 |
| 1.4 | Joint variables and position of end effector, Dotand cross products | 2 |
| 1.5 | Coordinate frames, Rotations, Homogeneous coordinates. | 2 |
| **2.0** | **Direct Kinematics** | |
| 2.1 | Link coordinates D-H Representation | 1 |
| 2.2 | ARM equation, Direct kinematic | 2 |
| 2.3 | Analysis for Four axis SCARARobot and three | 2 |
| 2.4 | Five and six axis | 2 |
| 2.5 | Articulated Robots | 2 |
| **3.0** | **Inverse Kinematics** | |
| 3.1 | The inverse kinematics problem | 2 |
| 3.2 | General properties of solutions | 2 |
| 3.3 | Tool configuration | 2 |
| 3.4 | Inverse kinematics of four axis | 2 |
| 3.5 | SCARA robot and three and five axis, Articulated robot | 1 |
| **4.0** | **Workspace Analysis and Trajectory Planning** | |
| 4.1 | Workspace Analysis, work envelope of a Four axis | 2 |
| 4.2 | SCARA robot and five axis articulated robot workspace | 2 |
| 4.3 | Fixtures, the pick and place operations, Joint space technique | 2 |
| 4.4 | Continuous path motion, Interpolated motion, straight line motion and Cartesian | 2 |
| 4.5 | Space technique in trajectory planning | 1 |
| **5.0** | **Manipulator Dynamics** | |
| 5.1 | Introduction, Lagrange's equation kinetic and potential energy. Link inertia Tensor, link Jacobian | 1 |
| 5.2 | Manipulator inertia tensor. Gravity, Generalized forces, Lagrange | 2 |
| 5.3 | Euler Dynamic model, Dynamic model of a Two-axis | 2 |
| 5.4 | Planar robot, Newton Euler formulation | 2 |
| 5.5 | Lagrange Euler formulation, problems Lagrange Euler formulation, problems | 2 |

## Course Designer(s)

Dr. A.Ramesh Kumar - rameshkumar@ksrct.ac.in

| 60 MC E31 | Robots and Systems in Smart Manufacturing | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To acquire the basic concepts of Industrial Robot.
- To selection of robots based on various applications.
- To familiar with a material handling system
- To impart the knowledge on robotic welding
- To obtain the knowledge on various type of robot welding operation

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Recognize various concepts of Industrial Robot. | Understand |
| CO2 | Select the appropriate manufacturing procedure for Robots | Understand |
| CO3 | Apply various manufacturing process in Robot manufacturing. | Understand |
| CO4 | Learn about the Welding operation and also related to Programming | Understand |
| CO5 | Produce a manufacturing plan for developing a robot | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 1 | 2 | 3 | 3 | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 3 | 3 |
| CO4 | 2 | 2 | 3 | 3 | 1 | 2 | 1 | 2 | 3 | 1 | 2 | 2 | 3 | 3 |
| CO5 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 30 | 20 | 30 |
| Understand | 30 | 40 | 40 |
| Apply | - | - | 30 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

w.e.f. 23/12/2023
Passed in the BoS Meeting Held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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Mechatronics Engineering

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MCE31 - Robots and Systems in Smart Manufacturing** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction*** <br> Types of Industrial Robots – Load Handling Capacity – General Considerations in Robotic Material Handling-Material Transfer – Machine Loading and Unloading – CNC Machine tool Loading – Robot Centered cell | **[9]** |
| **Selection of Robots and Other Applications*** <br> Factors Influencing the Choice of a Robot – Robot Performance Testing – Economics of Robotisation – Impact of Robot on Industry and Society. Application of Robots in Continuous arc Welding – Spot Welding – Spray Painting -Assembly Operation – Cleaning – Robot for Underwater Applications. | **[9]** |
| **Traction and Testing*** <br> Hitching- Principles of Hitching- Types of Hitches- Hitching and Weight Transfer- Control of Hitches- Tires and Traction Models-Traction predictor Spread Sheet- Soil Compaction- Traction Aids- Tractor Testing. | **[9]** |
| **Material Handling*** <br> Concepts of Material Handling - Principles and Considerations in Material Handling Systems Design - Conventional Material Handling Systems - Industrial Trucks - Monorails - Rail Guided Vehicles - Conveyor Systems -Cranes and Hoists - Advanced Material Handling Systems - Automated Guided Vehicle Systems - Automated Storage and Retrieval Systems(ASRS) - Bar Code Technology - Radio Frequency Identification Technology -Introduction to Automation Plant Design Software. | **[9]** |
| **Applications of Robots in Welding and Allied Processes**** <br> Application of Robot in Manufacturing: Exploration of Practical Application of Robots in Welding: Robots for Car Body's Welding, Robots for Box Fabrication, Robots for Microelectronic Welding and Soldering – Applications in Nuclear, Aerospace and ship Building, Case Studies for Simple and Complex Applications. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Ajit K. Srivastava, Carroll E. Goering, Roger P. Rohrbach, Dennis R. Buckmaster, "Engineering Principles of Agricultural Machines", ASABE Publication, 2012. |
| 2. | Pires J N, Loureiro A, Bolmsjo G, "Welding Robots: Technology, System Issues and Application", Springer, London, 2010. |

**Reference(s):**

| | |
|---|---|
| 1. | Parmar R S , "Welding Processes and Technology", Khanna Publishers, New Delhi, 2nd Edition, 2013. |
| 2. | John A. piotrowski, William T. Randolph, "Robotic welding: A Guide to Selection and Application, Welding Division, Robotics International of SME", Publications Development Dept., Marketing Division, 1987. |
| 3. | Mikell P Groover, Mitchel Weiss, Roger N Nagel, N.G. Odrey, AshishDutta, "Industrial Robotics (SIE): Technology, Programming and Applications", 2nd Edition, McGraw Hill Education India Pvt Ltd, 2012. |
| 4. | YoramKoren , "Robotics for Engineers", McGraw-Hill, 1987. |

*SDG 9 – Industry Innovation and Infrastructure
**SDG 4 – Quality Education

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Introduction** | |
| 1.1 | Types of Industrial Robots | 2 |
| 1.2 | Load Handling Capacity | 1 |
| 1.3 | General Considerations in Robotic Material Handling | 2 |
| 1.4 | Material Transfer, Machine Loading and Unloading | 2 |
| 1.5 | CNC machine tool Loading , Robot Centered Cell | 2 |
| **2.0** | **Electrical and Emission Control System** | |
| 2.1 | Battery: Function, Types, Construction and Working Principle (Lead Acid and Lithium Ion) | 2 |
| 2.2 | Starting and Charging System: Function, Layout and Working Principle | 2 |
| 2.3 | Lighting System: Function and Layout | 2 |
| 2.4 | Vehicle Pollutants and its Effect | 1 |
| 2.5 | Emission Control System: Function, Construction and Working Principle (Catalytic Convertor & Exhaust Gas Recirculation) | 2 |
| **3.0** | **Traction and Testing** | |
| 3.1 | Hitching, Principles of Hitching, Types of Hitches | 2 |
| 3.2 | Hitching and Weight Transfer | 1 |
| 3.3 | Control of hitches, Tires and Traction Models | 2 |
| 3.4 | Traction Predictor Spread Sheet | 1 |
| 3.5 | Soil Compaction, Traction Aids | 2 |
| 3.6 | Tractor Testing | 1 |
| **4.0** | **Material Handling** | |
| 4.1 | Concepts Of Material Handling ,Principles And Considerations In Material Handling Systems Design | 2 |
| 4.2 | Conventional Material Handling Systems ,Industrial Trucks | 2 |
| 4.3 | Monorails, Rail Guided Vehicles ,Conveyor Systems | 1 |
| 4.4 | Cranes and Hoists, Advanced Material Handling Systems, Automated Guided Vehicle Systems, Automated Storage and Retrieval Systems(ASRS) | 2 |
| 4.5 | Bar Code Technology, Radio Frequency Identification Technology, Introduction to Automation Plant Design Software | 2 |
| **5.0** | **Applications of Robots in Welding and Allied Processes** | |
| 5.1 | Application of Robot in Manufacturing: Exploration of Practical Application of Robots in Welding | 2 |
| 5.2 | Robots for Car Body's Welding, Robots for Box Fabrication | 1 |
| 5.3 | Robots for Microelectronic Welding and Soldering | 2 |
| 5.4 | Applications in Nuclear, Aerospace and Ship Building | 2 |
| 5.5 | Case Studies for Simple and Complex Applications | 2 |

**Course Designer(s)**

Dr.M.Ravi – ravi@ksrct.ac.in

| 60 MC E32 | Automotive Electronics | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To study the basics of electronics and Various Vehicle Sensors.
- To study the Ignition and Injection system in Automobiles
- To expose students about the automotive engine management and its construction details.
- To understand the principles of comfort, safety systems
- To understand the concept of advanced vehicle technologies of automobiles.

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Know the working of Various Vehicle Sensors | Remember |
| CO2 | Understand the electronic fuel injection/ignition components and their function. | Understand |
| CO3 | Study the construction details of new developments in engine management | Understand |
| CO4 | Exposure of different automotive safety systems | Understand |
| CO5 | Acquire knowledge about advanced vehicle technology and navigation systems | Understand |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 1 | 2 | 3 | 3 | 1 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 3 | 3 |
| CO4 | 2 | 2 | 3 | 3 | 1 | 2 | 1 | 2 | 3 | 1 | 2 | 1 | 3 | 3 |
| CO5 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 30 | 20 | 50 |
| Understand | 30 | 40 | 50 |
| Apply | - | - | - |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

| Syllabus | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC E32 - Automotive Electronics** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Vehicle Sensors*** <br> Working principle of Sensors-Speed and Pressure Sensors, Vehicle Speed Sensors(VSS), Manifold Absolute Pressure Sensor(MAP), Knock Sensor, Mass air Flow Sensor (MAF)-Temperature Sensors, Coolant and Exhaust gas Temperature Sensor, Exhaust Oxygen Level Sensor-Position Sensors, Throttle Position Sensor, Accelerator Pedal Position Sensor and Crank Shaft Position Sensor-Air Mass Flow Sensor. | **[9]** |
| **Ignition and Injection*** <br> Ignition Systems: Ignition Fundamental, Types of Electronic Ignition Systems. Programmed Ignition, Distribution less Ignition, Direct Ignition, IGBTs Automotive Ignition-Spark Plugs – Injection Systems – Throttle Body Injection – Multipoint Fuel Injection – Sequential Fuel Injection – GDI –CRDI- Supercharger. | **[9]** |
| **Engine Management*** <br> Introduction: Input, output and Control Strategies, Combined Electronic Ignition and Fuel Management Systems – Exhaust Emission Control – Advanced vehicle Control Systems – New Developments in Engine Management System, Fuel Injection Timing Control. | **[9]** |
| **Safety and Comfort**** <br> Antilock Braking System (ABS) – Traction Control System (TCS) —Electric Seats-Power Steering, Mirrors and Sun-Roofs – Central locking and Electric Windows - Cruise Control System (CCS) - Electric Power Steering - Electronic Clutch – Electronic Suspension system – Airbags, Seat Belt Tensioners, Collision Avoidance Radar Warning System and Low tire Pressure Warning System. | **[9]** |
| **Advanced Vehicle Technology**** <br> Gasoline Direct Injection.- Electronic Control of Automatic Transmission (ECAT) – Keyless Entry – Noise Control – Reverse Sensing / Parking aid – Car Navigation System – Telematics - Global Positioning System, e- Mobility. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Tom Denton, “Automobile Electrical and Electronics Systems”, Edward Arnold Publishers, 2000. |
| 2. | Ribbens, "Understanding Automotive Electronics", 8th Edition, Elsevier, Indian Reprint, 2017. |

**Reference(s):**

| | |
|---|---|
| 1. | Allan Bonnick, Automotive computer controlled systems, Kindle Edition, 2012. |
| 2. | William B. Ribbens, “Understanding Automotive Electronics”, Butterworth-Heinemann, Burlington, 2003. |
| 3. | Richard K. Dupuy “Fuel System and Emission controls”, Check Chart Publication,4th edition, 2000. |
| 4. | Bosch Automotive Hand Book, 8 th Edition, 2011. |

*SDG 9 – Industry Innovation and Infrastructure
**SDG 4 – Quality Education



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## Course Contents and Lecture Schedule

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Vehicle Sensors** | |
| 1.1 | Working Principle of Sensors-Speed and Pressure Sensors | 1 |
| 1.2 | Vehicle Speed Sensors(VSS), Manifold Absolute Pressure Sensor(MAP), | 1 |
| 1.3 | Knock Sensor, Mass air Flow Sensor (MAF) | 1 |
| 1.4 | Temperature Sensors, Coolant and Exhaust gas temperature Sensor, Exhaust Oxygen level Sensor | 1 |
| 1.5 | Position Sensors, Throttle Position Sensor | 1 |
| 1.6 | Accelerator Pedal Position Sensor and Crank Shaft Position Sensor | 2 |
| 1.7 | Air mass Flow Sensor. | 2 |
| **2.0** | **Ignition and Injection** | |
| 2.1 | Ignition Systems: Ignition Fundamental, Types of Electronic Ignition Systems. | 1 |
| 2.2 | Programmed Ignition, Distribution Less Ignition, | 1 |
| 2.3 | Direct ignition, IGBTs Automotive Ignition | 1 |
| 2.4 | Spark Plugs – Injection Systems | 2 |
| 2.5 | Throttle Body Injection – Multipoint Fuel Injection | 2 |
| 2.6 | Sequential Fuel Injection – GDI –CRDI- Supercharger | 2 |
| **3.0** | **Engine Management** | |
| 3.1 | Introduction: INPUT, Output and Control Strategies, | 2 |
| 3.2 | Combined Electronic Ignition and Fuel Management Systems | 1 |
| 3.3 | Exhaust Emission Control | 2 |
| 3.4 | Advanced Vehicle Control Systems | 1 |
| 3.5 | New Developments in Engine Management System, | 1 |
| 3.6 | Fuel Injection Timing Control. | 2 |
| **4.0** | **Safety and Comfort** | |
| 4.1 | Antilock Braking System (ABS) | 2 |
| 4.2 | Traction Control System (TCS) | 1 |
| 4.3 | Electric Seats-Power Steering, Mirrors and Sun-Roofs – Central locking and Electric Windows - Cruise Control System (CCS) | 2 |
| 4.4 | Electric Power Steering - Electronic Clutch | 1 |
| 4.5 | Electronic Suspension System | 1 |
| 4.6 | Airbags, Seat Belt Tensioners, Collision Avoidance Radar Warning System And Low Tire Pressure Warning System | 2 |
| **5.0** | **Advanced Vehicle Technology** | |
| 5.1 | Gasoline Direct Injection. | 1 |
| 5.2 | Electronic Control of Automatic Transmission (Ecat) – Keyless Entry | 2 |
| 5.3 | Noise Control – Reverse Sensing / Parking Aid | 2 |
| 5.4 | Car Navigation System – Telematics | 2 |
| 5.5 | Global Positioning System, E- Mobility | 2 |

## Course Designer(s)

Dr.C.Vijayakumar – vijayakumarc@ksrct.ac.in

| 60 MC E33 | Design of UAV Systems | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To expose students to concepts needed in modelling and analysing an unmanned system.
- To expose students to the design and development of UAV.
- To expose students to the type of payloads used in UAV.
- To study path planning communication and payload control
- To understand the avionics hardware used in the UAV

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the concept of UAV system | Understand |
| CO2 | Prepare preliminary design requirements for an unmanned aerial vehicle. | Understand |
| CO3 | Identify different hardware for UAV | Understand |
| CO4 | Perform system testing for unmanned aerial vehicles | Understand |
| CO5 | Design micro aerial vehicle systems by considering practical limitations. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 3 |
| CO2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 2 | 3 | 3 | 1 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 2 | 2 | 3 |
| CO4 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 3 | 2 |
| CO5 | 3 | 3 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 30 | 20 | 40 |
| Understand | 30 | 40 | 40 |
| Apply | - | - | 20 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |



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**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC E33 - Design of UAV Systems** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to UAV***<br>History of UAV –Classification – Introduction to Unmanned Aircraft Systems--Models and Prototypes – System Composition-Applications. | **[9]** |
| **The Design of UAV Systems***<br>Introduction to Design and Selection of the System- Aerodynamics and Airframe Configurations Characteristics of Aircraft Types- Design Standards and Regulatory Aspects-UK,USA and Europe Design for Stealth--Control Surfaces-Specifications. | **[9]** |
| **Avionics Hardware***<br>Autopilot – AGL-Pressure Sensors-Servos-Accelerometer –Gyros-Actuators- Power Supply Processor, Integration, Installation, Configuration, and Testing. | **[9]** |
| **Communication Payloads and Controls***<br>Payloads-Telemetry-Tracking-Aerial Photography-Controls-PID Feedback-Radio Control Frequency Range –Modems-Memory System-Simulation-Ground Test-Analysis-Trouble Shooting. | **[9]** |
| **The Development of UAV Systems***<br>Waypoints Navigation-Ground Control Software- System Ground Testing- System In-Flight Testing Future Prospects and Challenges-Case Studies – Mini and Micro UAVs. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Paul G Fahlstrom, Thomas J Gleason, “Introduction to UAV Systems”, UAV Systems, Inc, 1998 |
| 2. | Reg Austin “Unmanned Aircraft Systems UAV design, development and deployment”, Wiley, 2010. |

**Reference(s):**

| | |
|---|---|
| 1. | Dr. Armand J. Chaput, “Design of Unmanned Air Vehicle Systems”, Lockheed Martin Aeronautics Company, 2001 |
| 2. | Kimon P. Valavanis, “Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy”, Springer, 2007 |
| 3. | Robert C. Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998. |

*SDG 9 – Industry Innovation and Infrastructure

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Introduction to UAV** | |
| 1.1 | History of UAV | 2 |
| 1.2 | Classification | 1 |
| 1.3 | Introduction to Unmanned Aircraft Systems | 2 |
| 1.4 | Models and Prototypes | 1 |
| 1.5 | System Composition | 2 |
| 1.6 | Applications | 1 |
| **2.0** | **The Design of UAV Systems** | |
| 2.1 | Introduction to Design and Selection of the System | 2 |
| 2.2 | Aerodynamics and Airframe Configurations | 1 |
| 2.3 | Characteristics of Aircraft Types | 2 |
| 2.4 | UK,USA and Europe Design for Stealth | 2 |
| 2.5 | Control Surfaces | 1 |
| 2.6 | Specifications | 1 |
| **3.0** | **Avionics Hardware** | |
| 3.1 | Autopilot | 1 |
| 3.2 | AGL | 1 |
| 3.3 | Pressure sensors | 1 |
| 3.4 | Servos, Accelerometer | 1 |
| 3.5 | Gyros, Actuators | 1 |
| 3.6 | Specifications | 1 |
| 3.7 | Power Supply Processor | 1 |
| 3.8 | Integration, installation, Configuration, and Testing | 2 |
| **4.0** | **Communication Payloads and Controls** | |
| 4.1 | Payloads | 1 |
| 4.2 | Telemetry-Tracking | 1 |
| 4.3 | Aerial Photography | 1 |
| 4.4 | Controls-PID Feedback. | 1 |
| 4.5 | Radio Control Frequency Range | 1 |
| 4.6 | Modems-Memory System | 1 |
| 4.7 | Simulation-Ground Test-Analysis | 2 |
| 4.8 | Trouble Shooting | 1 |
| **5.0** | **The Development of UAV Systems** | |
| 5.1 | Waypoints Navigation | 1 |
| 5.2 | Ground Control Software | 2 |
| 5.3 | System Ground Testing | 1 |
| 5.4 | System In-Flight Testing | 2 |
| 5.5 | Future Prospects and Challenges | 1 |
| 5.6 | Case Studies – Mini and Micro UAVs | 2 |

**Course Designer(s)**

Mr.S.Hari Prasadh -hariprasadh@ksrct.ac.in

| 60 MC E34 | Non-Conventional Machining Processes | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- Give an exposure about various unconventional machining processes.
- Recognize the role of mechanical energy in unconventional machining processes.
- Gain the knowledge on machining the electrically conductive material through electrical energy in unconventional machining processes
- Impart specifies the concept of machining the hard material using chemical energy and electrochemical energy.
- Familiarity with various thermal energy based unconventional machining processes.

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Describe the classification of non-traditional machining methods and process selection. | Understand |
| CO2 | Understand the Mechanical energy based unconventional machining processes. | Understand |
| CO3 | Understand the Electrical energy based unconventional machining processes. | Understand |
| CO4 | Recognize the Chemical and Electrochemical energy based unconventional machining processes. | Understand |
| CO5 | Understand the Thermal energy based unconventional machining processes | Understand |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 2 | 2 | 1 | - | 2 | 2 | 2 | 1 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 3 | 1 | 2 | - | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 1 | 1 | - | 2 | 2 | 1 | 1 | 3 | 3 | 3 |
| CO4 | 2 | 2 | 3 | 3 | 1 | 2 | - | 2 | 3 | 1 | 2 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 2 | 1 | 1 | 2 | - | 2 | 1 | 1 | 2 | 3 | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 30 | 20 | 50 |
| Understand | 30 | 40 | 50 |
| Apply | - | - | - |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

| Syllabus | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC E34 - Non-Conventional Machining Processes** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction***<br>Introduction - Need of non-traditional Machining Methods - Classification of Modern Machining Processes, Process Selection, Materials Applications. Ultrasonic Machining: Elements of the Process, Mechanics of Metal Removal Process, Parameters, Economic Considerations, Applications and Limitations, Recent Development. | **[9]** |
| **Mechanical Energy Based Processes***<br>Abrasive Jet Machining, Water Jet Machining and Abrasive Water Jet Machining: Basic Principles, Equipment, Process Variable, and Mechanics of Material Removal (MRR)- Application and Limitations | **[9]** |
| **Electrical Energy Based Processes****<br>Electric Discharge Machining (EDM): Basic Principle, Equipment, Process Parameters, Surface Finish and MRR, Electrode/Tool, Power and Control Circuits, Tool Wear, Dielectric, Flushing. Wire cut EDM, Applications. | **[9]** |
| Chemical and Electro-Chemical Energy Based Processes*<br>Chemical Machining: Etchants, Maskant, Techniques of Applying Mask Ants, Process Parameters, Surface Finish and MRR, Applications. Electro-Chemical Machining: Basic Principle, Equipment, Surface Roughness and MRR Electrical Circuit, Process Parameters, Electrochemical grinding and Electrochemical Honing Applications. | **[9]** |
| **Thermal Energy Based Processes****<br>Laser Beam Machining and Drilling (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam Control Techniques – Applications. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Singh K K, "Unconventional Manufacturing Process", Dhanpat Rai & Company, New Delhi, 2012. |
| 2. | P C Pandey and H S Shan, "Modern Machining Processes" Tata McGraw-Hill, New Delhi, 2017. |

**Reference(s):**

| | |
|---|---|
| 1. | Paul De Garmo, J.T. Black, and Ronald.A. Kohser, Material and Processes in Manufacturing, Prentice Hall of India Pvt. Ltd., New Delhi, 2011. |
| 2. | Serope Kalpakjian and Steven Schmid, "Manufacturing Engineering and Technology", 7th Edition, Pearson education India Ltd, New Delhi, 2013. |
| 3. | Mishra P. K, Non-Conventional Machining, Narosa Publishing House, New Delhi, 2010. |
| 4. | Gary F Benedict, 'Nontraditional Manufacturing processes", CRC press, 2011 |

*SDG 9 – Industry Innovation and Infrastructure
**SDG 13 –Climate Action



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| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Introduction and Mechanical Energy Based Processes** | |
| 1.1 | Comparison between Traditional and non- Conventional Machining Process | 1 |
| 1.2 | Need for Non - Conventional Machining Process | 1 |
| 1.3 | Classification Based on Nature of Energy Employed in Machining | 1 |
| 1.4 | Selection of non-Conventional Machining Processes | 1 |
| 1.5 | Specific Advantages, limitations and Applications | 1 |
| 1.6 | Abrasive Jet Machining - Working Principles – Equipment used – Process Parameters – MRR - Applications. | 1 |
| 1.7 | Water Jet Machining - Working Principles – Equipment used – Process Parameters – MRR - Applications. | 1 |
| 1.8 | Abrasive Water Jet Machining - Working Principles – Equipment used – Process Parameters – MRR - Applications. | 1 |
| 1.9 | Ultrasonic Machining - Working Principles – Equipment used – Process Parameters – MRR - Applications. | 1 |
| **2.0** | **Thermal and Electrical Energy Based Processes** | |
| 2.1 | Electric Discharge Machining – Working Principle – Equipments - Process Parameters - Surface Finish and MRR - Electrode/Tool – Power and Control Circuits - Tool Wear | 1 |
| 2.2 | Wire cut EDM - Working Principle – Equipments - Process Parameters - Surface Finish and MRR - Electrode/Tool – Power and Control Circuits - Tool Wear | 1 |
| 2.3 | Electrical Discharge Grinding Working Principle – Equipments - Process Parameters - Surface Finish and MRR - Electrode/Tool – Power and Control Circuits - Tool Wear | 1 |
| 2.4 | Flushing types - Pressure Flushing, Suction Flushing, Side Flushing, Pulsed Flushing. | 1 |
| 2.5 | EDM Process Parameters: Spark Frequency, Current & Spark Gap, Surface Finish, Heat Affected Zone | 1 |
| 2.6 | Laser Beam Machining - Principles – Equipment – Types – Beam control techniques – Applications | 1 |
| 2.7 | Laser Beam Drilling - Principles – Equipment – Types – Beam control techniques – Applications | 1 |
| 2.8 | Plasma Arc Machining - Principles – Equipment – Types – Beam control techniques – Applications | 1 |
| 2.9 | Electron Beam Machining - Principles – Equipment – Types – Beam control techniques – Applications | 1 |
| **3.0** | **Chemical and Electro-Chemical Energy Based Processes** | |
| 3.1 | Chemical Machining - Process Parameters | 1 |
| 3.2 | Surface Finish and MRR - Applications | 1 |
| 3.3 | Electro-Chemical Machining - Process Parameters | 1 |
| 3.4 | Surface Finish and MRR - Applications | 1 |
| 3.5 | Etchants – Maskant Techniques of Applying Maskants | 1 |
| 3.6 | Principles of ECM - Equipment - Surface Roughness | 1 |
| 3.7 | ECM - MRR - Electrical Circuit | 1 |
| 3.8 | Electro-Chemical Grinding - Process Parameters - Applications | 1 |
| 3.9 | Electro-Chemical Honing - Process Parameters - Applications | 1 |

| | | |
|---|---|---|
| **4.0** | **Advanced Nano Finishing Processes** | |
| 4.1 | Abrasive Flow Machining - Working Principles, Equipments | 1 |
| 4.2 | Effect Of Process Parameters, Applications, Advantages And Limitations | 1 |
| 4.3 | Chemo Mechanical Polishing - Working Principles, Equipments | 1 |
| 4.4 | Effect Of Process Parameters, Applications, Advantages And Limitations | 1 |
| 4.5 | Magnetic Abrasive Finishing - Working Principles, Equipments | 1 |
| 4.6 | Effect Of Process Parameters, Applications, Advantages And Limitations | 1 |
| 4.7 | Magnetorheological Abrasive Flow Finishing - Working Principles, Equipments | 2 |
| 4.8 | Effect Of Process Parameters, Applications, Advantages And Limitations | 1 |
| **5.0** | **Recent Trends In Non-Conventional Machining Processes** | |
| 5.1 | Recent Developments In Non-Conventional Machining Processes | 2 |
| 5.2 | Electric Discharge Diamond Grinding - Working Principles, Equipments | 1 |
| 5.3 | Effect Of Process Parameters, Applications, Advantages And Limitations | 1 |
| 5.4 | Wire Electro Discharge Grinding - Working Principles, Equipments | 1 |
| 5.5 | Effect Of Process Parameters, Applications, Advantages And Limitations | 1 |
| 5.6 | Electro Chemical Spark Machining - Working Principles, Equipments | 1 |
| 5.7 | Effect Of Process Parameters, Applications, Advantages And Limitations | 1 |
| 5.8 | Comparison Of Non-Conventional Machining Processes | 1 |

**Course Designer(s)**

Dr. A.Ramesh Kumar - rameshkumar@ksrct.ac.in

| 60 MC E35 | Product Design and Costing | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To enable the student to understand the various aspects of the product design and development.
- To educate the concept of customer need and product architecture.
- To train the student in the concept of product development economics in product design.
- To impart knowledge on various types of costs associated with production of components
- To educate the concept of work study and ergonomics and its influence in production.

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the fundamentals of product design, planning, development and product life cycle. | Understand |
| CO2 | Understand the significance of customer satisfaction and issues associated with it | Understand |
| CO3 | Learn the economic analysis process, factors affecting it and trade-offs. | Understand |
| CO4 | Estimate various types of costs for producing components by turning, drilling, shaping, planning, milling, grinding, welding and forging. | Understand |
| CO5 | Learn the process of work study, method study, tools and techniques used for it and able to calculate the standard time | Understand |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 2 | 2 | 1 | - | 2 | 2 | 2 | 2 | - | 3 | 3 |
| CO2 | 3 | 3 | 2 | 3 | 2 | 2 | - | 2 | 2 | 3 | 3 | - | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 1 | - | 2 | 2 | 1 | 1 | - | 3 | 3 |
| CO4 | 2 | 2 | 3 | 3 | 2 | 2 | - | 2 | 3 | 1 | 2 | - | 3 | 3 |
| CO5 | 3 | 3 | 2 | 1 | 1 | 2 | - | 2 | 1 | 1 | 2 | - | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 30 | 20 | 50 |
| Understand | 30 | 40 | 50 |
| Apply | - | - | - |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |



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Syllabus

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| B.E - Mechanical Engineering | | | | | | | | |
| 60 MC E35 - Product Design and Costing | | | | | | | | |
| Semester | Hours/Week | | | Total Hours | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Product Design and Development***<br>Principles Of Creativity In Design - Product Development Planning - Planning Process - Product Analysis — Criteria for Product Design - Market Research - Design for Customer And Design For Manufacture - Product Life Cycle. | **[9]** |
| **Customer Needs and Product Architecture***<br>Customer Satisfaction - Voice of Customer, Types of Customer Needs, Customer Need Model - Organizing and Prioritizing Customer Needs. Product Architecture - Architecture Types - Implication - Establishing Product Modularity – Types. | **[9]** |
| **Product Development Economics***<br>Elements of Economic Analysis - Quantitative Analysis- Qualitative Analysis. Economic Analysis Process - Build A Base- Case Financial Model - Sensitivity Analysis - Understand The Project Trade-offs - Influence of The Qualitative Factors on Project Success. | **[9]** |
| **Cost Estimation of Manufactured Jobs***<br>Cost Estimation to Find out Labor and Total Costs for Simple Machining Works Such As Turning, Drilling, Shaping Planning, Milling, Grinding, Cast, Welded and Forged Components. | **[9]** |
| **Work Study and Ergonomics**<br>Method Study - Definition - Objectives - Motion Economy Principles - Tools and Techniques — Applications. Work and Measurement - Purpose - Use - Procedure Techniques - Standard Time. Ergonomics - Tools - Principles - Applications. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Karl T. Ulrich, Steven D. Eppinger, "Product Design and Development", Tata Mc Graw-Hill edition, 4th Edition, 2012. |
| 2. | Kevin Otto, Kristin Wood, "Product Design: Techniques in Reverse Engineering and New Product Development", Pearson education, 2012. |

**Reference(s):**

| | |
|---|---|
| 1. | George E Dieter, " Engineering Design: A Materials and Processing Approach", McGraw Hill Publishing Company, London, 2000. |
| 2. | Stanley Walker Jones, "Product Design and Process Selection", Butterworth Publications, 1973. |
| 3. | Sameul Eilon, "Elements of Production Planning and Control", McMillan and Company, 1962. |
| 4. | R Kesavan, C Elanchezhian and B Vijaya Ramnath, "Process Planning and Cost Estimation", New Age International (P) Ltd., Publishers, 2015. |

*SDG 9 – Industry Innovation and Infrastructure

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Product Design and Development** | |
| 1.1 | Principles of Creativity In Design | 1 |
| 1.2 | Product Development Planning | 1 |
| 1.3 | Planning Process | 1 |
| 1.4 | Product Analysis | 1 |
| 1.5 | Criteria for Product Design | 1 |
| 1.6 | Market Research | 2 |
| 1.7 | Design for Customer And Design For Manufacture | 1 |
| 1.8 | Product Life Cycle | 1 |
| **2.0** | **Customer Needs And Product Architecture** | |
| 2.1 | Customer Satisfaction | 2 |
| 2.2 | Voice of Customer, Types of Customer Needs | 2 |
| 2.3 | Customer Need Model | 1 |
| 2.4 | Organizing and Prioritizing Customer Needs | 1 |
| 2.5 | Product Architecture, Architecture Types | 1 |
| 2.6 | Implication, Establishing Product Modularity ,Types | 2 |
| **3.0** | **Product Development Economics** | |
| 3.1 | Elements of Economic Analysis | 1 |
| 3.2 | Quantitative Analysis, Qualitative Analysis | 2 |
| 3.3 | Economic Analysis Process, Build A Base | 1 |
| 3.4 | Case Financial Model | 2 |
| 3.5 | Sensitivity Analysis | 1 |
| 3.6 | Understand The Project Trade-Offs | 1 |
| 3.7 | Influence of The Qualitative Factors on Project Success. | 1 |
| **4.0** | **Cost Estimation Of Manufactured Jobs** | |
| 4.1 | Cost Estimation to Find out Labor And Total Costs for Simple Machining Works Such as Turning | 2 |
| 4.2 | Drilling | 1 |
| 4.3 | Shaping Planning | 2 |
| 4.4 | Milling | 1 |
| 4.5 | Grinding | 1 |
| 4.6 | Cast, Welded and Forged Components. | 2 |
| **5.0** | **Work Study And Ergonomics** | |
| 5.1 | Method Study, Definition -. Ergonomics - Tools - Principles - Applications. | 1 |
| 5.2 | Objectives, Motion Economy Principles | 1 |
| 5.3 | Tools and Techniques, Applications | 1 |
| 5.4 | Work and Measurement, Purpose ,Use | 2 |
| 5.5 | Procedure Techniques, Standard Time | 1 |
| 5.6 | Ergonomics, Tools | 2 |
| 5.7 | Principles, Applications | 1 |

**Course Designer(s)**

Dr.C.Vijayakumar – vijayakumarc@ksrct.ac.in

| 60 MC E36 | Ware House Management | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To develop competencies and knowledge of students to become Warehouse professionals
- To orient students in the field of Logistics
- To understand Warehousing and distribution centre operations.
- To study Warehouse Safety Rules and Procedures
- To understand complete the analysis and to select the most appropriate solution for warehouse automation

## Pre-requisites

- NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the Basic concept of Warehouse | Understand |
| CO2 | Plan the activity in the field of Logistics | Understand |
| CO3 | Identify Warehousing and distribution centre operations | Understand |
| CO4 | Know the Warehouse Safety Rules and Procedures | Understand |
| CO5 | Understand the basic concept of the most common automations from light to heavy | Understand |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | 2 | 2 | 2 | - | 2 | 2 | 2 | 2 | - | 3 | 3 |
| CO2 | 3 | 3 | 2 | 3 | 2 | 2 | - | 2 | 2 | 3 | 3 | - | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 1 | - | 2 | 2 | 2 | 2 | - | 3 | 3 |
| CO4 | 2 | 2 | 3 | 3 | 2 | 2 | - | 2 | 3 | 2 | 2 | - | 3 | 3 |
| CO5 | 3 | 3 | 2 | 2 | 2 | 2 | - | 1 | 1 | 1 | 2 | - | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 30 | 30 | 30 |
| Understand | 30 | 30 | 70 |
| Apply | - | - | - |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

w.e.f. 23/12/2023
Passed in the BoS Meeting Held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| B.E - Mechatronics Engineering | | | | | | | | | |
| 60 MC E36- Ware House Management | | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | | |
| | L | T | P | | C | CA | ES | Total | |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 | |

| Content | Hours |
|---|---|
| **Introduction to Warehouse*** (Storage and Packaging) Background — Need for Warehouse — Importance of Warehouse -Types of Warehouses -Broad Functions in a Warehouse -Warehouse Layouts and Layout Related to Functions. Associate Warehouse -Its Functions - Equipment Available in Associate Ware House -Video on Warehouse – Visits to Ware Houses - Warehouse Organization Structure -Benefits of Warehousing. | **[9]** |
| **Receiving and Dispatch of Goods in Warehouse*** Various Stages Involved in Receiving Goods — Stages Involved Receipt of Goods-Advanced Shipment Notice (ASN) or Invoice Items List-Procedure for Arranging of Goods on Dock for Counting and Visual Inspection of Goods Unloaded-Formats for Recording of Goods Unloaded from Carriers-Generation of Goods Receipt Note Using Computer-Put Away of Goods-Put Away List and its Need-Put Away of Goods Into Storage Locations - Storage Location Codes and its Application-Process of Put Away Activity-Procedure to Prepare Warehouse Dispatches | **[9]** |
| **Warehouse Activities*** Explain Receiving, Sorting, Loading, Unloading, Picking Packing and Dispatch, Activities and Their Importance in a Warehouse -Quality Parameters -Quality Check-Need for Quality Check-Importance of Quality Check. Procedure to Develop Packing List / Dispatch Note-Cross Docking Method -Situations Suited for Application of Cross Docking - Information Required for Coordinating Cross Docking-Importance of Proper Packing- Packing Materials -Packing Machines -Reading Labels. | **[9]** |
| **Warehouse Safety Rules and Procedures*** The Safety Rules and 'Procedures to Be Observed In a Warehouse -Hazardous Cargo — Procedure for Identification of Hazardous Cargo -Safety Data Sheet-Instructions to Handle Hazardous Cargo -Familiarization with the Industry. Health, Safety & Environment -Safety Equipment's and Their Uses -5S Concept on Shop Floor. Personal Protective Equipment's (PPE) and Their Uses. | **[9]** |
| **Warehouse Automation Vehicles*** Material Flow Automation -Conveyors -Lifts -Automated Guided Vehicles –Monorail-Picking /Outbound Automation : Pick / Put to Light -A Frame -Automated Order Selection – Pick-N-Go - Outbound Sorters -Automatic Truck Loading | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Saxena JP, Warehouse Management and Inventory Control-Vikas Publication House Pvt Ltd, First Edition, 2003. |
| 2. | Warehouse Management: Automation and Organisation of Warehouse and Order Picking Systems, Michael Ten Hompel, Thorsten Schmidt, Springer-verlag, First Edition, 2006. |

**Reference(s):**


| | |
|---|---|
| 1. | Keller, S., & Keller, B. C. The definitive guide to warehousing: managing the storage and handling of materials and products in the supply chain. Pearson Education,2014 |
| 2. | Kimon P. Valavanis, "Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy", Springer, 2007 |
| 3. | Advanced Industrial Automation and its Application: Ravindra Sharma Industrial Control Electronics Devices, Systems, & Applications 3D Edition Author: Terry Bartler Publisher: Delmar |
| 4. | Richards, G. Warehouse management: a complete guide to improving efficiency and minimizing costs in the modern warehouse. Kogan Page Publishers,2017 |


*SDG 9 – Industry Innovation and Infrastructure

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Introduction to Warehouse** | |
| 1.1 | Introduction to Warehouse | 1 |
| 1.2 | (Storage and Packaging) Background | 1 |
| 1.3 | Need for Warehouse – Importance of Warehouse | 1 |
| 1.4 | Types of Warehouses -Broad Functions In A Warehouse | 1 |
| 1.5 | Warehouse Layouts and Layout Related to Functions. | 1 |
| 1.6 | Associate Warehouse -Its Functions | 1 |
| 1.7 | Equipment Available In Associate Ware House | 1 |
| 1.8 | Video on Warehouse – Visits to Ware Houses | 1 |
| 1.9 | Warehouse Organization Structure -Benefits of Warehousing. | 1 |
| **2.0** | **Receiving and Dispatch of Goods In Warehouse** | |
| 2.1 | Receiving and Dispatch of Goods In Warehouse | 1 |
| 2.2 | Various Stages Involved In Receiving Goods | 1 |
| 2.3 | Stages Involved Receipt of Goods-Advanced Shipment Notice (ASN) or Invoice Items List | 1 |
| 2.4 | Procedure for Arranging of Goods on Dock for Counting and Visual Inspection of Goods Unloaded | 1 |
| 2.5 | Formats for Recording of Goods Unloaded from Carriers-Generation of Goods Receipt note Using Computer | 1 |
| 2.6 | Put Away of Goods-Put Away List and Its Need-Put Away of Goods into Storage Locations | 1 |
| 2.7 | Storage Location Codes and Its Application | 1 |
| 2.8 | Process of Put Away Activity, Procedure to Prepare Warehouse Dispatches | 2 |
| **3.0** | **Warehouse Activities** | |
| 3.1 | Warehouse Activities | 1 |
| 3.2 | Elucidate Receiving, Sorting, Loading, Unloading, Picking Packing and Dispatch, Activities and Their Importance In a Warehouse | 1 |
| 3.3 | Quality Parameters -Quality Check-Need for Quality Check-Importance of Quality Check. | 1 |
| 3.4 | Procedure To Develop Packing List / Dispatch Note | 1 |
| 3.5 | Cross Docking Method -Situations Suited For Application Of Cross Docking | 1 |
| 3.6 | Information Required for Coordinating Cross Docking | 1 |
| 3.7 | Importance of Proper Packing, Packing Materials | 2 |
| **4.0** | **Warehouse Safety Rules and Procedures** | |
| 4.1 | Warehouse Safety Rules and Procedures | 1 |
| 4.2 | The Safety Rules and 'Procedures to Be Observed in A Warehouse | 1 |
| 4.3 | Hazardous Cargo – Procedure for Identification of Hazardous Cargo | 1 |
| 4.4 | Safety Data Sheet-Instructions to Handle Hazardous Cargo | 1 |
| 4.5 | Familiarization With The Industry. | 1 |
| 4.6 | Health, Safety & Environment | 1 |
| 4.7 | Safety Equipment's and Their Uses | 1 |
| 4.8 | 5S Concept on Shop Floor, Personal Protective Equipment's (PPE) and Their Uses. | 2 |
| **5.0** | **Supply Chain and Warehousing** | |
| 5.1 | Supply Chain and Warehousing | 1 |
| 5.2 | Introduction, Objectives | 1 |
| 5.3 | Supply Chain Impact on Stores and Warehousing | 1 |
| 5.4 | Retail Logistics & Transportation | 2 |
| 5.6 | Issues in Retail Logistics, Retailing and Warehousing | 2 |
| 5.8 | Challenges in Retail Warehousing, Setting Up a Warehouse | 2 |

**Course Designer(s)**

Mr.R.Vivek – vivekr@ksrct.ac.in

| 60 MC E37 | Applied and Industrial Robotics | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To familiarize robot structures, classification and Types, levels, need of Automation.
- To develop knowledge in Grippers and Sensors for Robotics.
- To develop skills in performing Drives, Transmission and Control for Robotics.
- To develop knowledge in the Artificial Intelligence for Robotics.
- To design and develop a robotic system for a given industrial application.

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Identify and understand the automation concepts for Industries. | Understand |
| CO2 | Understand various grippers and sensors for robotics | Understand |
| CO3 | Interpret terminologies related to drives, actuators and controllers. | Apply |
| CO4 | Apply the principles of AI in robot system integration | Apply |
| CO5 | Integrate the applications of robots and digital technology | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO2 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO3 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO4 | 3 | 3 | - | - | - | 3 | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO5 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 20 | 20 | 20 |
| Understand | 40 | 20 | 60 |
| Apply | - | 20 | 20 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

w.e.f. 23/12/2023
Passed in the BoS Meeting Held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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Board Of Studies/
Mechatronics Engineering

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E – Mechatronics Engineering** | | | | | | | | |
| **60 MC E37 - Applied and Industrial Robotics** | | | | | | | | |
| **Semester** | | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to Robotics**<br>Elements of Robotic Systems, Robot anatomy, DOF, Classification of Robotic systems -work volume, type of drive, Associated parameter - resolution, accuracy, repeatability, dexterity, compliance, Remote Center of Compliance. Introduction to Principles & Strategies of Automation, Types & Levels of Automations,<br>Need of automation. | **[9]** |
| **Grippers and Sensors for Robotics**<br>Grippers for Robotics - Types of Grippers, Guidelines for design for robotic gripper, Force analysis for various basic gripper system. Sensors for Robots - Types of Sensors used in Robotics, Classification andapplications of sensors, Characteristics of sensing devices, Selections of sensors. Need for sensors andvision system in the working and control of a robot. | **[9]** |
| **Drives and Control for Robotics**<br>Drive - Types of Drives, Types of transmission systems, Actuators and its selection while designing a robot system. Control Systems: Types of Controllers, Introduction to closed loop control. | **[9]** |
| **AI in Robotics**<br>Socio-Economic aspect of robotisation. Economical aspects for robot design, Safety for robot and standards, Introduction to Artificial Intelligence, AI techniques, Need and application of AI, mobile robotics, New trends & recent updates in robotics. Mobile Robot locomotion: Types of locomotion, hopping robots, legged robots, wheeled robots, stability, manoeuvrability, controllability. | **[9]** |
| **Applications and Digital Manufacturing**<br>Robots Manufacturing, Construction, Medical, Defense, Logistics & Storage, Packing & Palletizing, Inspection & Quality Control, Harvesting, Painting & Coating, Cleaning & Hygiene, Aerospace, basics incyber-physical production systems, data- driven production, industrial internet of things, digital twin technology and simulation methodologies. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | S. K. Saha, Introduction to Robotics, $2^{nd}$ Edition, TATA McGraw Hills Education,2014. |
| 2. | John.J.Craig, " Introduction to Robotics: Mechanics & control" , Pearson Publication, $4^{th}$ Edition, 2018. |

**Reference(s):**

| | |
|---|---|
| 1. | Dilip Kumar Pratihar, Fundamentals of Robotics, Narosa Publishing House, 2019 |
| 2. | Jazar, "Theory of Applied Robotics: Kinematics, Dynamics and Control", Springer, $2^{nd}$ Edition, 2016. |
| 3. | Roland Seigwart, Illah Reza Nourbakhsh, and Davide Scaramuzza, "Introduction to autonomous mobilerobots", $2^{nd}$ Edition, MIT Press, 2011. |
| 4. | S.R. Deb, Robotics Technology and flexible automation, $2^{nd}$ Edition, Tata McGraw-Hill Education, 2017 |

*SDG 3 – Good Health and Well Being

w.e.f. 23/12/2023
Passed in the BoS Meeting Held on 24/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Introduction to Robotics** | |
| 1.1 | Elements of Robotic Systems, Robot anatomy, DOF | 2 |
| 1.2 | Classification of Robotic systems | 1 |
| 1.3 | Work volume, type of drive, Associated parameter resolution, accuracy, repeatability | 1 |
| 1.4 | Dexterity, compliance Remote Centerof Compliance. | 2 |
| 1.5 | Introduction to Principles & Strategies of Automation | 1 |
| 1.6 | Types & Levels of Automations | 1 |
| 1.7 | Need of automation. | 1 |
| **2.0** | **Grippers and Sensors for Robotics** | |
| 2.1 | Grippers for Robotics - Types of Grippers, Guidelines for design for robotic gripper | 2 |
| 2.2 | Force analysis for various basic gripper system. Sensors for Robots | 2 |
| 2.3 | Types of Sensors used in Robotics | 1 |
| 2.4 | Classification and applications of sensors | 1 |
| 2.5 | Characteristics of sensing devices, Selections of sensors | 1 |
| 2.6 | Need for sensors andvision system in the working and control of a robot. | 2 |
| **3.0** | **Drives and Control for Robotics** | |
| 3.1 | Drive - Types of Drives, Types of transmission systems | 2 |
| 3.2 | Actuators and its selection while designing | 2 |
| 3.3 | Robot system | 2 |
| 3.4 | Types of Controllers | 2 |
| 3.5 | Introduction to closed loop control. | 1 |
| **4.0** | **AI in Robotics** | |
| 4.1 | Socio-Economic aspect of robotisation. | 1 |
| 4.2 | Economical aspects for robot design, Safety for robot and standards | 2 |
| 4.3 | Introduction to Artificial Intelligence, AI techniques, Need and application of AI, mobile robotics | 2 |
| 4.4 | New trends & recent updates in robotics. Mobile Robot locomotion | 2 |
| 4.5 | Types of locomotion, hopping robots, legged robots, wheeled robots, | 1 |
| 4.6 | Stability, manoeuvrability, controllability. | 1 |
| **5.0** | **Applications and Digital Manufacturing** | |
| 5.1 | Robots Manufacturing, Construction, Medical, Defense, Logistics & Storage | 2 |
| 5.2 | Packing & Palletizing, Inspection & Quality Control, Harvesting, Painting & Coating | 2 |
| 5.3 | Cleaning & Hygiene, Aerospace | 2 |
| 5.4 | Basics in cyber-physical production systems | 1 |
| 5.5 | Data- driven production, industrial internet of things | 2 |
| 5.5 | Digital twin technology and simulation methodologies. | 2 |

**Course Designer(s)**

1. Dr.M.Ravi-ravi@ksrct.ac.in
2. Mrs. V.Indumathi – indumathi@ksrct.ac.in

| 60 MC E41 | Design of Robot Elements | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 2 | 0 | 2 | 3 |

## Objectives

- To design and optimize a robotic arm for a specified application
- To investigate and analyse the properties of engineering materials
- To understand the principles and operation of different types of actuators
- To explore the principles and characteristics of different types of joints
- To examine robot element design including bioinspired design principles

## Pre-requisites

- Robotics Engineering, Sensors and Instrumentation

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Demonstrate an ample understanding of the principles and practices involved in designing robots. | Apply |
| CO2 | Apply appropriate materials for various robot elements based on their properties and performance requirements. | Apply |
| CO3 | Proficient in selecting, and implementing actuators and transmission systems in robotic applications | Apply |
| CO4 | Gain a comprehensive understanding of linkages, mechanisms, force distribution and stress in linkages | Apply |
| CO5 | Equipped to integrate advanced sensor technologies, utilize emerging trends in bioinspired design and smart materials | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 2 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 3 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | | | Model Examination (Marks) | End Sem Examination (Marks) | |
|---|---|---|---|---|---|---|---|
| | Test 1 | | Test 2 | | | | |
| | Theory | Lab | Theory | Lab | Lab | Theory | Lab |
| Remember | 10 | - | 10 | - | - | 10 | - |
| Understand | 10 | 50 | 10 | 50 | 50 | 40 | 50 |
| Apply | 40 | 50 | 40 | 50 | 50 | 50 | 50 |
| Analyse | - | - | - | - | - | - | - |
| Evaluate | - | - | - | - | - | - | - |
| Create | - | - | - | - | - | - | - |
| Total | 60 | 100 | 60 | 100 | 100 | 100 | 100 |

w.e.f. 25/05/2024
Passed in the BoS Meeting Held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

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Board Of Studies/
Mechatronics Engineering

**Syllabus**

**K.S.Rangasamy College of Technology – Autonomous R2022**

**B.E - Mechatronics Engineering**

**60 MC E41 - Design of Robot Elements**

| Semester | Hours / Week | | | Total Hours | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| VII | 2 | 0 | 2 | 60 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| **Robot Design*** Introduction to Robots and Their Applications - Design Considerations: Functionality, Strength, Weight, Cost - Kinematics and Dynamics Fundamentals - Design Process and Optimization Techniques. | **[6]** |
| **Materials for Robot Elements**** Properties of Engineering Materials: Metals, Polymers, Composites - Material Selection for Specific Robot Components - Weight Optimization and Lightweight Materials. | **[6]** |
| **Actuators and Transmissions***** Actuator Characteristics: Power, Torque, Speed, Efficiency, Controllability - Actuator Selection: Matching Actuator Capabilities to Robot Requirements. - Transmission Design Considerations: Gear Ratios, Efficiency, Backlash, Power Transmission Capacity. | **[6]** |
| **Linkages and Mechanisms*** Design Considerations for Linkages - Applications of Linkages in Robotics - Types of Mechanisms (Gear, Cam, Geneva, Rack and Pinion) - Design Considerations for Mechanisms - Applications of Mechanisms in Robotics. | **[6]** |
| **Advances in Robot Element Design*** Robot Sensors: Proprioceptive and Exteroceptive Sensors - Emerging Trends In Robot Element Design: Bioinspired Design - Smart Materials and Actuators. | **[6]** |
| **Practical:**<br>1. Use Simulation Software to Model a Simple Robot arm and Analyze its Forward and Inverse Kinematics<br>2. Simulate The Speed and Torque Characteristics of Different Types of Electric Motors (DC, AC Induction, Stepper Motor) Under Varying Loads<br>3. Design and Build a Simple Pick-And-Place System Using a Pneumatic Actuator and Control Valves<br>4. Design a Lightweight Bridge or Cantilever Beam Using Limited Materials (E.G., Cardboard, Balsa Wood) to Support a Specific Load<br>5. Simulate The Behaviour of a Single-Acting Hydraulic Actuator Using Any Simulation Software<br>6. Design of Robotic Arms Focusing On Gripping Force and Control Using Servo Motors, Simple Gripper Mechanism and Force Gauge<br>7. Plan The Robot's Trajectory Using Forward and Inverse Kinematics to Move the End-Effector to The Desired Locations for Grasping and Placing an Object<br>8. Detect and Avoid Obstacles Using Obstacle Detection with Ultrasonic Sensor<br>9. Track A Light Source Using a Light Sensor<br>10. Use Simulation Software to Model a Simple Robot with a Bioinspired Locomotion Mechanism<br>**Tools Used: MATLAB, Simulink, Fluidsim** | **[30]** |
| **Total Hours: (Lecture - 30; Practical - 30)** | **60** |

**Text Book(s):**

| | |
|---|---|
| 1. | John J. Craig, “Introduction to Robotics: Mechanics and Control”, 4th edition, Pearson Education, 2020. |
| 2. | Paul Sandin, “Robot Mechanisms and Mechanical Devices Illustrated" McGraw-Hill Education, 2020. |

**Reference(s):**

| | |
|---|---|
| 1. | Bruno Siciliano and Lorenzo Sciavicco, "Robotics: Modelling, Planning and Control", Springer, 2021 |
| 2. | Howell L.L. and C.A. Barnes, "Robotics: Theory and Industrial Applications", Cengage Learning, 2021 |
| 3. | Sandler B.Z. , "Robotics: Designing the Mechanisms for Automated Machinery", Academic Press, 2018 |
| 4. | Matthew T. Mason, "Mechanics of Robotic Manipulation", Cambridge University Press, 2019 |

*SDG 9 – Industry Innovation and Infrastructure
**SDG 12 – Responsible Consumption and Production
***SDG 7 – Affordable and Clean Energy

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of Hours** |
| **1** | **Robot Design** | |
| 1.1 | Introduction to Robots and their Applications | 1 |
| 1.2 | Design Considerations: Functionality | 1 |
| 1.3 | Design Considerations: Strength, Weight | 1 |
| 1.4 | Design Considerations: Cost | 1 |
| 1.5 | Kinematics and Dynamics Fundamentals | 1 |
| 1.6 | Design Process and Optimization Techniques | 1 |
| **2** | **Materials for Robot Elements** | |
| 2.1 | Properties of Engineering Materials: Metals | 1 |
| 2.2 | Properties of Engineering Materials: Polymers | 1 |
| 2.3 | Properties of Engineering Materials: Composites | 1 |
| 2.4 | Material Selection for Specific Robot Components | 1 |
| 2.5 | Weight Optimization | 1 |
| 2.6 | Lightweight Materials | 1 |
| **3** | **Actuators and Transmissions** | |
| 3.1 | Actuator Characteristics: Power, Torque, Speed | 1 |
| 3.2 | Actuator Characteristics: Efficiency, Controllability | 1 |
| 3.3 | Actuator Selection: Matching Actuator Capabilities to Robot Requirements | 1 |
| 3.4 | Transmission Design Considerations: Gear Ratios, Efficiency | 1 |
| 3.5 | Transmission Design Considerations: Backlash, Power Transmission | 1 |
| 3.6 | Transmission Design Considerations: Capacity | 1 |
| **4** | **Linkages and Mechanisms** | |
| 4.1 | Design Considerations for Linkages | 1 |
| 4.2 | Applications of linkages in Robotics | 1 |
| 4.3 | Types of Mechanisms (Gear, Cam) | 1 |
| 4.4 | Types of Mechanisms (Geneva, Rack and Pinion) | 1 |
| 4.5 | Design Considerations for Mechanisms | 1 |
| 4.6 | Applications of Mechanisms in Robotics | 1 |
| **5** | **Advances in Robot Element Design** | |
| 5.1 | Robot Sensors: Proprioceptive Sensors | 1 |
| 5.2 | Robot Sensors: Exteroceptive Sensors | 1 |
| 5.3 | Emerging Trends in Robot Element Design | 1 |
| 5.4 | Bioinspired Design | 1 |
| 5.5 | Smart Materials | 1 |
| 5.6 | Actuators | 1 |

| Practical: | | |
|---|---|---|
| 1. | Use Simulation Software to Model a Simple Robot Arm and Analyze Its Forward And Inverse Kinematics | 4 |
| 2. | Simulate the Speed and Torque Characteristics of Different Types of Electric Motors (DC, AC Induction, Stepper Motor) Under Varying Loads | 4 |
| 3. | Design and Build a Simple Pick-and-Place System Using a Pneumatic Actuator And Control Valves | 2 |
| 4. | Design a Lightweight Bridge or Cantilever Beam Using Limited Materials (E.G., Cardboard, Balsa Wood) to Support a Specific Load | 2 |
| 5. | Simulate The Behaviour of a Single-Acting Hydraulic Actuator Using any Simulation Software | 2 |
| 6. | Design of Robotic Arms Focusing on Gripping Force And Control Using Servo Motors, Simple Gripper Mechanism And Force Gauge | 4 |
| 7. | Plan the Robot's Trajectory Using Forward and Inverse Kinematics to Move the End-Effector to the Desired Locations for Grasping and Placing an Object | 4 |
| 8. | Detect and Avoid Obstacles Using Obstacle Detection With Ultrasonic Sensor | 2 |
| 9. | Track a Light Source Using a Light Sensor | 2 |
| 10. | Use Simulation Software to Model a Simple Robot With a Bioinspired Locomotion Mechanism | 4 |

**Course Designer(s)**

1. Dr. A. Ramesh Kumar – rameshkumar@ksrct.ac.in

| 60 MC E42 | Mechatronics System | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 2 | 0 | 2 | 3 |

## Objectives

- To learn about Mechatronics system design and simulation, ergonomics and safety.
- To know about Electro mechanical system design.
- To understand theoretical and practical aspects of interfacing, real time data acquisition and control.
- To learn the real time interfacing software and man machine interface.
- To know about the various applications in this system

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Recognize the fundamental ideas and components of mechatronics | Apply |
| CO2 | Develop system models and acquire familiar with the design process for mechatronics. | Apply |
| CO3 | Realize the data acquisition for Real Time application. | Apply |
| CO4 | Select the suitable interface for mechatronics system | Apply |
| CO5 | Develop the various Mechatronics system | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | 2 |
| CO2 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 2 | 2 |
| CO3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | 2 |
| CO4 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 2 | 2 |
| CO5 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | | | Model Examination (Marks) | End Sem Examination (Marks) | |
|---|---|---|---|---|---|---|---|
| | Test 1 | | Test 2 | | | | |
| | Theory | Lab | Theory | Lab | Lab | Theory | Lab |
| Remember | 10 | - | 10 | - | - | 30 | - |
| Understand | 10 | 50 | 10 | 50 | 50 | 30 | 50 |
| Apply | 40 | 50 | 40 | 50 | 50 | 40 | 50 |
| Analyse | - | - | - | - | - | - | - |
| Evaluate | - | - | - | - | - | - | - |
| Create | - | - | - | - | - | - | - |
| Total | 60 | 100 | 60 | 100 | 100 | 100 | 100 |



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Mechatronics Engineering

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC E42 – Mechatronics System** | | | | | | | | |
| **Semester** | **Hours / Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VII | 2 | 0 | 2 | 60 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| **Introduction to Design of Mechatronics System**<br>Key Elements – Mechatronics Design Process – Design Parameters – Mechatronics and Traditional Design. Advanced Approaches in Mechatronics Design – Introduction to Industrial Design, Modelling, Simulation and Analysis – Ergonomics and Safety. | **[6]** |
| **Basic System Modelling**<br>Introduction – Model Categories – Model Development –– Verification and Validation – Mathematical Modelling: Design of Mixed System: Electro Mechanical System Design – Model Transformation –Domain Independent Description Forms: Bond Graph and Block Diagram | **[6]** |
| **Mechatronic System Modelling**<br>Engineering Systems: Rotational – Translational, Electro-Mechanical, Pneumatic-Mechanical, Hydraulic-Mechanical, Micro Electro Mechanical System – Dynamic Responses of System: First Order, Second Order System – Performance Measures | **[6]** |
| **System Interfacing**<br>Introduction – Selection of Interfacing Standards- Elements of Data Acquisition and Control Systems – Overview of I/O Process – -Installation of I/O Card and Software – Data Conversion Process – Application Software – Man Machine Interface | **[6]** |
| **Case Studies on Design of Mechatronics System**<br>Machine Tool Control System - Electronics Engine Management System – Pick and Place Robot – Artificial Intelligence in Mechatronics -– Auto Focus Camera, Exposure Control | **[6]** |
| **Practical:**<br>1. Designing and Testing a Basic Hydraulic Circuit, Specifically Focusing on Meter-In and Meter-Out Circuits.<br>2. Designing and Testing a Automatic Reciprocating Circuits Using Pneumatic Components.<br>3. Creating a Virtual Instrument Using LabVIEW that Incorporates Structures, Arrays, Clusters, File I/O, and Graphs Palettes Involves Several Steps.<br>4. Creating a Virtual Instrument Using Local and Global Variables in LabVIEW Can Provide a Way to Share Data Between Different Parts of the Program.<br>5. Temperature Conversion Using Virtal Instrumentation Software.<br>6. Monitoring of Furnace Temperature Using Data Acquisition System.<br>7. Control of LED Display Output Using Data Acquisition.<br>8. Define the Specifications of the Pick-And-Place Robot, Including its Payload Capacity, Reach, and Workspace.<br>9. Robot Programming and Simulation for Colour Identification.<br>10. Robot Programming and Simulation for Shape Identification. | **[30]** |
| **Total Hours: (Lecture - 30; Practical - 30)** | **60** |
| **Text Book(s):** | |

| | |
|---|---|
| 1. | Devdas Shetty, Richard A. Kolk, “Mechatronics System Design”, 2nd Edition, Cengage Learning 2016. |
| 2. | Bolton W., "Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering", 3rd Edition, Pearson Education Limited, New York, 2009. |
| **Reference(s):** | |
| 1. | Bradley, Dawson, N.C. Burd and A.J. Loader, "Mechatronics: Electronics in Products and Processes", Nelson Thomas Ltd U.K 2004. |

*SDG 9 – Industry Innovation and Infrastructure
**SDG 3 – Good Health and Well Being
***SDG 7 – Affordable and Clean Energy

w.e.f. 25/05/2024
Passed in the BoS Meeting Held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

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Mechatronics Engineering

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of Hours |
|---|---|---|
| **1** | **Mechatronics, Sensors and Transducers** | |
| 1.1 | Introduction to Mechatronics | 2 |
| 1.2 | Definition-Scope- Importance of Mechatronics | 2 |
| 1.3 | Importance and Applications of Mechatronics in Modern Engineering | 2 |
| 1.4 | Measurement Systems | 1 |
| 1.5 | Control Systems. | 1 |
| 1.6 | Microprocessor Based Controllers. | 1 |
| **2** | **Actuation Systems** | |
| 2.1 | Mechanical Components and Systems. | 2 |
| 2.2 | Kinematics and Dynamics of Mechanical Systems | 1 |
| 2.3 | Mechanical Sensors and Actuators | 1 |
| 2.4 | Basic Electrical Components –Resistors- Capacitors- Inductors-DC and AC Circuits | 2 |
| 2.5 | Sensors and Transducers-Electronic Systems | 1 |
| 2.6 | Operational Amplifiers-Digital Electronics-Microcontrollers and Microprocessors | 2 |
| **3** | **System Models and Controllers** | |
| 3.1 | Introduction to Control Systems-Feedback Control Systems-. | 2 |
| 3.2 | Continuous and Discrete Process Controllers | 1 |
| 3.3 | Control Mode ,Two – Step Mode, Proportional Mode | 2 |
| 3.4 | Derivative Mode , Integral Mode | 1 |
| 3.5 | PID Controllers, Digital Controllers. Velocity Control | 2 |
| 3.6 | Adaptive Control ,Digital Logic Control , Micro Processors Control. | 1 |
| **4** | **Introduction to Robotics** | |
| 4.1 | Definition, Laws of Robot | 2 |
| 4.2 | Classification, Ethical Considerations in Robotics | 2 |
| 4.3 | Forward and Inverse Kinematics | 1 |
| 4.4 | Differential Kinematics | 1 |
| 4.5 | Dynamics of Manipulators and Mobile Robots | 1 |
| 4.6 | Grippers | 1 |
| **5** | **Robot Sensors and Actuators** | |
| 5.1 | Types of Sensors ,Position | 2 |
| 5.2 | Velocity, Force, Actuators | 1 |
| 5.3 | DC Motors, servos | 1 |
| 5.4 | Stepper Motor | 1 |
| 5.5 | Sensor Fusion and Calibration | 1 |
| 5.6 | Industrial Applications of Mechatronics and Robotics | 1 |
| 5.7 | Automated Manufacturing Systems ,Robotic Assembly Lines | 1 |
| 5.8 | Autonomous Vehicles and Drones. | 1 |
| **Practical** | | |
| 1. | Designing and Testing a Basic Hydraulic Circuit, Specifically Focusing on Meter-In and Meter-Out Circuits. | 3 |
| 2. | Designing and Testing a Automatic Reciprocating Circuits Using Pneumatic Components. | 3 |
| 3. | Creating a Virtual Instrument Using LabVIEW that Incorporates Structures, Arrays, Clusters, File I/O, and Graphs Palettes Involves Several Steps. | 3 |
| 4. | Creating a Virtual Instrument Using Local and Global Variables in LabVIEW Can Provide a Way to Share Data Between Different Parts of the Program. | 3 |
| 5. | Temperature Conversion Using Virtal Instrumentation Software. | 3 |
| 6. | Monitoring of Furnace Temperature Using Data Acquisition System. | 3 |
| 7. | Control of LED Display Output Using Data Acquisition. | 3 |
| 8. | Define the Specifications of the Pick-And-Place Robot, Including its Payload Capacity, Reach, and Workspace. | 3 |
| 9. | Robot Programming and Simulation for Colour Identification. | 3 |
| 10. | Robot Programming and Simulation for Shape Identification. | 3 |

**Course Designer(s)**

1. Dr.R.Senthilmurugan – senthilmurugan@ksrct.ac.in

| 60 MC E43 | Drone Technology | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 2 | 0 | 2 | 3 |

## Objectives

- The main aim of this course is to understand the basics of Drones and its components.
- To make the students understand the basic working principle and different Sensors used in UAV.
- To Learn about the various components of drone design.
- To enable the students to identify and understand various navigation guidance systems.
- To Learn about the various types of Drones and its applications

## Pre-requisites

- Sensor and Instrumentation

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Explain the fundamental ideology about unmanned and micro air vehicles. | Remember |
| CO2 | Demonstrate the design process of UAVs fixed wing multi copter and electronic components used in Drones and its specification. | Apply |
| CO3 | Predict the effect of Flight Mechanics and Dynamics | Apply |
| CO4 | Apply guidance and trajectory control algorithm to navigate the unmanned system. | Apply |
| CO5 | Apply the mechanism and applications of the different types of drones | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | - | 3 | 2 | 2 | - | - | - | - | 3 | 2 | 2 |
| CO2 | 3 | 3 | - | - | 3 | 2 | 2 | - | - | - | - | 3 | 2 | 3 |
| CO3 | 3 | 3 | - | - | 3 | 2 | 2 | - | - | - | - | 3 | 2 | 2 |
| CO4 | 3 | 2 | 3 | - | 3 | 2 | 2 | - | - | - | - | 3 | 2 | 3 |
| CO5 | 3 | 2 | - | - | 3 | 2 | 2 | - | - | - | - | 3 | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | | | Model Examination (Marks) | End Sem Examination (Marks) | |
|---|---|---|---|---|---|---|---|
| | Test 1 | | Test 2 | | | | |
| | Theory | Lab | Theory | Lab | Lab | Theory | Lab |
| Remember | 10 | - | 10 | - | - | 25 | - |
| Understand | 10 | 50 | 10 | 50 | 50 | 25 | 50 |
| Apply | 40 | 50 | 40 | 50 | 50 | 50 | 50 |
| Analyse | - | - | - | - | - | - | - |
| Evaluate | - | - | - | - | - | - | - |
| Create | - | - | - | - | - | - | - |
| Total | 60 | 100 | 60 | 100 | 100 | 100 | 100 |

w.e.f. 25/05/2024
Passed in the BoS Meeting Held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

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**Syllabus**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC E43- Drone Technology** | | | | | | | | |
| **Semester** | **Hours / Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VII | 2 | 0 | 2 | 60 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| **Introduction to Drone**<br>Basic Drone Terminology- Historical Development-Types of Drones- Components for UAV Prototypes-Functional Operations and Advantages of UAVs. | **[6]** |
| **Integration of Aerial Robots and Sensors**<br>Fixed wing UAVs- Multi Copter UAV- Flapping Wing UAV- Swarm Robot, Integration of Aerial Robot- Introduction to Sensors – Types of Sensors – Accelerometer-Barometer-Gyro Sensor and Magneto Sensor | **[6]** |
| **Flight Mechanics and Dynamics**<br>Basic Principles of Flight Mechanics - Flight Controller Board - Selection of Drone Controller With Example - Factors Affecting Drone - Flight Performance and Efficiency. | **[6]** |
| **Navigation and Guidance System of Aerial Vehicles**<br>Flight Control System –Path Planning- Way Point Navigation System - Obstacle's Avoidance Techniques – Functional Block of Lateral and Longitudinal Guidance- GPS – GCS-Telemetry –Transmitter & Receiver. | **[6]** |
| **Applications of Drone**<br>Overview of Commercial and Industrial Drone Applications - Case Studies and Examples of Successful Drone Deployments- Drone Camera Systems-Agro Application, Drone Delivery-Future Trends and Developments in the Drone Industry. | **[6]** |
| **Practical:**<br>1. Assembling the Quadcopter<br>2. Dismantling the Quadcopter<br>3. Design the Drone Using Tinker Cad Software<br>4. Compass Calibration the Drone using Mission Planner<br>5. IMU Calibration the Drone Using Mission Planner<br>6. Calibration the Drone Using Beta Flight<br>7. Path Planning Using Mission Planner for Autonomous Drone<br>8. Fail Safes Using Mission Planner for UAVs<br>9. Flying Simulation Using Free Raider Software<br>10. RC Transmitter Calibration Using Mission Planner | **[30]** |
| **Total Hours: (Lecture - 30; Practical - 30)** | **60** |

**Text Book(s):**


| | |
|---|---|
| 1. | Tooley E., Practical Drones: Building, Programming, and Applications, Apress, 2021. |
| 2. | Sundar K. and R. V. Rajakumar, Multicopters: Principles and Applications, Springer, 2021. |


**Reference(s):**


| | |
|---|---|
| 1. | Saxby D., Drone Aerial Photography and Video: Techniques and Stories from the Field, Cengage Learning, 2018. |
| 2. | McLeod D, Getting Started with Drone: How to Build, Fly, and Program Your Own Drone, Apress, 2019. |
| 3. | Kopparthy S. K, Drone Technology: Theory and Practice, Springer, 2020. |
| 4. | Balasubramaniam R,"Callister'sMaterialsScienceandEngineering",Secondedition,Wiley,2014. |


*SDG 9 – Industry Innovation and Infrastructure
**SDG: 11 – Sustainable cities and communities



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| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of Hours** |
| **1** | **Introduction to Drone** | |
| 1.1 | Basic Drone Terminology | 1 |
| 1.2 | Historical Development | 1 |
| 1.3 | Types of Drones | 1 |
| 1.4 | Components for UAV Prototypes | 1 |
| 1.5 | Functional Operations and Advantages of UAVs. | 2 |
| **2** | **Integration of Aerial Robots and Sensors** | |
| 2.1 | Fixed Wing UAVs | 1 |
| 2.2 | Multi Copter UAV- Flapping wing UAV | 1 |
| 2.3 | Swarm Robot, Integration of Aerial Robot | 1 |
| 2.4 | Introduction to Sensors – Types of Sensors | 1 |
| 2.5 | Accelerometer-Barometer | 1 |
| 2.6 | Gyro Sensor and Magneto Sensor | 1 |
| **3** | **Flight Mechanics and Dynamics** | |
| 3.1 | Basic Principles of Flight Mechanics | 1 |
| 3.2 | Flight Controller Board | 2 |
| 3.3 | Selection of Drone Controller with Example | 1 |
| 3.4 | Factors Affecting Drone | 1 |
| 3.5 | Fight Performance and Efficiency | 1 |
| **4** | **Navigation and Guidance System of Aerial Vehicle** | |
| 4.1 | Flight Control System | 1 |
| 4.2 | Path Planning- Way Point Navigation System | 1 |
| 4.3 | Obstacle's Avoidance Techniques | 1 |
| 4.4 | Functional Block of Lateral and Longitudinal Guidance | 1 |
| 4.5 | GPS – GCS | 1 |
| 4.6 | Transmitter & Receiver. | 1 |
| **5** | **Applications of Drone** | |
| 5.1 | Overview of Commercial and Industrial Drone Applications | 1 |
| 5.2 | Case Studies and Examples of Successful Drone Deployments | 1 |
| 5.3 | Drone Camera Systems | 1 |
| 5.4 | Agro Application, Drone Delivery | 1 |
| 5.5 | Future Trends and Developments in the Drone Industry. | 2 |
| **Practical** | | |
| 1. | To Assembling the Quadcopter | 3 |
| 2. | To Dismantling the Quadcopter | 3 |
| 3. | Design the Drone Using Tinker Cad Software | 3 |
| 4. | Compass Calibration the Drone Using Mission Planner | 3 |
| 5. | IMU Calibration the Drone Using Mission Planner | 3 |
| 6. | Calibration the Drone Using Beta Flight | 3 |
| 7. | Park Planning Using Mission Planner for Autonomous Drone | 3 |
| 8. | Fail Saves Using Mission Planner for UAVs | 3 |
| 9. | Flying Simulation Using Free Raider Software | 3 |
| 10. | RC Transmitter Calibration Using Mission Planner | 3 |

**Course Designer(s)**

1. Mr.S.Hari Prasadh -hariprasadh@ksrct.ac.in

| 60 MC E44 | Design for Manufacturing | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 2 | 0 | 2 | 3 |

## Objectives

- To provide an overview of DFM processes and their importance in product design and development
- To familiarize the key design considerations involved in DFM and their impact on product manufacturability and cost
- To familiarize the principles of DFA and Cost Analysis in the context of product design and manufacturing
- To educate the principles of Design for Quality (DFQ) and Tolerance Analysis in product design
- To introduce the concept of Sustainable Design to focus on minimizing environmental impact and maximizing resource efficiency

## Pre-requisites

- Manufacturing Technology, Computer Aided Design and Manufacturing

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the concept of DFM and its significance in optimizing product designs | Understand |
| CO2 | Apply design considerations in Design for Manufacturing | Apply |
| CO3 | Conduct cost analyses for product designs and identify cost-saving opportunities | Apply |
| CO4 | Apply DFQ principles to design products that meet quality standards and are robust to variations in manufacturing processes | Apply |
| CO5 | Integrate sustainable design principles into product development processes, considering environmental, social, and economic factors | Apply |

## Mapping with Programme Outcomes

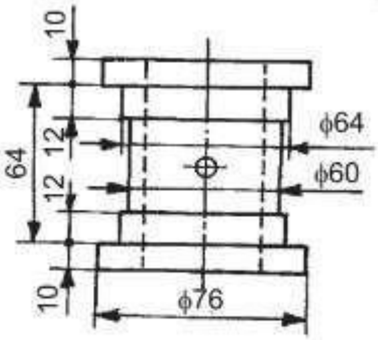
| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | - | 3 | - | 3 | 3 | 3 | - | 3 | 3 | - | 3 | 3 | - |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | 3 | 3 | - | 3 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | 3 | - | 3 | 2 | - |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | 3 | 3 | - | 3 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | 3 | - | 3 | 2 | 3 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | | | Model Examination (Marks) | End Sem Examination (Marks) | |
|---|---|---|---|---|---|---|---|
| | Test 1 | | Test 2 | | | | |
| | Theory | Lab | Theory | Lab | Lab | Theory | Lab |
| Remember | 10 | - | 10 | - | - | 25 | - |
| Understand | 20 | 50 | 20 | 50 | 50 | 25 | 50 |
| Apply | 30 | 50 | 30 | 50 | 50 | 50 | 50 |
| Analyse | - | - | - | - | - | - | - |
| Evaluate | - | - | - | - | - | - | - |
| Create | - | - | - | - | - | - | - |
| Total | 60 | 100 | 60 | 100 | 100 | 100 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC E44 - Design for Manufacturing** | | | | | | | | |
| **Semester** | **Hours / Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VII | 2 | 0 | 2 | 60 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| **Introduction to Design for Manufacturing Processes*** Definition and Importance of DFM - Benefits and Cost Savings through DFM - DFM Principles and Guidelines - Design for Assembly (DFA) Concepts - Common Manufacturing Processes: Casting, Machining. | **[6]** |
| **Design Considerations**** Design for Machinability: Minimizing Machining Time and Cost - Design for Forging: Design Rules for Forgeable Parts - Design for Additive Manufacturing: Design Concept Generation, Manufacturability and Process Selection. | **[6]** |
| **Design for Assembly and Cost Analysis*** Assembly Process Analysis and Simplification - Design for Minimum Parts and Reduced Assembly Time - Techniques for Designing for Easy Assembly - Cost Estimation Techniques for Manufacturing - Life Cycle Cost Analysis and Design Optimization. | **[6]** |
| **Design for Quality and Tolerance Analysis*** Principles of Quality Control and Defect Prevention - Design Platforms with cloud-based software tools - Design for Robustness - Tolerance Analysis: Symbols and Terms - Datum Reference Frames (DRFs) - Form Tolerances - Position Tolerance. | **[6]** |
| **Emerging Technologies and Sustainable Design*** Design for Automation and Robotics Integration - Design for Additive Manufacturing (3D Printing) - Sustainable Design Considerations and Material Selection - Design for Disassembly and Remanufacturing. | **[6]** |
| **Practical:** 1. For the Pedestal Shown in Fig.1 Indicate the Probable Parting Line and any Unnecessary Sand Cores, Accepting that the Probable Parting line is the one Involving the Minimum Sand Cores. Show a Design Modification to Reduce or Eliminate the Need for Sand Cores; Maintain Approximately Same Weight of Casting in the Modified Design Simulate the Speed and Torque characteristics of different types of Electric Motors (DC, AC Induction, Stepper motor) under Varying Loads.   **Fig. 1** 2. There are two Possible Parting Lines for the V-belt Pulley. These Parting Lines can be Indicated along with the Appropriate sand Cores. Assuming that the V-Grooves are Machined from a Solid rim, a Design Modification is Required to Reduce or eliminate the need for sand cores while maintaining similar weight and stability of the casting. Provide the possible solutions with appropriate solid models. 3. The Shaft is to be Manufactured from 0.4% carbon steel to the sizes shown in Fig.2. The 30 mm and the 40 mm diameter are to be ground. Prepare a production detail drawing for shaft using any modeling software. | **[30]** |

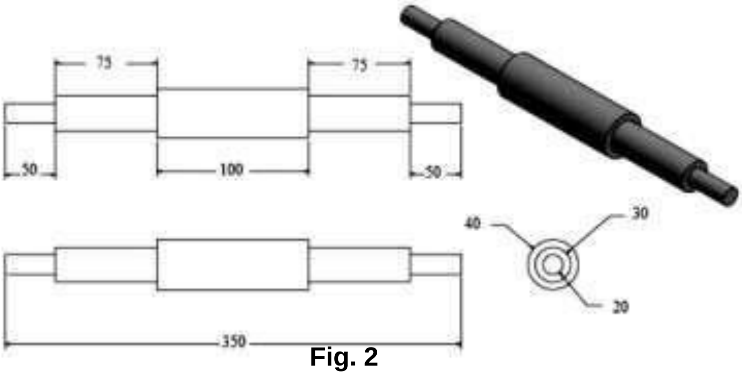



Fig. 2

1. There are two possible parting lines for the V-belt pulley. These parting lines can be indicated along with the appropriate sand cores. Assuming that the V-grooves are machined from a solid rim, a design modification is required to reduce or eliminate the need for sand cores while maintaining similar weight and stability of the casting. Provide the possible solutions with appropriate solid models.

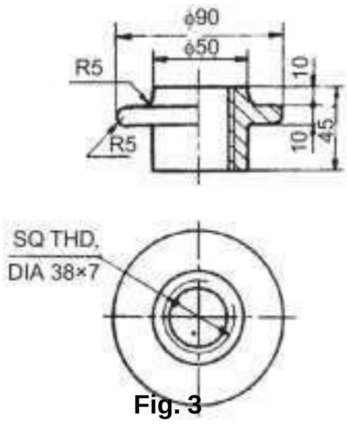



Fig. 3

2. Create a Square headed bolt as shown in Fig.4 in additive manufacturing technique using FreeCAD software. Use D = 10 mm, 15 mm, 20 mm.

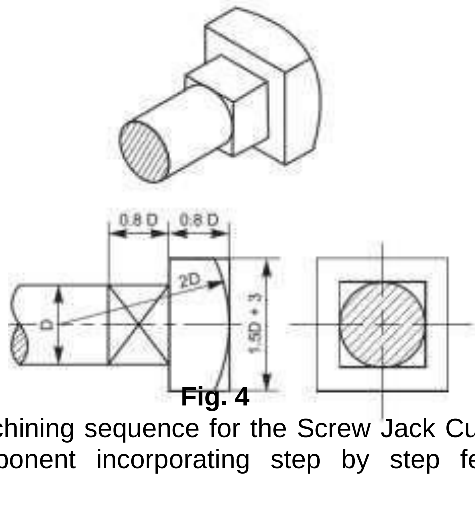



Fig. 4

3. Suggest a suitable machining sequence for the Screw Jack Cup as shown in Fig.5 and redraw the component incorporating step by step features to facilitate manufacture.

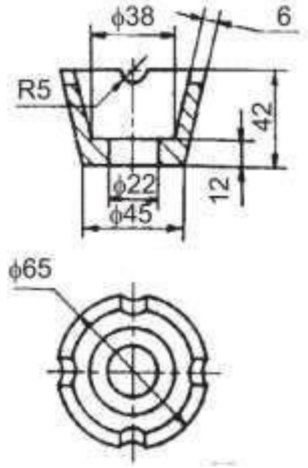



**Fig. 5**

7. In a four Story Wooden Rack Furniture Assembly Line the Furniture Manufacturer Sought to Reduce the Complexity of Assembling In the Product Line. Provide as Case Study With Appropriate Diagrams That Which Focuses on Assembly Process Analysis and Simplification.
8. A Company Manufactures a Stapler With 14 Individual Parts. The Assembly Process Is Time-Consuming And Prone to Errors. Demonstrate the Benefits of Designing for Minimum Parts In The Stapler to Achieve Simplicity And Reduce Costs.
9. A Company That Manufactures Smartphones Wants to Improve the Recyclability of Its Products By Designing them for Easier Disassembly At The End of Their Life Cycle. Provide a Detailed Approach That Can Be Disassembled More Easily, AllowingFor The Efficient Recovery of Valuable Components And Materials for Recycling.
10. A Company Designs Disposable Plastic Water Bottles. They Want to Create a More Sustainable Alternative. Discuss In Details About that the Final Design Might Be a Reusable and Cost Effective With Appropriate Sketches

| | |
|---|---|
| **Tools used: Fusion 360, AutoCAD, FreeCAD** | |
| **Total Hours: (Lecture - 30; Practical - 30)** | **60** |

**Text Book(s):**


| | |
|---|---|
| 1. | Geoffrey Boothroyd, Peter Dewhurst and Winston Knight, “Product Design for Manufacture and Assembly”, CRC Press, 2018 |
| 2. | Andreas Gebhardt and Phillip M. Campbell, “Design for Additive Manufacturing: Tips, Tricks and Strategies from Rapid Prototyping Production”, Hanser Publishers, 2023 |


**Reference(s):**


| | |
|---|---|
| 1. | Steven Cochran, “The Hitchhiker’s Guide to Manufacturing: Ideas for Those Who Want to Make Things Better”, Productivity Press, 2016 |
| 2. | Theodore D. Ward, Christoph Meinel and Kenneth L. Starker, Concurrent Engineering Fundamentals: Integrated Product and Process Design”, CRC Press, 2022 |
| 3. | Jian Ma, "DFM Principles for Engineers", Academic Press, 2019 |
| 4. | Vladimir Navrotsky, "DFM for 3D Printing: A Practical Guide to Manufacturing Design for 3D Printers", Apress, 2020 |


*SDG 9 – Industry Innovation and Infrastructure
**SDG 12 – Responsible Consumption and Production

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of Hours |
|---|---|---|
| **1** | **Introduction to Design for Manufacturing Processes** | |
| 1.1 | Definition and Importance of DFM | 1 |
| 1.2 | Benefits and Cost Savings through DFM | 1 |
| 1.3 | DFM Principles and Guidelines | 1 |
| 1.4 | Design for Assembly (DFA) Concepts | 1 |
| 1.5 | Common Manufacturing Processes: Casting | 1 |
| 1.6 | Common Manufacturing Processes: Machining | 1 |
| **2** | **Design Considerations** | |
| 2.1 | Design for Machinability | 1 |
| 2.2 | Minimizing Machining Time and Cost | 1 |
| 2.3 | Design for Forging: Design Rules for Forgeable Parts | 1 |
| 2.4 | Design for Additive Manufacturing | 1 |
| 2.5 | Design Concept Generation | 1 |
| 2.6 | Manufacturability and Process Selection | 1 |
| **3** | **Design for Assembly and Cost Analysis** | |
| 3.1 | Assembly Process Analysis and Simplification | 1 |
| 3.2 | Design for Minimum Parts and Reduced Assembly Time | 1 |
| 3.3 | Techniques for Designing for Easy Assembly | 1 |
| 3.4 | Cost Estimation Techniques for Manufacturing | 1 |
| 3.5 | Life Cycle Cost Analysis | 1 |
| 3.6 | Design Optimization | 1 |
| **4** | **Design for Quality and Tolerance Analysis** | |
| 4.1 | Principles of Quality Control - Principles of Defect Prevention | 1 |
| 4.2 | Design Platforms with Cloud-Based Software Tools | 1 |
| 4.3 | Design for Robustness | 1 |
| 4.4 | Tolerance Analysis: Symbols and Terms | 1 |
| 4.5 | Datum Reference Frames (DRFs) | 1 |
| 4.6 | Form Tolerances - Position Tolerance | 1 |
| **5** | **Emerging Technologies and Sustainable Design** | |
| 5.1 | Design for Automation | 1 |
| 5.2 | Design for Robotics Integration | 1 |
| 5.3 | Design for Additive Manufacturing (3D Printing) | 1 |
| 5.4 | Sustainable Design Considerations and Material Selection | 1 |
| 5.5 | Design for Disassembly | 1 |
| 5.6 | Design for Remanufacturing | 1 |
| **Practical:** | | |
| 1. | For The Pedestal Shown In Fig.1 Indicate the Probable Parting Line and any Unnecessary Sand Cores, Accepting That the Probable Parting Line is The One Involving The Minimum Sand Cores. Show a Design Modification To Reduce or Eliminate the Need for Sand Cores; Maintain Approximately Same Weight of Casting In the Modified Design. | 4 |



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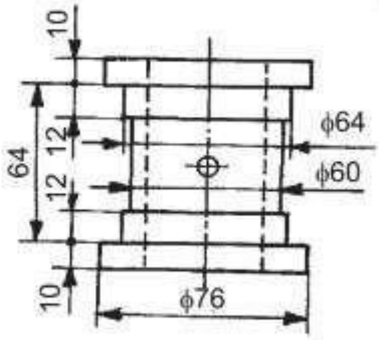
<table>
<tr><td></td><td>

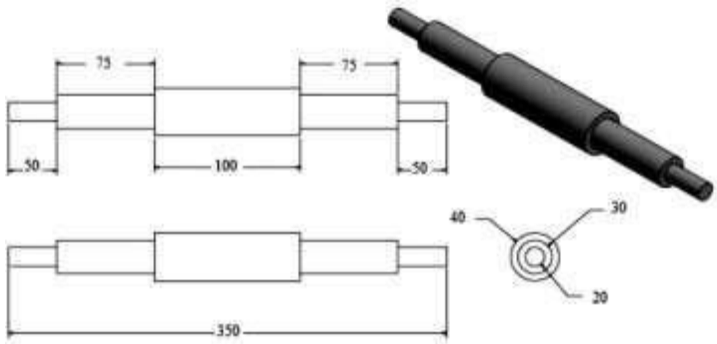
Fig. 1</td><td></td></tr>
<tr><td>2.</td><td>There are two possible parting lines for the V-belt pulley. These parting lines can be indicated along with the appropriate sand cores. Assuming that the V-grooves are machined from a solid rim, a design modification is required to reduce or eliminate the need for sand cores while maintaining similar weight and stability of the casting. Provide the possible solutions with appropriate solid models.</td><td>4</td></tr>
<tr><td>3.</td><td>The shaft is to be manufactured from 0.4% carbon steel to the sizes shown in Fig.2. The 30 mm and the 40 mm diameter are to be ground. Prepare a production detail drawing for shaft using any modeling software.


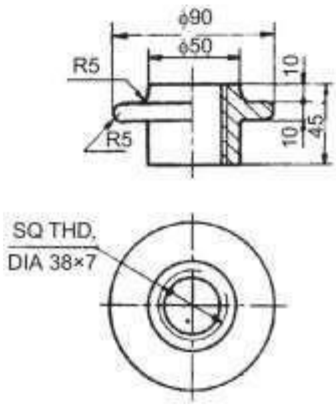
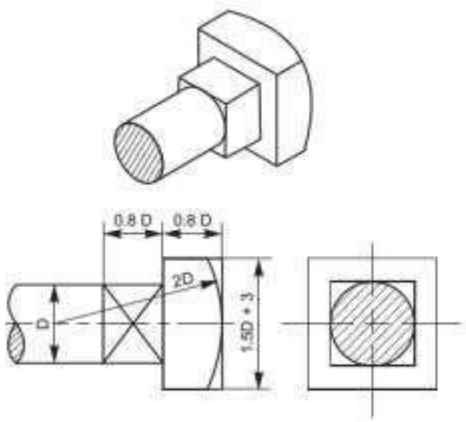
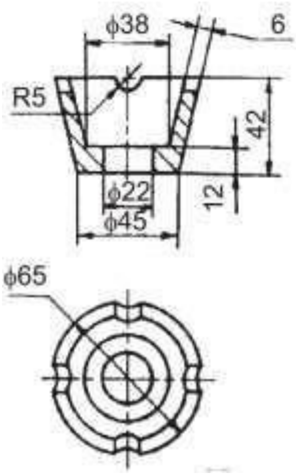
Fig. 2</td><td>4</td></tr>
<tr><td>4.</td><td>The Screw Jack Nut as shown in Fig.3 is to be manufactured in batches of 100. Describe a method of manufacture intended to reduce machining time to a minimum.


Fig. 3</td><td>2</td></tr>
</table>

| | | |
|---|---|---|
| 5. | Create a Square headed bolt as shown in Fig.4 in additive manufacturing technique using FreeCAD software. Use D = 10 mm, 15 mm, 20 mm.   **Fig. 4** | 4 |
| 6. | Suggest a suitable machining sequence for the Screw Jack Cup as shown in Fig.5 and redraw the component incorporating step by step features to facilitate manufacture.   **Fig. 5** | 4 |
| 7. | In a four-story wooden rack furniture assembly line the furniture manufacturer sought to reduce the complexity of assembling in the product line. Provide as case study with appropriate diagrams that which focuses on assembly process analysis and simplification. | 2 |
| 8. | A company manufactures a stapler with 14 individual parts. The assembly process is time-consuming and prone to errors. Demonstrate the benefits of designing for minimum parts in the stapler to achieve simplicity and reduce costs. | 2 |
| 9. | A company that manufactures smartphones wants to improve the recyclability of its products by designing them for easier disassembly at the end of their life cycle. Provide a detailed approach that can be disassembled more easily, allowing for the efficient recovery of valuable components and materials for recycling. | 2 |
| 10. | A company designs disposable plastic water bottles. They want to create a more sustainable alternative. Discuss in details about that the final design might be a reusable and cost effective with appropriate sketches. | 2 |

**Course Designer(s)**

Dr. A. Ramesh Kumar – rameshkumar@ksrct.ac.in

| 60 MC E45 | Finite Element Analysis | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 2 | 0 | 2 | 3 |

## Objectives

- To explore the mathematical theory keystones in finite element analysis.
- To practice the various steps involved in the finite element analysis of a problem.
- To learn solve the two-dimensional problems.
- To apply the finite element method by solving the problems in solid and structural mechanics, heat transfer.
- To solve isoperimetric element problems.

## Pre-requisites

NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the concept of FEA and develop the governing equations for a continuum. | Understand |
| CO2 | Model and assemble the stiffness matrices for 1D elements | Apply |
| CO3 | Apply plane stress and plane strain and solve 2D heat transfer problems. | Apply |
| CO4 | Solve and analyze the engineering problems in axisymmetric elements. | Apply |
| CO5 | Apply the concepts of isoparametric elements in FEA | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | - | 2 | - | - | - | - | - | - | - | 1 | 1 |
| CO2 | 3 | 2 | 3 | - | 2 | - | - | - | - | - | - | - | 1 | 1 |
| CO3 | 3 | 3 | 2 | - | 2 | - | - | - | - | - | - | - | 1 | 1 |
| CO4 | 3 | 2 | 3 | - | 2 | - | - | - | - | - | - | - | 1 | 1 |
| CO5 | 3 | 2 | 3 | - | 2 | - | - | - | - | - | - | - | 1 | 1 |
| 3 - Strong; 2 - Medium; 1 - Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | | | Model Examination (Marks) | End Sem Examination (Marks) | |
|---|---|---|---|---|---|---|---|
| | Test 1 | | Test 2 | | | | |
| | Theory | Lab | Theory | Lab | Lab | Theory | Lab |
| Remember | 10 | - | 10 | - | - | 10 | - |
| Understand | 10 | 50 | 10 | 50 | 50 | 10 | 50 |
| Apply | 40 | 50 | 40 | 50 | 50 | 80 | 50 |
| Analyse | - | - | - | - | - | - | - |
| Evaluate | - | - | - | - | - | - | - |
| Create | - | - | - | - | - | - | - |
| Total | 60 | 100 | 60 | 100 | 100 | 100 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E - Mechatronics Engineering** | | | | | | | | |
| **60 MC E45 - Finite Element Analysis** | | | | | | | | |
| **Semester** | **Hours / Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 2 | 0 | 2 | 60 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| **Introduction to FEM**<br>Introduction to Finite Element Analysis – Discretization –Basics of Matrix Algebra and Gauss Elimination Method – Governing Equations for Continuum – Classical Techniques in FEM. | **[6]** |
| **One Dimensional Problems**<br>1-D Finite Element Modeling – Bar Element – Beam Element- Coordinates and Shape Functions – Assembly of Stiffness Matrix –Formulation of Element Matrices and Equations. | **[6]** |
| **Two Dimensional Problems**<br>2-D Finite Element Modeling – Plane Stress and Plane Strain – Assumptions- Element Equations and Element Matrices – 2D heat Transfer Problems. | **[6]** |
| **Axisymmetric Elements**<br>Asymmetric Formulation – Stiffness Matrix – Pressure Vessel Analysis – Axisymmetric Problems - Application to Structural and Heat Transfer Problems. | **[6]** |
| **Isoparametric Elements**<br>Quadrilateral Elements – Coordinate Transformations – Jacobin Transformation Matrix - Shape Functions - Numerical Integration. | **[6]** |
| **Practical:**<br>1. Force and Stress Analysis Using Link Elements in Trusses. Applying the VI Program to Design a Half Adder.<br>2. Stress and Deflection Analysis in Beams with Different Support Conditions.<br>3. Stress Analysis of Flat Plates.<br>4. Stress Analysis of Axis–Symmetric Components.<br>5. Thermal Stress and Heat Transfer Analysis of Plates.<br>6. Thermal Stress Analysis of Cylindrical Shells.<br>7. Vibration Analysis of Spring-Mass Systems.<br>8. Couple Field Analysis (Thermo – Structural Analysis).<br>9. Modal Analysis of Beams.<br>10. Harmonic Response of Structural Members. | **[30]** |
| **Total Hours: (Lecture - 30; Practical - 30)** | **60** |

**Text Book(s):**

| | |
|---|---|
| 1. | Chandrupatla T.R and Belegundu A.D., “Introduction to Finite Elements in Engineering”, 3rd Edition, Pearson Education, New Delhi, 2012. |
| 2. | Rao S S “The Finite Element Method in Engineering”, 4th Edition,Elsevier India, noida 2011 |

**Reference(s):**

| | |
|---|---|
| 1. | Daryl L.Logan,“A First course in the Finite Element Method”,, Cengage Learning, 2015. |
| 2. | Cook R D, Malkus D S,Plesha M E, “Concepts and Applications of Finite Element Analysis”, John Wiley and Sons, New Delhi, 2015 |

w.e.f. 25/05/2024
Passed in the BoS Meeting Held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

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| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of Hours** |
| **1.0** | **Introduction to FEM** | |
| 1.1 | Introduction to Finite Element Analysis | 1 |
| 1.2 | Discretization | 1 |
| 1.3 | Basics of Matrix algebra | 1 |
| 1.4 | Gauss Elimination Method | 1 |
| 1.5 | Governing Equations for Continuum | 1 |
| 1.6 | Classical Techniques in FEM | 1 |
| **2.0** | **One Dimensional Problems** | |
| 2.1 | 1-D Finite Element Modeling | 1 |
| 2.2 | Bar Element | 1 |
| 2.3 | Beam Element | 1 |
| 2.4 | Coordinates and Shape Functions | 1 |
| 2.5 | Assembly of Stiffness Matrix | 1 |
| 2.6 | Formulation of Element Matrices and Equations. | 1 |
| **3.0** | **Two Dimensional Problems** | |
| 3.1 | 2-D Finite Element Modeling | 1 |
| 3.2 | Plane stress and Plane Strain | 1 |
| 3.3 | Assumptions | 1 |
| 3.4 | Element Equations | 1 |
| 3.5 | Element Matrices | 1 |
| 3.6 | 2D heat Transfer Problems. | 1 |
| **4.0** | **Axisymmetric Elements** | |
| 4.1 | Asymmetric Formulation | 1 |
| 4.2 | Stiffness Matrix | 1 |
| 4.3 | Pressure Vessel Analysis | 1 |
| 4.4 | Axisymmetric Problems | 1 |
| 4.5 | Application to Structural | 1 |
| 4.6 | Heat Transfer Problems | 1 |
| **5.0** | **Isoparametric Elements** | |
| 5.1 | Quadrilateral Elements | 1 |
| 5.2 | Coordinate Transformations | 1 |
| 5.3 | Jacobin Transformation Matrix | 1 |
| 5.4 | Shape Functions | 1 |
| 5.5 | Auto Focus Camera | 1 |
| 5.6 | Numerical Integration | 1 |
| **Practical:** | | |
| 1. | Force and Stress Analysis using link Elements in Trusses. Applying the VI Program to Design a half Adder. | 3 |
| 2. | Stress and Deflection Analysis in Beams with Different Support Conditions. | 3 |
| 3. | Stress Analysis of Flat Plates. | 3 |
| 4. | Stress Analysis of axis–Symmetric Components. | 3 |
| 5. | Thermal Stress and Heat Transfer Analysis of Plates. | 3 |
| 6. | Thermal Stress Analysis of Cylindrical Shells. | 3 |
| 7. | Vibration Analysis of Spring-Mass Systems. | 3 |
| 8. | Couple Field Analysis (Thermo – Structural Analysis). | 3 |
| 9. | Modal Analysis of Beams. | 3 |
| 10. | Harmonic Response of Structural Members. | 3 |

**Course Designer(s)**

Dr.R.Senthilmurugan – senthilmurugan@ksrct.ac.in

| 60 MC E46 | Process Planning and Cost Estimation | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 2 | 0 | 2 | 3 |

## Objectives

- To introduce the process planning concepts and its necessity
- Economic planning of tools and equipment requirement
- Differentiate between cost accounting and cost estimation
- Cost Estimation and analysis
- To estimate time for various machining operations

## Pre-requisites

Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Explain the concept of selection and steps in process planning, tooling, equipment selection and material evaluation | Understand |
| CO2 | Calculate process parameters and select Jig, Fixtures and quality assurance methods | Apply |
| CO3 | Apply the methods of costing and to explain the concept of estimation. | Apply |
| CO4 | Compute the cost of the product in various shops of production | Apply |
| CO5 | Calculate the machining time for various operation | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | - | 2 | 2 | 2 |
| CO2 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | - | 2 | 2 | 2 |
| CO3 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | - | 2 | 2 | 2 |
| CO4 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | - | 2 | 2 | 2 |
| CO5 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | - | 2 | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | | | Model Examination (Marks) | End Sem Examination (Marks) | |
|---|---|---|---|---|---|---|---|
| | Test 1 | | Test 2 | | | | |
| | Theory | Lab | Theory | Lab | Lab | Theory | Lab |
| Remember | 20 | - | 10 | - | - | 10 | - |
| Understand | 20 | 50 | 20 | 50 | 50 | 10 | 50 |
| Apply | 20 | 50 | 30 | 50 | 50 | 80 | 50 |
| Analyse | - | - | - | - | - | - | - |
| Evaluate | - | - | - | - | - | - | - |
| Create | - | - | - | - | - | - | - |
| Total | 60 | 100 | 60 | 100 | 100 | 100 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| B.E – Mechatronics Engineering | | | | | | | | |
| 60 MC E46 - Process Planning and Cost Estimation | | | | | | | | |
| **Semester** | **Hours / Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VII | 2 | 0 | 2 | 60 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| **Introduction to Process Planning**<br>Introduction- Methods of Process Planning-Drawing Interpretation-Material Evaluation – Steps in Process Selection, Production Equipment and Tooling Selection | **[6]** |
| **Process Planning Activities**<br>Process Parameters Calculation for Various Production Processes-Selection Jigs and Fixtures Selection of Quality Assurance Methods – Set of Documents for Process Planning-Economics of Process Planning- Case Studies | **[6]** |
| **Introduction to Cost Estimation**<br>Importance of Costing and Estimation –Methods of Costing-Elements of Cost Estimation –Types of Estimates – Estimating Procedure- Estimation of Labour Cost, Material Cost- Allocation of Overhead Charges- Calculation of Depreciation Cost | **[6]** |
| **Production Cost Estimation**<br>Estimation of Different Types of Jobs – Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop | **[6]** |
| **Machining Time Calculation**<br>Estimation of Machining Time — Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations, Drilling and Boring – Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding. | **[6]** |
| Practical:<br>1. Perform the Operations and Estimate the Machining Time Calculation on Facing and Step Turning<br>2. Perform the Operations and Estimate the Machining Time Calculation on Step Turning, Chamfering and Grooving<br>3. Perform the Operations and Estimate the Machining Time Calculation on Turning, Knurling and Thread Cutting<br>4. Perform the Operations and Estimate the Machining Time Calculation on Drilling and Tapping<br>5. Perform the Operations and Estimate the Machining Time Calculation on Cylindrical Grinding<br>6. Perform the Operations and Estimate Machining Time Calculation on Shaping<br>7. Perform the Operations and Estimate Machining Time Calculation on Milling<br>8. Case Study: Prepare the Operation Planning Sheet for A Given Component<br>**Tools Used**: Centre Lathe , Drilling Machine, Tapping Tool, Grinding Machine ,Shaping Machine , Milling Machine | **[30]** |
| **Total Hours: (Lecture - 30; Practical - 30)** | **60** |

**Text Book(s):**

| | |
|---|---|
| 1. | Narang G B S. and Kumar, V., “Production and Costing”, 4th Edition, Khanna Publishers, New Delhi 2013 |
| 2. | Banga T R., and Sharma, S C., “Mechanical Estimating and Costing Including Costing”, 16th Edition, Khanna Publishers, New Delhi.2006 |

**Reference(s):**

| | |
|---|---|
| 1. | Chitale A.V. and Gupta R.C., “Product Design and Manufacturing”, 7th Edition, PHI, 2023 |
| 2. | Peter scalon, “Process planning, Design/Manufacture Interface”, Elsevier science technology Books, Dec 2002 |
| 3. | Gideon Halevi, Process and operation planning‖, Kluwer academic Publishers (Printede-book), 2003. |
| 4 | R Kesavan, C Ellanchezhian, B Vijaya Ramanath, Process Planning and cost estimation, New Age International, New Edition 2017 |
| 5 | Russell R.S and Tailor B.W, “Operations Management”, 4th Edition, PHI, 2003 |

*SDG 9 – Industry Innovation and Infrastructure

w.e.f. 25/05/2024
Passed in the BoS Meeting Held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

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## Course Contents and Lecture Schedule

| S.No | Topic | No. of Hours |
|---|---|---|
| **1.0** | **Introduction to Process Planning** | |
| 1.1 | Introduction | 1 |
| 1.2 | Methods of Process Planning | 1 |
| 1.3 | Drawing Interpretation | 1 |
| 1.4 | Material Evaluation | 1 |
| 1.5 | Steps in Process Selection | 1 |
| 1.6 | Production Equipment and Tooling Selection | 1 |
| **2.0** | **Process Planning Activities** | |
| 2.1 | Process Parameters Calculation for Various Production Processes | 1 |
| 2.2 | Selection Jigs and Fixtures Election of Quality Assurance Methods | 1 |
| 2.3 | Set of Documents for Process Planning | 1 |
| 2.4 | Economics of Process Planning | 1 |
| 2.5 | Case Studies | 2 |
| **3.0** | **Introduction To Cost Estimation** | |
| 3.1 | Importance of Costing and Estimation | 1 |
| 3.2 | Methods of Costing,Elements of Cost Estimation | 1 |
| 3.3 | Types of Estimates – Estimating Procedure | 1 |
| 3.4 | Estimation of Labour Cost, Material Cost | 1 |
| 3.5 | Allocation of Overhead Charges | 1 |
| 3.6 | Calculation of Depreciation Cost | 1 |
| **4.0** | **Production Cost Estimation** | |
| 4.1 | Introduction | 1 |
| 4.2 | Estimation of Different Types of Jobs | 1 |
| 4.3 | Estimation of Forging Shop | 1 |
| 4.4 | Estimation of Welding Shop | 1 |
| 4.5 | Estimation of Foundry Shop | 2 |
| **5.0** | **Machining Time Calculation** | |
| 5.1 | Estimation of Machining Time ,Importance of Machine Time Calculation | 1 |
| 5.2 | Calculation of Machining Time for Different Lathe Operations | 1 |
| 5.3 | Drilling and Boring | 1 |
| 5.4 | Machining Time Calculation for Milling | 1 |
| 5.5 | Shaping and Planning | 1 |
| 5.6 | Machining Time Calculation for Grinding | 1 |
| | **Total** | **30** |
| **Practical:** | | |
| 1 | Perform the Operations and Estimate the Machining Time Calculation on Facing and Step Turning | 4 |
| 2 | .Perform the Operations and Estimate the Machining Time Calculation on Step Turning ,Chamfering and Grooving | 4 |
| 3 | Perform the Operations and Estimate the Machining Time Calculation on Turning ,Knurling and Thread Cutting | 4 |
| 4 | Perform the Operations and Estimate the Machining Time Calculation on Drilling and Tapping | 4 |
| 5 | Perform the Operations and Estimate the Machining Time Calculation on Cylindrical Grinding | 4 |
| 6 | Perform the Operations and Estimate Machining Time Calculation on Shaping | 4 |
| 7 | Perform the Operations and Estimate Machining Time Calculation on Milling | 4 |
| 8 | Case Study: Prepare the Operation Planning Sheet for A Given Component | 2 |

Dr.P.Mohanram -mohanram@ksrct.ac.in

| 60 MC E47 | Robotics Programming | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To introduce the fundamentals of robotic programming
- To understand the ROS fundamentals.
- To understand the criteria for selecting a sensor and actuator for a particular ROS robotic application.
- To familiarize with various hardware based robotic application
- Learn about various sensors, actuators, robot programming

## Pre-requisites

- Robotics Engineering

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the robotics design and implementation. | Understand |
| CO2 | Gain the knowledge on fundamentals of robotic programming | Understand |
| CO3 | Comprehend, classify and analyze the behavior of different types of sensors and actuators | Apply |
| CO4 | Understand the ROS fundamentals | Understand |
| CO5 | Design robotic applications using ROS | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO2 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO3 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO4 | 3 | 3 | - | - | - | 3 | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO5 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 20 | 20 | 20 |
| Understand | 40 | 30 | 70 |
| Apply | - | 10 | 10 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E – Mechatronics Engineering** | | | | | | | | |
| **60 MC E47 - Robotics Programming** | | | | | | | | |
| Semester | | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to Robotics Programming**<br>Overview of robotics applications and domains- Introduction to robot components: sensors, actuators, controllers- Basics of robot kinematics and dynamics- Introduction to ROS (Robot Operating System)- ROS architecture and concepts (nodes, topics, messages)- Writing simple ROS programs in Python or C++. | **[09]** |
| **Sensors and Perception**<br>Introduction to sensors commonly used in robotics- Sensor data processing and interpretation- Introduction to computer vision techniques for robotics- Basics of motion planning algorithms- Path planning and trajectory generation- Integration of motion planning with ROS. | **[09]** |
| **Robot Control**<br>Introduction to localization and mapping (SLAM)- Techniques for robot localization - Building maps of robot environments using ROS packages- Introduction to machine learning for robotics- Reinforcement learning for robot control-Integration of AI techniques with ROS. | **[09]** |
| **AI in Robotics**<br>Socio-Economic aspect of robotisation. Economical aspects for robot design, Safety for robot and standards, Introduction to Artificial Intelligence, AI techniques, Need and application of AI, mobile robotics,<br>New trends & recent updates in robotics. Mobile Robot locomotion: Types of locomotion, hopping robots, legged robots, wheeled robots, stability, manoeuvrability, controllability. | **[09]** |
| **Applications and Digital Manufacturing**<br>Robots Manufacturing, Construction, Medical, Defense, Logistics & Storage, Packing & Palletizing, Inspection & Quality Control, Harvesting, Painting & Coating, Cleaning & Hygiene, Aerospace, basics incyber-physical production systems, data- driven production, industrial internet of things, digital twin technology and simulation methodologies. | **[09]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | S. K. Saha, Introduction to Robotics, 2nd Edition, TATA McGraw Hills Education,2014. |
| 2. | John.J.Craig, " Introduction to Robotics: Mechanics & control" , Pearson Publication, 4th Edition, 2018. |

**Reference(s):**

| | |
|---|---|
| 1. | Lentin Joseph, Robot Operating System (ROS) for Absolute Beginners: Robotics Programming Made Easy, 1st Edition, A Press, 2018. |
| 2. | Jonathan Cacace; Lentin Joseph, Mastering ROS for Robotics Programming: Design, build, and simulate complex robots using the Robot Operating System, 2nd Edition, Packt Publishing, 2018 |
| 3. | Anil Mahtani, Luis Sanchez, Enrique Fernandez, Aaron Martinez, Lentin Joseph. ROS Programming: Building Powerful Robots. Packt Publishing, 2018. |
| 4. | Robotic Engineering by Richard D.Klafter, Prentice Hall |

*SDG 3 – Good Health and Well Being

w.e.f. 25/05/2024
Passed in the BoS Meeting Held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

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Mechatronics Engineering

## Course Contents and Lecture Schedule

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Introduction to Robotics Programming** | |
| 1.1 | Overview of robotics applications and domains | 2 |
| 1.2 | Introduction to robot components: sensors | 1 |
| 1.3 | Actuators, controllers- Basics of robot kinematics and dynamics | 1 |
| 1.4 | Introduction to ROS (Robot Operating System) | 2 |
| 1.5 | ROS architecture and concepts (nodes, topics, messages) | 2 |
| 1.6 | Writing simple ROS programs in Python or C++. | 1 |
| **2.0** | **Sensors and Perception** | |
| 2.1 | Introduction to sensors commonly used in robotics | 1 |
| 2.2 | Sensor data processing and interpretation | 2 |
| 2.3 | Introduction to computer vision techniques for robotics | 2 |
| 2.4 | Basics of motion planning algorithms | 2 |
| 2.5 | Path planning and trajectory generation | 1 |
| 2..6 | Integration of motion planning with ROS | 1 |
| **3.0** | **Robot Control** | |
| 3.1 | Introduction to localization and mapping (SLAM) | 2 |
| 3.2 | Techniques for robot localization | 2 |
| 3.3 | Building maps of robot environments using ROS packages | 2 |
| 3.4 | Introduction to machine learning for robotics | 1 |
| 3.5 | Reinforcement learning for robot control | 1 |
| 3.6 | Integration of AI techniques with ROS | 1 |
| **4.0** | **AI in Robotics** | |
| 4.1 | Socio-Economic aspect of robotisation. Economical aspects for robot design | 1 |
| 4.2 | Safety for robot and standards, Introduction to Artificial Intelligence | 2 |
| 4.3 | AI techniques, Need and application of AI, mobile robotics | 1 |
| 4.4 | New trends & recent updates in robotics | 2 |
| 4.5 | Mobile Robot locomotion: Types of locomotion | 1 |
| 4.6 | Hopping robots,legged robots, wheeled robots, stability, maneuverability, controllability | 2 |
| **5.0** | **Applications and Digital Manufacturing** | |
| 5.1 | Robots Manufacturing, Construction | 1 |
| 5.2 | Medical, Defence, Logistics & Storage, Packing & Palletizing | 2 |
| 5.3 | Inspection & Quality Control, Harvesting, Painting & Coating, Cleaning & Hygiene | 2 |
| 5.4 | Aerospace, basics in cyber physical production systems | 1 |
| 5.5 | Data driven production, industrial internet of things | 2 |
| 5.4 | Digital twin technology and simulation methodologies. | 1 |

## Course Designer(s)

1. Dr.M.Ravi-ravi@ksrct.ac.in

| 60 MC E48 | Sensors and Machine Vision System | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- Acquaint students with the various types of sensors, their principles, and their applications indiverse fields.
- Provide students with a comprehensive overview of machine vision systems, image processing techniques, and their role in automation and analysis.
- Develop practical skills in interfacing sensors, processing visual data, and designing simple vision-based systems.
- Enable students to apply sensor and machine vision knowledge to solve real-world challenges in fields like robotics, manufacturing, and healthcare.
- Foster an understanding of the ethical considerations related to data collection, privacy, and bias in machine vision applications

## Pre-requisites

- Sensors and Instrumentation, Robotics Engineering

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Identify and classify various sensor types based on their principles and applications. | Understand |
| CO2 | Assess the suitability of different sensors for specific tasks based on their characteristics. | Understand |
| CO3 | Describe the opstical components, image formation process, and image sensor technologies in machine vision systems. | Apply |
| CO4 | Apply image enhancement, transformation, and segmentation techniques to preprocess images for analysis. | Apply |
| CO5 | Utilize image processing libraries and tools to extract relevant features from images. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO2 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO3 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO4 | 3 | 3 | - | - | - | 3 | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO5 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 30 | 20 | 30 |
| Understand | 30 | 30 | 30 |
| Apply | - | 10 | 40 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| B.E – Mechatronics Engineering | | | | | | | | |
| 60 MC E48 - Sensors and Machine Vision System | | | | | | | | |
| Semester | | | | Total Hours | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to Sensors**<br>Definition and importance of Sensors-Sensor classification based on physical properties-Sensing mechanisms : electrical, mechanical, optical, thermal-Sensor characteristics: sensitivity, accuracy,precision, resolution. | **[09]** |
| **Sensor Technologies**<br>Introduction to different sensor types: temperature, pressure, proximity, motion- Resistive, capacitive, inductive, and piezoelectric sensors- Optical sensors: photodiodes, phototransistors, lasers- Sensorcalibration and compensation techniques. | **[09]** |
| **Sensor Interfaces and Signal Conditioning**<br>Analog and digital sensor interfaces- Amplification and filtering of sensor signals- Analog-to-digital conversion (ADC) and digital-to-analog conversion (DAC)- Noise reduction and error handling in sensor data. | **[09]** |
| **Vision Systems Fundamentals**<br>Basics of human vision and perception- Image formation: lenses, cameras, optics- Color representationand perception- Image sensors: CCD and CMOS. | **[09]** |
| **Image Processing Techniques**<br>Image enhancement: filtering, histogram equalization, contrast adjustment- Image transformation: Fourier transform, Hough transform- Image segmentation: thresholding, edge detection- Feature extraction: corners, edges, texture. | **[09]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | Orlando E. Ruiz "Introduction to Sensors" CRC Press,2018 |
| 2. | Carsten Steger, Markus Ulrich, and Christian Wiedemann "Machine Vision Algorithms and Applications" Wiley,2018 |

**Reference(s):**

| | |
|---|---|
| 1. | Ramon Pallas-Areny and John G. Webster "Sensors and Signal Conditioning" Wiley,2010 |
| 2. | Jon S. Wilson "Sensor Technology Handbook", Newnes 2010 |
| 3. | Krzysztof Iniewski "Smart Sensors for Industrial Applications" CRC Press,2013 |
| 4. | E. R. Davies "Computer and Machine Vision: Theory, Algorithms, Practicalities" Academic Press,2015 |

*SDG 3 – Good Health and Well Being



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Board Of Studies/
Mechatronics Engineering

## Course Contents and Lecture Schedule

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Introduction to Sensors** | |
| 1.1 | Definition and importance of sensors-Sensor classification | 2 |
| 1.2 | Based on physical properties-Sensing mechanisms : electrical, mechanical | 1 |
| 1.3 | Optical, thermal-Sensor characteristics | 3 |
| 1.4 | Sensitivity, accuracy, precision, resolution | 3 |
| **2.0** | **Sensor Technologies** | |
| 2.1 | Introduction to different sensor types | 1 |
| 2.2 | Temperature, pressure, proximity, motion | 2 |
| 2.3 | Resistive, capacitive, inductive, and piezoelectric sensors | 2 |
| 2.4 | Optical sensors: photodiodes, phototransistors, lasers | 2 |
| 2.5 | Sensorcalibration and compensation techniques | 2 |
| **3.0** | **Sensor Interfaces and Signal Conditioning** | |
| 3.1 | Analog and digital sensor interfaces | 2 |
| 3.2 | Amplification and filteringn of sensor signals | 2 |
| 3.3 | Analog-to-digital conversion (ADC) and digital-to | 2 |
| 3.4 | Analog conversion (DAC)- Noise reduction and error | 2 |
| 3.5 | Handling in sensordata | 1 |
| **4.0** | **Vision Systems Fundamentals** | |
| 4.1 | Basics of human vision and perception | 2 |
| 4.2 | Image formation: lenses | 1 |
| 4.3 | Cameras, optics | 2 |
| 4.4 | Color representationand perception | 2 |
| 4.5 | Image sensors | 1 |
| 4.6 | CCD and CMOS | 1 |
| **5.0** | **Image Processing Techniques** | |
| 5.1 | Image enhancement: filtering, histogram equalization | 1 |
| 5.2 | Contrast adjustment- Image transformation | 2 |
| 5.3 | Fourier transform, Hough transform | 2 |
| 5.4 | Image segmentation: thresholding, edge detection | 2 |
| 5.5 | Feature extraction: | 1 |
| 5.4 | Corners, edges, texture | 1 |

## Course Designer(s)

1. Dr.M.Ravi-ravi@ksrct.ac.in
2. Mrs. V.Indumathi – indumathi@ksrct.ac.in



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Board Of Studies/
Mechatronics Engineering

| 60 MC E51 | Robotic Welding Technology | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To familiarize the fundamental types of welding technologies
- To understand the concepts of robotic welding systems.
- Learn about safety protocols and best practices in robotic welding.
- To enhance the knowledge in welding inspection and quality control techniques.
- Explore real-world applications of robotic welding in various industries

## Pre-requisites

- Robotics Engineering

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Realize the operation and processes of welding processes. | Understand |
| CO2 | Recognize the significance of various robotic welding systems | Apply |
| CO3 | Monitor and measure safety performance of robotic welding | Apply |
| CO4 | Apply basic knowledge of welding inspection and quality control techniques to identify welding defects. | Apply |
| CO5 | Recognize the various industrial applications of robotic welding. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | - | - | - | - | - | - | - | - | - | 3 | 3 | - | - |
| CO2 | 3 | - | - | - | - | - | - | - | - | - | 3 | 3 | - | - |
| CO3 | 3 | - | - | - | - | - | - | - | - | - | 3 | 3 | - | - |
| CO4 | 3 | - | - | - | - | 2 | - | - | - | - | 3 | 3 | - | - |
| CO5 | 3 | - | - | - | - | - | - | - | - | - | 3 | 3 | - | - |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 10 | 20 | 20 |
| Understand | 20 | 25 | 40 |
| Apply | 30 | 15 | 40 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

| Syllabus | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
| **B.E – Mechatronics Engineering** | | | | | | | | |
| **60 MC E51- Robotic Welding Technology** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VIII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| Content | Hours |
|---|---|
| **Welding Processes**<br>Classification of Welding Processes; Gas Welding; Arc Welding; Arc Physics, Power Source Characteristics - Gas Tungsten Arc Welding: Concepts, Processes and Applications; Gas Metal Arc Welding, Concepts, Processes and Applications, Types of Metal Transfer, Co2 Welding, Pulsed and Synergic Mig Welding, Fcaw. | **[9]** |
| **Robotics Welding**<br>Manual Versus Robotic Welding -Components of a Robotic Welding System - Classification of Welding Robots-Resistance Spot Welding Robot- Cobot Welding- Robot Laser Welding- Seam Welding -Programming the Robot- Advantages and Limitations - Challenges | **[9]** |
| **Safety In Robotic Welding**<br>Safety in Human -Robot Collaborations- General Robot Safety- Installation of Welding Robots -Electrical ,Blunt Force , Pinch Point, Eye Injuries - Hazards in Working with Robots – Fire Hazard Protection – Hazards in Workplace | **[9]** |
| **Welding Inspection and Quality Control***<br>Quality Issues in Robot Welding-Purpose and Limitations of NDT, Comparison of NDT Methods and Selection of NDT Methods.Concepts, Operating Principles, Advantages, Limitations, Of Liquid Penetrant And Magnetic Particle Testing, Eddy Current Testing, Ultrasonic Testing Radiography, Gamma Radiography Testing Acoustic Emission, Thermal Imaging Method. | **[9]** |
| **Industrial Applications****<br>Automatic Welding and Systems in Automobile Industry,-Welding Automation-Oil and Gas Industry, Field Welding for Pressure Vessel Applications-Materials, Processes, Fabrication, Inspection and Testing- Case Studies, Recent Trends and Developments | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**


| | |
|---|---|
| 1. | Norberto J. Pires, Altino Loureiro, Gunnar Bölmsjo, “Welding Robots: Technology, System Issues and Application” Springer Science & Business Media, 2006 |
| 2. | Tarn T. J., S. B. Chen, and K. L. Wu, “Robotic Welding, Intelligence, and Automation” [Online]. Available: https://www.springer.com/gp/book/9783662446747 ,2014. |


**Reference(s):**


| | |
|---|---|
| 1. | Groover M. P, “Industrial Robotics Technology, Programming, and Applications” New York, USA: McGraw-Hill, 2007. |
| 2. | Chen S. B. and J. Wu, “Intelligentized Methodology for Arc Welding Dynamical Processes” Berlin, Germany: Springer-Verlag, 2006 |
| 3. | Baldev Raj, Jayakumar.T, Thavasimuthu.M, “Practical Non Destructive Testing” 3rd Edition Narosa Publishing House, New Delhi,2009. |
| 4. | Larry Jeffus, “Welding: Principles and Applications” 8th Edition, CBS Publishers & Distributors, 2019 |


*SDG 3 – Good Health and Well Being

**SDG 9 – Industry Innovation and Infrastructure

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Welding Processes** | |
| 1.1 | Classification of Welding Processes | 1 |
| 1.2 | Gas Welding,Arc Welding | 2 |
| 1.3 | Arc Physics, Power Source Characteristics | 1 |
| 1.4 | Gas Tungsten Arc Welding: Concepts, Processes and Applications | 2 |
| 1.5 | Gas Metal Arc Welding, Concepts, Processes and Applications | 1 |
| 1.6 | Types of Metal Transfer, CO2 Welding | 1 |
| 1.7 | Pulsed and Synergic MIG Welding, FCAW. | 1 |
| **2.0** | **Robotics Welding** | |
| 2.1 | Manual Versus Robotic Welding | 1 |
| 2.2 | Components of a Robotic Welding System | 1 |
| 2.3 | Classification of welding robots | 1 |
| 2.4 | Resistance Spot Welding Robot | 1 |
| 2.5 | Cobot Welding | 1 |
| 2.6 | Robot Laser Welding | 1 |
| 2.7 | Programming the Robot | 1 |
| 2.8 | Advantages and Limitations, Challenges | 2 |
| **3.0** | **Safety in Robotic Welding** | |
| 3.1 | Safety in Human | 2 |
| 3.2 | Robot Collaborations | 1 |
| 3.3 | General Robot Safety | 1 |
| 3.4 | Installation of Welding Robots | 1 |
| 3.5 | Electrical ,Blunt Force , Pinch Point, Eye Injuries | 1 |
| 3.6 | Hazards in Working with Robots | 1 |
| 3.7 | Fire Hazard Protection | 1 |
| 3.8 | Hazards in Workplace | 1 |
| **4.0** | **Welding Inspection and Quality Control** | |
| 4.1 | Quality Issues in Robot Welding | 1 |
| 4.2 | Purpose and Limitations of NDT, Concepts | 2 |
| 4.3 | Operating Principles, Advantages | 1 |
| 4.4 | Limitations, of Liquid Penetrant and Magnetic Particle Testing, Eddy Current Testing, | 1 |
| 4.5 | Ultrasonic Testing Radiography | 1 |
| 4.6 | Acoustic Emission, Thermal Imaging Method. | 2 |
| 4.7 | Comparison of NDT Methods and Selection of NDT Methods | 1 |
| **5.0** | **Industrial Applications** | |
| 5.1 | Automatic Welding and Systems in Automobile Industry | 2 |
| 5.2 | Welding Automation | 1 |
| 5.3 | Oil and Gas Industry | 2 |
| 5.4 | Field Welding for Pressure Vessel Applications | 1 |
| 5.5 | Materials, Processes | 1 |
| 5.6 | Fabrication, Inspection and Testing | 1 |
| 5.7 | Case Studies, Recent Trends and Developments | 1 |

**Course Designer(s)**

1. Dr.M.Baskaran-baskaran@ksrct.ac.in

w.e.f. 25/05/2024
Passed in the BoS Meeting Held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

CHAIRMAN
Board Of Studies/
Mechatronics Engineering

| 60 MC E52 | Smart Mobility and Intelligent Vehicles | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To introduce students to the various technologies and systems used to implement smart mobility and intelligent vehicles.
- To learn Basics of Radar Technology and Systems, Ultrasonic Sonar Systems, LIDAR Sensor Technology and Systems and other sensors for automobile vision system.
- To learn Basic Control System Theory applied to Autonomous Automobiles.
- To produce overall impact of automating like various driving functions, connecting the automobile to sources of information that assist with a task
- To allow the automobile to make autonomous intelligent decisions concerning future actions

## Pre-requisites

- Autonomous Vehicle

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Recognize the concept of cyber-physical control systems and their application to collision avoidance and autonomous vehicles | Understand |
| CO2 | Select the concept of remote sensing and the types of sensor technology needed to implement remote sensing | Understand |
| CO3 | Familiar with the concept of comfort systems for smart vehicles. | Understand |
| CO4 | Apply the basic concepts of wireless communications and wireless data networks | Apply |
| CO5 | Apply the concept of the Intelligent and Safety systems for intelligent vehicles. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | 1 | 1 | - | 1 | - | - | - | - | - | 1 | 2 | 1 |
| CO2 | 3 | 2 | 1 | 1 | - | 1 | - | - | - | - | - | 1 | 2 | 1 |
| CO3 | 3 | 2 | 1 | 1 | - | 1 | - | - | - | - | - | 1 | 2 | 1 |
| CO4 | 3 | 2 | 1 | 1 | - | 1 | - | - | - | - | - | 1 | 2 | 1 |
| CO5 | 3 | 2 | 1 | 1 | - | 1 | - | - | - | - | - | 1 | 2 | 1 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 30 | 25 | 50 |
| Understand | 30 | 25 | 40 |
| Apply | - | 10 | 10 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

**Syllabus**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
| **B.E – Mechatronics Engineering** | | | | | | | | |
| **60 MC E52- Smart Mobility and Intelligent Vehicles** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VIII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to Automated, Connected, And Intelligent Vehicles**<br>Concept of Automotive Electronics, Electronics Overview, History & Evolution, Infotainment, Body, Chassis, and Powertrain Electronics, Introduction to Automated, Connected, and Intelligent Vehicles. Case studies: Automated, Connected, and Intelligent Vehicles | **[9]** |
| **Sensor Technology for Smart Mobility***<br>Basics of Radar Technology and Systems, Ultrasonic Sonar Systems, Lidar Sensor Technology and Systems, Camera Technology, Night Vision Technology, Other Sensors, Use of Sensor Data Fusion, Integration of Sensor Data to On-Board Control Systems | **[9]** |
| **COMFORT SYSTEMS**<br>Adaptive Cruise Control System, Active Suspension System, Power Steering, Collapsible and Tiltable Steering Column, Power Windows, Eight way Seating System and Climate Control System, Adaptive Lighting Systems , Automatic Wiper System | **[9]** |
| **Vehicle Wireless Technology & Networking**<br>Wireless System Block Diagram and Overview of Components, Transmission Systems – Modulation/Encoding, Receiver System Concepts– Demodulation/Decoding, Wireless Networking and Applications to Vehicle Autonomy, Basics of Computer Networking – the Internet of Things, Wireless Networking Fundamentals, Integration of Wireless Networking and on-Board Vehicle Networks. | **[9]** |
| **Intelligent and Safety systems**<br>Lane Departure Warning System, Adaptive Headlight Systems, Day time running lights (DRL), Active and Passive Safety, Airbags, Seat Belt Tightening System, Forward Collision Warning Systems, Child Lock, Antilock Braking System, Vehicle Communication-<br>Car to X Communication. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | "Intelligent Transportation Systems and Connected and Automated Vehicles", 2016, Transportation Research Board |
| 2. | Radovan Miucic, "Connected Vehicles: Intelligent Transportation Systems", 2019, Springer |

**Reference(s):**

| | |
|---|---|
| 1. | Tom Denton, "Automobile Electrical and Electronic systems, Roultedge", Taylor & Francis Group,5th Edition,2018. |
| 2. | Raghavan.V., "Materials Science and Engineering: A First Course",5th Edition, Prentice Hall of India Pvt.Ltd., NewDelhi,2009 |
| 3. | Lyla B Das," Embedded Systems-An Integrated Approach", Pearson Education 2013 |
| 4. | ARM Systems Developer's Guides- Designing & Optimizing System Software – Andrew N. Sloss, Dominic Symes, Chris Wright, 2008, Elsevier. |

*SDG: 4 – Quality Education
**SDG: 15 – Sustainable Cities and Communites



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**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Introduction To Automated, Connected, And Intelligent Vehicles** | |
| 1.1 | Concept of Automotive Electronics | 1 |
| 1.2 | Electronics Overview | 1 |
| 1.3 | History & Evolution, Infotainment, Body, | 2 |
| 1.4 | Chassis, and Powertrain Electronics, | 1 |
| 1.5 | Introduction to Automated, Connected, and Intelligent Vehicles. | 2 |
| 1.6 | Case studies: Automated, Connected, and Intelligent Vehicles | 2 |
| **2.0** | **Sensor Technology for Smart Mobility** | |
| 2.1 | Sensor Technology For Smart Mobility | 1 |
| 2.2 | Basics of Radar Technology and Systems, | 1 |
| 2.3 | Ultrasonic Sonar Systems, | 1 |
| 2.4 | Lidar Sensor Technology and Systems, | 2 |
| 2.5 | Camera Technology, Night Vision Technology, | 2 |
| 2.6 | Other Sensors, Use of Sensor Data Fusion, | 1 |
| 2.7 | Integration of Sensor Data to On-Board Control Systems | 1 |
| **3.0** | **Comfort systems** | |
| 3.1 | Comfort Systems | 1 |
| 3.2 | Adaptive Cruise Control System, | 2 |
| 3.3 | Active Suspension System, Power Steering, | 2 |
| 3.4 | COLLAPSIBLE and Tiltable Steering Column, Power Windows, | 1 |
| 3.5 | Eight-way Seating System and Climate Control System, | 2 |
| 3.6 | Adaptive Lighting Systems, Automatic Wiper System | 1 |
| **4.0** | **Vehicle Wireless Technology & Networking** | |
| 4.1 | Wireless System Block Diagram and Overview of Components, | 1 |
| 4.2 | Transmission Systems – Modulation/Encoding, | 1 |
| 4.3 | Receiver System Concepts– Demodulation/Decoding, | 1 |
| 4.4 | Wireless Networking and Applications to Vehicle Autonomy, | 2 |
| 4.5 | Basics of Computer Networking – the Internet of Things, | 1 |
| 4.6 | Wireless Networking Fundamentals, | 1 |
| 4.7 | Integration of Wireless Networking and On-Board Vehicle Networks. | 2 |
| **5.0** | **Intelligent And Safety systems** | |
| 5.1 | Intelligent and Safety Systems | 1 |
| 5.2 | Lane Departure Warning System, | 1 |
| 5.3 | Adaptive Headlight Systems, | 1 |
| 5.4 | Day time Running Lights (DRL), Active and Passive Safety, | 1 |
| 5.5 | Airbags, Seat Belt Tightening System, | 2 |
| 5.6 | Forward Collision Warning Systems, Child Lock, | 1 |
| 5.7 | Antilock Braking System, | 1 |
| 5.8 | Vehicle Communication-Car to X Communication. | 1 |

**Course Designer(s)**

1. Mr.R.Vivek -vivekr@ksrct.ac.in

w.e.f. 25/05/2024
Passed in the BoS Meeting Held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

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Mechatronics Engineering

| 60 MC E53 | Aerodynamics of Drones | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- The main aim of this course is to understand the basics of aerodynamics
- To make the students understand the basic working principle and different Sensors used in UAV.
- To Learn about the various components of drone design.
- To enable the students to identify and understand rotorcraft aerodynamics.
- To Learn about the various Automated flight stability

## Pre-requisites

- Drone technology

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Explain the fundamental ideology about unmanned and micro air vehicles. | Remember |
| CO2 | Demonstrate the design process of UAVs fixed wing multi copter and Airfoils | Apply |
| CO3 | Predict the effect of airfoils of aerodynamics | Apply |
| CO4 | Apply guidance and trajectory control algorithm to rotorcraft aerodynamics . | Apply |
| CO5 | Utilize the mechanism of Automated flight stability | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 3 | - | 3 | - | - | - | - | - | - | 3 | 2 | 2 |
| CO2 | 3 | 3 | - | - | 3 | - | - | - | - | - | - | 3 | 2 | 3 |
| CO3 | 3 | 3 | - | - | 3 | - | - | - | - | - | - | 3 | 2 | 2 |
| CO4 | 3 | 2 | 3 | - | 3 | - | - | - | - | - | - | 3 | 2 | 3 |
| CO5 | 3 | 2 | - | - | 3 | - | - | - | - | - | - | 3 | 2 | 2 |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 10 | 20 | 20 |
| Understand | 30 | 30 | 40 |
| Apply | 20 | 10 | 40 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

w.e.f. 25/05/2024
Passed in the BoS Meeting Held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

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Board Of Studies/
Mechatronics Engineering

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E – Mechatronics Engineering** | | | | | | | | |
| **60 MC E53- Aerodynamics of Drones** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VIII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction; Fundamentals of Aerodynamics*** <br> Historical Perspective - Forces and Moments - Centre of Pressure - Aerodynamic Centre - Inviscid/Viscous Flow; Incompressible/Compressible Flow - Bernoulli's Equation - d'Alembert's Paradox - Kutta-Joukowski Theorem- Circulation - Laminar and Turbulent Boundary Layers. . | **[9]** |
| **Airfoils for Uavs*** <br> Symmetric and Cambered Airfoils-Airfoil Nomenclature-Airfoil Numbering System- Modern Low-Speed Airfoils- Natural Laminar Flow (NLF) Airfoils- Reflexed Airfoils - Concave Pressure Recovery-High-Lift Design | **[9]** |
| **Airfoil Aerodynamics** <br> Viscous Flow; Transition-Separation- Separation Bubble-Real Flow Over Airfoils- Physical Features-Airfoil Thickness- Airfoil Experimental Data- Drag Polar- Camber And Lift - Camber and Drag- Flaps and Controls- Surface Roughness | **[9]** |
| **Rotorcraft Aerodynamics.** <br> Helicopter Uavs- Rotor Thrust-Rotor Drag, Coning Angle- Disc Loading - Helicopter Flight Principles - Ground Effect- Translational Lift- Autorotation- Vortex Ring State- Blade & Blade Tip Design-Rotational Airflow-Blade Tip Speed- Retreating Blade Stall-Blade Flapping-Blade Sailing- High-Inertia Blades. | **[9]** |
| **Automated Flight Stability**** <br> Static Stability - Dynamic Stability - Longitudinal Stability and Control-Neutral Point-Static Margin- Elevator Effectiveness- Lateral Stability and Control- Directional Stability and Control- Stability Derivatives-Pitching, Rolling and Yawing Rate-Inertial and Aerodynamic Damping. | **[9]** |
| **Total Hours:** | **45** |

| **Text Book(s):** | |
|---|---|
| 1. | Tooley E., Practical Drones: Building, Programming, and Applications, Apress, 2021. |
| 2. | Sundar K. and R. V. Rajakumar, Multicopters: Principles and Applications, Springer, 2021. |
| **Reference(s):** | |
| 1. | Saxby D., Drone Aerial Photography and Video: Techniques and Stories from the Field, Cengage Learning, 2018. |
| 2. | McLeod D., Getting Started with Drone: How to Build, Fly, and Program Your Own Drone, A press, 2019. |
| 3. | Kopparthy S. K., Drone Technology: Theory and Practice, Springer, 2020. |
| 4. | Balasubramaniam R,"Callister'sMaterialsScienceandEngineering",Secondedition,Wiley,2014. |

*SDG: 9 – Industrial Innovation Infrastructure

**SDG: 11 – Sustainable cities and communities

**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Introduction; Fundamentals of Aerodynamics** | |
| 1.1 | Historical Perspective - Forces and Moments | 1 |
| 1.2 | Centre of Pressure - Aerodynamic Centre | 2 |
| 1.3 | Inviscid/Viscous Flow; Incompressible/Compressible Flow | 2 |
| 1.4 | Bernoulli's Equation - D'alembert's Paradox - Kutta-Joukowski Theorem | 2 |
| 1.5 | Laminar and Turbulent Boundary Layers | 2 |
| **2.0** | **Airfoils for Uavs** | |
| 2.1 | Symmetric and Cambered Airfoils | 1 |
| 2.2 | Airfoil Nomenclature | 1 |
| 2.3 | Airfoil Numbering System- Modern Low-Speed Airfoils | 1 |
| 2.4 | Natural Laminar Flow (NLF) Airfoils | 1 |
| 2.5 | Reflexed Airfoils | 1 |
| 2.6 | Concave Pressure Recovery | 1 |
| 2.7 | High-Lift Design | 2 |
| **3.0** | **Airfoil Aerodynamics** | |
| 3.1 | Viscous Flow; Transition-Separation- Separation Bubble | 1 |
| 3.2 | Physical Features-Airfoil Thickness, Real Flow Over Airfoils | 2 |
| 3.3 | Airfoil Experimental Data- Drag Polar- Camber and Lift | 2 |
| 3.4 | Camber and Drag- Flaps And Controls | 2 |
| 3.5 | Surface Roughness | 2 |
| **4.0** | **Rotorcraft Aerodynamics** | |
| 4.1 | Helicopter Uavs- Rotor Thrust-Rotor Drag, Coning Angle | 1 |
| 4.2 | Disc Loading - Helicopter Flight Principles | 1 |
| 4.3 | Ground Effect- Translational Lift- Autorotation | 1 |
| 4.4 | Vortex Ring State- Blade & Blade Tip Design-Rotational Airflow | 2 |
| 4.5 | Blade Tip Speed- Retreating Blade Stall | 1 |
| 4.6 | Blade Flapping- Blade Sailing | 1 |
| 4.7 | High-Inertia Blades | 2 |
| **5.0** | **Automated Flight Stability** | |
| 5.1 | Static Stability - Dynamic Stability | 1 |
| 5.2 | Longitudinal Stability and Control-Neutral Point | 2 |
| 5.3 | Static Margin- Elevator Effectiveness | 2 |
| 5.4 | Lateral Stability and Control- Directional Stability and Control | 2 |
| 5.5 | Stability Derivatives-Pitching, Rolling and Yawing Rate | 1 |
| 5.6 | Inertial and Aerodynamic Damping. | 1 |

**Course Designer(s)**

1. Mr.S.Hari Prasadh -hariprasadh@ksrct.ac.in

| 60 MC E54 | AI/ML for Manufacturing | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- This course systematically introduces the aspects of artificial intelligence and machine learning in the context of manufacturing.
- The course will provide state of the art ideas in AI, ML and their applications in manufacturing process & control, robotics applications, etc.
- This course will enable the students to apply artificial intelligence based techniques
- To solve the core engineering problems related to manufacturing

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Recognize the artificial intelligence based techniques to solve the core engineering problems related to manufacturing | Understand |
| CO2 | Realize the Machine learning based techniques to solve the core engineering problems related to manufacturing | Understand |
| CO3 | Understand the different expert tools used for manufacturing | Understand |
| CO4 | Apply the different Expert Systems Tools in suitable applications | Apply |
| CO5 | Apply the Artificial Neural Networks, Fuzzy Logic and Genetic Algorithms in different applications. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | 2 | - | 1 | - | - | - | 2 | - | - | 3 | 3 | - |
| CO2 | 3 | 2 | 2 | - | 1 | - | - | - | 2 | - | - | 3 | 2 | 2 |
| CO3 | 2 | 3 | 2 | - | 2 | - | - | - | - | - | - | 3 | 3 | 1 |
| CO4 | 3 | 2 | 2 | - | 2 | - | - | - | - | - | - | 3 | 3 | - |
| CO5 | 3 | 3 | 2 | - | 2 | - | - | - | 2 | - | - | 3 | 2 | - |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 30 | 20 | 20 |
| Understand | 30 | 30 | 40 |
| Apply | - | 10 | 40 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

w.e.f. 25/05/2024
Passed in the BoS Meeting Held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

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Board Of Studies/
Mechatronics Engineering

| Syllabus | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
| **B.E – Mechatronics Engineering** | | | | | | | | |
| **60 MC E54- AI/ML for Manufacturing** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VIII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Artificial Intelligence (AI) for Manufacturing**<br>Definitions of Intelligence and Artificial Intelligence - Human Mental Capabilities: Association, Stereotyping, Reasoning and Vision - Artificial Intelligence: Components, Scope and Application Areas. Introduction to Modern Manufacturing Process- Industry 4.0 - Introduction to AI and its Applications in Manufacturing - Design in Manufacturing and AI Requirements. | **[9]** |
| **Machine Learning (ML) for Manufacturing**<br>Introduction to Machine Learning and its Methods- Difference Between AI and ML, Types of ML, Applications of ML, Types of Data In ML, Exploring Structure of Data, Data Preprocessing, Model Selection, Feature Transformation, Feature Sub-Set Selection, Bias, Variance and Complexity, Confusion Matrix, Model Accuracy Measure, K-Nearest Neighbor, Decision Tree, Random Forest Model, Support Vector Machines, Logistic Regression, Factor Analysis, Learning Process in ANN, Deep Learning | **[9]** |
| **Expert Systems**<br>Knowledge-Based or Expert Systems: Definition, Structure, Characterization and Justification - Knowledge Sources - Expert - Knowledge Acquisition and Representation - Knowledge Base - Interference Strategies: Forward and Backward Chaining. | **[9]** |
| **Expert Systems Tools and Applications**<br>Expert System Languages - Expert System Shells: Typical Examples of Shells - CLIPS Programming - Expert System Software for Manufacturing Applications in CAD, CAPP, MRP, Adaptive Control, Robotics, Process Control, Fault Diagnosis, Failure Analysis, Process Selection, Group Technology, Etc. | **[9]** |
| **Industry 4.0**<br>Industry 4.0- Artificial intelligence- Deep Learning -The Internet of Things and Industrial Internet of Things, Additive Manufacturing- Robotization and Automation-Current Situation of Industry 4.0. Introduction to Industry 4.0 to Industry 5.0 Advances-Case Study - I : Milk Processing and Packaging Industries Case Study - II: Manufacturing Industries and Industry 4.0. | **[9]** |
| **Total Hours:** | **45** |

| | |
|---|---|
| **Text Book(s):** | |
| 1. | Artificial Intelligence: A Modern Approach, Stuart J. Russell and Peter Norvig, 3rd Edition, Prentice Hall, 2010 |
| 2. | Jean-Claude André, —Industry 4.0, Wiley- ISTE, July 2019, ISBN: 781786304827,2019 |
| **Reference(s):** | |
| 1. | Deep Learning - Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 2018. |
| 2. | Additive manufacturing of Metals: The Technology, Materials , Design and Production; Ed. Li Yang, et al.; Springer International Publishing AG, 2017. |
| 3. | Machine Learning in Production, Kellaher, A. and Kellaher, A., Pearson,2019. |
| 4. | Pattern Recognition and Machine Learning, Christopher Bishop, Springer, 2006. |

*SDG: 7 - Affordable and Clean Energy



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## Course Contents and Lecture Schedule

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Artificial Intelligence (AI) for Manufacturing** | |
| 1.1 | **Definitions of intelligence and Artificial Intelligence** | 2 |
| 1.2 | Human Mental Capabilities: Association, Stereotyping, Reasoning and Vision | 1 |
| 1.3 | Artificial Intelligence: Components, Scope and Application Areas | 2 |
| 1.4 | Introduction to Modern Manufacturing Process | 2 |
| 1.5 | Industry 4.0 - Introduction to AI and Its Applications in Manufacturing | 1 |
| 1.6 | Design in Manufacturing and AI Requirements. | 1 |
| **2.0** | **Machine Learning (ML) for Manufacturing** | |
| 2.1 | Introduction to Machine Learning and its Methods | 1 |
| 2.2 | Difference between AI and ML, Types of ML, applications of ML | 2 |
| 2.3 | Types of data in ML, Exploring Structure of Data, Data Preprocessing | 1 |
| 2.4 | Model Selection, Feature Transformation, Feature Sub-set Selection, Bias, Variance and Complexity | 2 |
| 2.5 | Confusion Matrix, Decision Tree, Random Forest Model, Support Vector Machines | 1 |
| 2.6 | Factor Analysis, Learning Process in ANN | 2 |
| **3.0** | **Expert Systems** | |
| 3.1 | Definition, Structure | 1 |
| 3.2 | Characterization and Justification | 2 |
| 3.3 | Knowledge Sources – Expert Systems | 2 |
| 3.4 | Knowledge Acquisition and Representation | 2 |
| 3.5 | Knowledge Base - Interference Strategies: Forward and Backward Chaining | 2 |
| **4.0** | **Expert Systems Tools and Applications** | |
| 4.1 | Expert System Languages | 1 |
| 4.2 | Expert System Shells: Typical Examples of Shells | 1 |
| 4.3 | CLIPS Programming | 1 |
| 4.4 | Expert System Software for Manufacturing Applications in CAD, CAPP | 2 |
| 4.5 | MRP, Adaptive Control, Robotics, Process Control | 1 |
| 4.6 | Fault Diagnosis, Failure Analysis, | 1 |
| 4.7 | Process Selection ,Group Technology | 2 |
| **5.0** | **Industry 4.0** | |
| 5.1 | Industry 4.0, Artificial intelligence | 2 |
| 5.2 | Deep Learning | 1 |
| 5.3 | The Internet of Things and Industrial Internet of Things | 1 |
| 5.4 | Additive Manufacturing, Robotization and Automation | 2 |
| 5.5 | Current Situation of Industry 4.0, Introduction to Industry 4.0 to Industry 5.0 Advances | 1 |
| 5.6 | Case Study - I : Milk Processing and Packaging Industries Case Study - II: Manufacturing Industries and Industry 4.0. | 2 |

## Course Designer(s)

1. Dr.C.Vijayakumar - vijayakumarc@ksrct.ac.in

| 60 MC E55 | Rapid Prototyping | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To understand the various rapid prototyping, process and its applications.
- To know the principle methods, areas of usage, possibilities and limitations as well as environmental effects of the Additive Manufacturing technologies.
- To understand different types of tooling in additive manufacturing.
- To be familiar with the characteristics of the different materials those are used in Bio-Additive Manufacturing.
- To know the different applications additive manufacturing role in the medical field

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the need, history, growth and classification of RP system. | Understand |
| CO2 | Understand the Principle, process parameters, applications of SLA, FDM and LOM. | Understand |
| CO3 | Learn the Principle, process parameters, applications of SLS, 3DP and LENS. | Understand |
| CO4 | Initiate a continuous improvement in medical and bio additive manufacturing. | Understand |
| CO5 | Understand the different types of rapid tooling and applications | Understand |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | - | - | 1 | - | - | - | 2 | - | - | 3 | 2 | - |
| CO2 | 3 | 2 | - | - | 1 | - | - | - | 2 | - | - | 3 | 2 | 1 |
| CO3 | 2 | 3 | - | - | 1 | - | - | - | - | - | - | 3 | 2 | - |
| CO4 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | 3 | - |
| CO5 | 3 | 3 | - | - | 1 | - | - | - | 2 | - | - | 3 | 2 | - |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 30 | 30 | 50 |
| Understand | 30 | 30 | 50 |
| Apply | - | - | - |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

**Syllabus**

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E – Mechatronics Engineering** | | | | | | | | |
| **60 MC E55- Rapid Prototyping** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VIII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to Rapid Prototyping Systems**<br>Introduction to Prototyping, Traditional Prototyping & Rapid Prototyping – History - Need for the Time Compression in Product Development- Classification -Additive Manufacturing Technology in Product Development-Materials for Additive Manufacturing Technology – Applications. | **[9]** |
| **Liquid Based and Solid Based Rapid Prototyping Systems**<br>Classification – Liquid Based System – Stereo Lithography Apparatus (SLA) - Principle, Process, Advantages and Applications - Solid Based System –Fused Deposition Modeling (FDM) - Principle, Process, Advantages and Applications, Laminated Object Manufacturing (LOM)- Principle, Process, Advantages and Applications. | **[9]** |
| **Powder Based Rapid Prototyping Systems***<br>Classification – Powder Based System, Selective Laser Sintering(SLS) – Principles of SLS Process - Process, Advantages and Applications, Three Dimensional Printing - Principle, Process, Advantages and Applications, Laser Engineered Net Shaping (LENS)- Principle, Process, Advantages and Applications - | **[9]** |
| **Medical and Bio-Additive Manufacturing**<br>Customized Implants and Prosthesis: Design and Production, Bio-Additive Manufacturing-Computer Aided Tissue Engineering (CATE)-Applications. | **[9]** |
| **Software & Tools**<br>Designing for Additive Manufacturing (Dam)- Introduction to Advanced Product Quality Planning (Apqp) and Production Part Approval(Ppap). Software Tools Vs. Requirements-Pre-&Post-Processing-3dscanning & The Scanning Process –Modifying &Repairing Data-Am File Formats-Step File Format-More Detail on Nurbs - Model Validation-Working with Dicom Files for 3dprinting Medical Imagery | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**


| | |
|---|---|
| 1. | Hari Prasad I and A.V. Suresh, “Additive Manufacturing Technology”, 1 st Edition, Cengage Publishers, 2019. |
| 2. | Subramanian Senthilkannan Muthu and Monica Mahesh Savalani, “Handbook of Sustainability in Additive Manufacturing”, 1 st Edition, Springer, 2016. |


**Reference(s):**


| | |
|---|---|
| 1. | Jing Zhang and Yeon-Gil Jung, “Additive Manufacturing: Materials, Processes, Quantifications and Applications”, 1 st Edition, Butterworth-Heinemann, 2018.. |
| 2. | David Ian Wimpenny, Pulak M.Pandey and L.Jyothish Kumar, “Advances in 3D Printing & Additive Manufacturing Technologies”, 1 st Edition, Springer, 2017. |
| 3. | Amit Bandyopadhyay and Susmita Bose, “Additive Manufacturing”, 1 st Edition, CRC Press, 2015 |
| 4. | Ian Gibson, David Rosen and Brent Stucker, “Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing”, Springer Nature, 2nd Edition, 2015. |


*SDG: 7 - Affordable and Clean Energy

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Introduction to Additive Manufacturing** | |
| 1.1 | Overview – History of Additive Manufacturing | 2 |
| 1.2 | Need for the Time Compression in Product Development- | 1 |
| 1.3 | Classification | 2 |
| 1.4 | Additive Manufacturing Technology in Product Development | 2 |
| 1.5 | Materials for Additive Manufacturing Technology | 1 |
| 1.6 | Applications. | 1 |
| **2.0** | **Liquid Based and Solid Based Additive Manufacturing Systems** | |
| 2.1 | Classification of Liquid Based and Solid Based Additive Manufacturing Systems | 1 |
| 2.2 | Stereo Lithography Apparatus (SLA) - Principle, Process, Advantages and Applications | 2 |
| 2.3 | Advantages and Applications of SLA | 1 |
| 2.4 | Solid Based System –Fused Deposition Modeling(FDM) - Principle, Process, Advantages and Applications | 1 |
| 2.5 | Advantages and Applications of FDM | 1 |
| 2.6 | Laminated Object Manufacturing (LOM)- Principle, Process, Advantages and Applications | 2 |
| 2.7 | Advantages and Applications | 1 |
| **3.0** | **Powder Based Rapid Prototyping Systems** | |
| 3.1 | Classification of Powder Based Rapid Prototyping Systems | 1 |
| 3.2 | Selective Laser Sintering(SLS) – Principle and Process of SLS | 2 |
| 3.3 | Process Parameter ,Advantages and Applications of SLS | 1 |
| 3.4 | Three Dimensional Printing – Principle and Process of 3DP | 1 |
| 3.5 | Process Parameter ,Advantages and Applications of 3DP | 1 |
| 3.6 | Laser Engineered Net Shaping (LENS)- Principle, Process of LENS | 1 |
| 3.7 | Process Parameter ,Advantages and Applications of LENS | 1 |
| 3.8 | Process Parameter ,Advantages and Applications of LENS | 1 |
| **4.0** | **Medical and Bio-Additive Manufacturing** | |
| 4.1 | Introduction to Medical and Bio-Additive Manufacturing | 1 |
| 4.2 | Customized Implants and Prosthesis Design and Production | 1 |
| 4.3 | Introduction to Bio-Additive | 1 |
| 4.4 | Bio-Additive Manufacturing | 2 |
| 4.5 | Computer Aided Tissue Engineering (Cate) | 1 |
| 4.6 | CATE Applications | 1 |
| 4.7 | Applications of RP Process in Various Areas in Medical Field | 2 |
| **5.0** | **Software& Tools** | |
| 5.1 | Software Tools Vs.Requirements | 1 |
| 5.2 | Pre-&Post-Processing | 1 |
| 5.3 | 3D scanning and Process | 1 |
| 5.4 | Modifying &Repairing Data | 1 |
| 5.5 | AM File Formats,Step File Format | 1 |
| 5.6 | Nurbs | 1 |
| 5.7 | Model Validation | 1 |
| 5.8 | Working with DICOM Files for 3D Printing Medical Imagery | 2 |

**Course Designer(s)**


1. Dr.C.Vijayakumar - vijayakumarc@ksrct.ac.in

| 60 MC E56 | Container Logistics | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- Provide the learner with a good knowledge of warehousing, material handling
- To understand different cargo and facilities available in Indian railway
- To make learner understand about the regulation and ground handling operations in air cargo industry
- To comprehend the meaning of logistics and importance of its operation
- To provide general information about different components of logistics business.

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Learn the need and importance of logistics in product flow | Understand |
| CO2 | Gain knowledge on warehousing and material handling | Understand |
| CO3 | Gain knowledge and understanding facilities and cargo Process in Indian railway | Understand |
| CO4 | Demonstrate knowledge and understanding of Air cargo and Documentation Process | Understand |
| CO5 | Learn the current challenges faced by logistics professionals | Understand |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 2 | - | - | - | 1 | - | - | - | 2 | 1 | 2 | 2 | - |
| CO2 | 3 | 2 | - | - | - | 1 | - | - | - | 2 | 1 | 2 | 2 | - |
| CO3 | 3 | 2 | - | - | - | 1 | - | - | - | 2 | 1 | 2 | 2 | - |
| CO4 | 3 | 2 | - | - | - | 1 | - | - | - | 2 | 1 | 2 | 2 | - |
| CO5 | 3 | 2 | - | - | - | 1 | - | - | - | 2 | 1 | 3 | 2 | - |
| 3 - Strong; 2 - Medium; 1 – Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 40 | 40 | 30 |
| Understand | 20 | 20 | 70 |
| Apply | - | - | - |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |



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**Syllabus**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
| **B.E – Mechatronics Engineering** | | | | | | | | |
| **60 MC E56- Container Logistics** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| VIII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to Logistics and Competitive Strategy**<br>Definition and Scope of Logistics - Functions & Objectives, Customer Value Chain - Service Phases and Attributes, Value Added Logistics Services - Role of Logistics in Competitive Strategy | **[9]** |
| **Warehousing and Materials Handling, Material Handling Equipment and Systems**<br>Warehousing Functions - Types and Site Selection, Layout Design and Costing - Virtual Warehouse, Role of Material Handling in Logistics - Material Storage Systems - Principles, Benefits, Methods - Automated Material Handling, Structure of Shipping Industry, Cost Analysis in Shipping. | **[9]** |
| **Railways and Logistics Contours**<br>Features and Facilities Offered by Railways-Factors Influencing Growth in Rail Logistics-Suitability for Different Cargo and Distance Ranges Segments-Innovative Schemes/Facilities to Popularize Rail Logistics in India-Railway Infrastructure in India and Freight Movement-Share of Railways in Cargo Movement in India and Worldwide | **[9]** |
| **Air Cargo Concept & Cargo Rates**<br>Concept of Air Cargo - Types of Air Cargo (Domestic/International /Bonded Cargo) – General Cargo - Special Cargo - Difference Between Air Cargo & Air Freight - Air Freight Logistics - Air Cargo Management - Air Waybill (Awb) Concept - Functions of Awb | **[9]** |
| **Current Trends**<br>E-Logistics Structure and Operation - Logistics Resource Management, Automatic Identification Technologies - Warehouse Simulation, Reverse Logistics - Global Logistics , Strategic Logistics Planning. | **[9]** |
| **Total Hours:** | **45** |


| | |
|---|---|
| **Text Book(s):** | |
| 1. | Sople Vinod V, “Logistics Management – The Supply Chain Imperative”, Pearson Education, 2010 |
| 2. | Emmy Arsonval Maniriho (2022). Aviation, Air Cargo and Logistics Management: A Manual for Air Cargo Handlers and Shippers. Notion Press |
| **Reference(s):** | |
| 1. | Ailawadi C Sathish & Rakesh Singh, “Logistics Management”, Prentice Hall India, 2005 |
| 2. | Coyle, “The Management of Business Logistics”, Thomson Learning, 2010 |
| 3. | Bloomberg David J, “Logistics”, Prentice Hall India, 2005 |
| 4. | Bowersox, D.J., Closs, D.J., Cooper, M.B., & Bowersox, J.C. Supply Chain Logistics Management, McGraw Hill/Irwin, 2013 |


*SDG: 7 - Affordable and Clean Energy

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Introduction to Logistics and Competitive Strategy** | |
| 1.1 | Introduction | 1 |
| 1.2 | Definition and Scope of Logistics | 1 |
| 1.3 | Functions & Objectives | 1 |
| 1.4 | Customer Value Chain | 2 |
| 1.5 | Service Phases and attributes | 1 |
| 1.6 | Value Added Logistics Services | 2 |
| 1.7 | Role of Logistics in Competitive Strategy | 1 |
| **2.0** | **Warehousing and Materials Handling, Material Handling Equipment and Systems** | |
| 2.1 | Warehousing Functions | 1 |
| 2.2 | Types and Site Selection | 1 |
| 2.3 | Layout Design and Costing | 1 |
| 2.4 | Virtual Warehouse | 1 |
| 2.5 | Role of Material Handling in Logistics | 1 |
| 2.6 | Material Storage Systems | 1 |
| 2.7 | Principles, Benefits, Methods | 1 |
| 2.8 | Automated Material Handling, Structure of Shipping Industry, Cost Analysis in Shipping. | 2 |
| **3.0** | **Railways and Logistics Contours** | |
| 3.1 | Features and Facilities Offered by Railways | 1 |
| 3.2 | Factors Influencing Growth in Rail Logistics | 1 |
| 3.3 | Suitability for Different Cargo and Distance Ranges segments | 2 |
| 3.4 | Innovative Schemes/Facilities to Popularize Rail Logistics in India | 1 |
| 3.5 | Railway Infrastructure in India | 2 |
| 3.6 | Freight Movement | 1 |
| 3.7 | Share of Railways in Cargo Movement in India and Worldwide | 1 |
| **4.0** | **Air Cargo Concept & Cargo Rates** | |
| 4.1 | Concept of Air Cargo | 1 |
| 4.2 | Types of Air Cargo (Domestic/International /Bonded Cargo) | 2 |
| 4.3 | General Cargo | 1 |
| 4.4 | Special Cargo | 1 |
| 4.5 | Difference between Air Cargo & Air Freight | 1 |
| 4.6 | Air Freight Logistics | 1 |
| 4.7 | Air Cargo Management | 1 |
| 4.8 | Air waybill (AWB) Concept - Functions of AWB | 1 |
| **5.0** | **Current Trends** | |
| 5.1 | E-Logistics Structure and Operation | 2 |
| 5.2 | Logistics Resource Management | 1 |
| 5.3 | Automatic Identification Technologies | 2 |
| 5.4 | Warehouse Simulation | 1 |
| 5.5 | Reverse Logistics | 1 |
| 5.6 | Global Logistics | 1 |
| 5.7 | Strategic logistics Planning | 1 |

**Course Designer(s)**


1. Dr.P.Mohanram -mohanram@ksrct.ac.in

| 60 MC L03 | Applied Ergonomics | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | OE | 3 | 0 | 0 | 3 |

## Objectives

- Course imparts basic knowledge on ergonomics anatomy and biomechanics.
- Insights on importance of organization ergonomics.
- Emphasis on the factors affecting ergonomic design.
- Course deals with Physical and cognitive ergonomics.
- Course provides an idea about man-workplace interface in regard with ergonomics

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the basic concept of ergonomics and human anatomy. | Understand |
| CO2 | Understand the factors contributing to human error. | Understand |
| CO3 | Correlate the parameters involved in designing ergo workplace. | Understand |
| CO4 | Determine the factors influencing physical ergonomics. | Apply |
| CO5 | Interface between man machine and work environment pertaining to ergonomics | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO2 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO3 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO4 | 3 | 3 | - | - | - | 3 | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO5 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 30 | 20 | 30 |
| Understand | 30 | 20 | 50 |
| Apply | - | 20 | 20 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

**Syllabus**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
| **B.E – Mechatronics Engineering** | | | | | | | | |
| **60 MC L03 – Applied Ergonomics** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| IV / V / VI / VII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to Ergonomics**<br>Definition, domains and Applications of Ergonomics- Basics of Human anatomy and Biomechanics – application of biomechanics-overview of human body- Musculoskeletal system-metabolism-cardiovascular system-respiratory system - structure and function-posture and health. | **[9]** |
| **Organization Ergonomics**<br>Job Factors - fitting person to job and fitting a job to a person(FPJ & FJP) -Human errors-brief descriptions of taxonomy of human error, job factors, environmental conditions Organisation ergonomics – responsibility and authority-types of decision-line organisation and staff functions matrix organisation motivation of work-Maslow gratification theory- workers motivation -Job evaluation in organisational ergonomics –job satisfaction-signs of job satisfaction-job rotation-job specialization-job enlargement –Job enrichment work organization. | **[9]** |
| **Ergonomics for design**<br>Human oriented design –anthropometry –anthropometry data – anthropometric design process – anthropometric data – measurements- how to use anthropometric data – statistical essentials - Ergo tools – measuring tools – software tools- designing for static and dynamic work- Human –machine system- human components-machine components-environmental components Tools. | **[9]** |
| **Physical ergonomics**<br>Physiology - work physiology –energy expenditure of the body and oxygen debt- muscle strength and endurance- heat balance – thermo regulations – climate of work place-heat stress-cold stress. | **[9]** |
| **Cognitive ergonomics**<br>Workplace ergonomics - Human sensory system-human cognitive system - human vision -– hearing sense and importance of auditory performance. –Long term memory and its importance in cognitive ergonomics - Common cognitive tasks – decision making –planning-problem solving.<br>Guidelines for cognitive work sensory reception and perception – Visual environment and lighting –physics of light-visibility-lighting system-auditory environment – effect of noise. | **[9]** |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | R.S.Bridger,"Introduction to Ergonomics",CRC Press,3rd edition,2008. |
| 2. | Mark S Sanders,Ernest J Mccormick," Human Factors in Engineering & Design", Mcgraw-Hill education Private Limited,7th edition,2016. |

**Reference(s):**

| | |
|---|---|
| 1. | M.I.Khan,"Industrial Ergonomics", PHI Learning Private Limited,New Delhi,2013. |
| 2. | Christoper D Wickens, Sallie E.Gordon-Becker, Yili Liu ,John D.Lee "An introduction to Human Factors Engineering", Pearson-Prentie Hall, 2nd edition,2004 |
| 3. | Mikell P Groover, " Work systems and the Methods,Measurement and Management of Work",Pearson-Prentice Hall,New Delhi,2nd edition,2006 |
| 4. | Knoz,Stephan A,Johnson,Steven,Holcomb Hathaway,Scottsdale, "Work Design: Industrial Ergonomics",7th edition, 2007 |

*SDG 3 – Good Health and Well Being



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**Course Contents and Lecture Schedule**

| S. No. | Topics | No. of hours |
|---|---|---|
| **1.0** | **Introduction to Ergonomics** | |
| 1.1 | Definition, domains and Applications of Ergonomics- Basics of Human anatomy and Biomechanics. | 2 |
| 1.2 | Application of biomechanics-overview of human body. | 2 |
| 1.3 | Musculoskeletal system. | 2 |
| 1.4 | Metabolism-cardiovascular system-respiratory system. | 2 |
| 1.5 | Structure and function-posture and health. | 1 |
| **2.0** | **Organization Ergonomics** | |
| 2.1 | Job Factors - fitting person to job and fitting a job to a person(FPJ & FJP) - Human errors. | 2 |
| 2.2 | Brief descriptions of taxonomy of hu.man error, job factors, environmental conditions Organisation ergonomics | 2 |
| 2.3 | Responsibility and authority-types of decision-line organisation and staff functions matrix organisation motivation of work-Maslow gratification theory. | 2 |
| 2.4 | Workers motivation -Job evaluation in organisational ergonomics –job satisfaction-signs of job satisfaction. | 2 |
| 2.5 | Job rotation-job specialization-job enlargement, Job enrichment work organization. | 1 |
| **3.0** | **Ergonomics for design** | |
| 3.1 | Human oriented design –anthropometry –anthropometry data. | 2 |
| 3.2 | Anthropometric design process – anthropometric data. | 2 |
| 3.3 | Measurements- how to use anthropometric data – statistical essentials. | 2 |
| 3.4 | Ergo tools – measuring tools – software tools- designing for static and dynamic work- Human –machine system. | 1 |
| 3.5 | Human components-machine components-environmental components Tools. | 2 |
| **4.0** | **Physical ergonomics:** | |
| 4.1 | Physiology - work physiology. | 2 |
| 4.2 | Energy expenditure of the body and oxygen debt. | 2 |
| 4.3 | Muscle strength and endurance- heat balance. | 2 |
| 4.4 | Thermo regulations – climate of work place. | 2 |
| 4.5 | Heat stress-cold stress. | 1 |
| **5.0** | **Cognitive ergonomics** | |
| 5.1 | Workplace ergonomics. | 1 |
| 5.2 | Human sensory system-human cognitive system - human vision. | 2 |
| 5.3 | Hearing sense and importance of auditory performance. –Long term memory and its importance in cognitive ergonomics - Common cognitive tasks – decision making –planning- problem solving. | 2 |
| 5.4 | Guidelines for cognitive work sensory reception and perception – Visual environment and lighting. | 2 |
| 5.5 | Physics of light-visibility-lighting system-auditory environment – effect of noise. | 2 |

**Course Designer(s)**

1. Mrs.S.Chandralekha-chandralekha@ksrct.ac.in

w.e.f.25/05/2024
Passed in the BoS Meeting Held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

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| 60 MC L04 | Introduction to Occupational Health | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | OE | 3 | 0 | 0 | 3 |

## Objective

- To Identify the various fields of safety and risk management
- To Identify and describe the organization of regulatory agencies that deal with issues of occupational safety and health, environmental health, and risk management.
- To Define and understand basic terminology used in the field of occupational safety and health and apply it appropriately.
- To Describe and demonstrate how to access safety information and resources.
- To Describe the history and evolution of occupational safety and health.

## Prerequisite

NIL

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the Need for EHS in industries and related Indian regulations | Understand |
| CO2 | Understand the Various types of Health hazards, effect, assessment and control methods | Understand |
| CO3 | Understand the Various safety systems in working environments | Understand |
| CO4 | Apply the methodology for preparation of Emergency Plans and Accident investigation | Apply |
| CO5 | Apply the EHS Management System and its elements | Apply |

## Mapping with Programme Outcomes

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | 3 | 3 | - | - | - | - | 2 | 3 | 2 | 3 | 3 |
| CO2 | 3 | 3 | 2 | - | 3 | - | - | - | - | 3 | - | - | 2 | 2 |
| CO3 | 2 | - | 2 | 2 | - | - | - | - | - | 3 | 2 | - | 3 | 3 |
| CO4 | - | 3 | 2 | 3 | 3 | - | - | - | - | 2 | - | 3 | 2 | 3 |
| CO5 | 3 | - | - | 3 | 2 | - | - | - | - | - | 3 | - | 3 | 3 |
| 3- Strong;2-Medium;1-Some | | | | | | | | | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 30 | 20 | 40 |
| Understand | 30 | 20 | 40 |
| Apply | - | 20 | 20 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

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Approved in Academic Council Meeting held on 25/05/2024

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| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B.E – Mechatronics Engineering** | | | | | | | | |
| **60 MC L04 – Introduction to Occupational Health** | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| IV / V / VI / VII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Basics of Occupational Health**<br>History of Occupational Health- Triangle of occupational health, Occupational health, hygiene and wellbeing – need for Occupational history- Industrial process and hazards. | **[09]** |
| **Physical Health**<br>Hazards, Types of hazards ,Physical, Chemical, Biological and Ergonomical hazards- effect of hazard, Notifiable diseases- Hazard control measures –Occupational exposure limits – Permissible Exposure Limit(PEL),Recommended Exposure Limit(REL),Threshold Limit Value-Time Weighted Average, TLV-TWA, Short Term Exposure Limit (STEL) ,Long Term Exposure Limit, Immediate Danger to Life and Health (IDLH)- Occupational health surveillance | **[09]** |
| **Mental Health**<br>Psychosocial factors and hazards in occupation- Shift work –fitting job to man –effects of psychosocial factors fatigue, anxiety and stress- Job rotation - welfare activities. | **[09]** |
| **Statutory norms**<br>National policy on Safety, health and environment at work place - Provisions pertaining to occupational health under the Factories Act,1948 and Tamil Nadu Factories Rules,1950 – Overview about Occupational Safety, health and Working Conditions Code 2020- Introduction to American Conference for Governmental Industrial Hygienist (ACGIH) & National Institute of Occupational Safety and Health (NIOSH), overview about OSHA Standards. | **[09]** |
| **Safety practices**<br>Safety protocols to minimize hazards, hazard control hierarchy, and risk matrix –work design, automation -overview on Behavior based safety and safety culture. | **[09]** |
| **Total Hours** | 45 |

**Text Book(s):**

| | |
|---|---|
| 1. | Haldar S K, " Industrial and Occupational Health, CBS Publishers & Distributors Private Limited, New Delhi, 2017 |
| 2 | Charles D Reese, "Occupational Health and Safety Management: A Practical Approach", CRC Press, 3rd Edition, 2018. |

**Reference(s):**

| | |
|---|---|
| 1. | "The Factories Act 1948", Madras Book Agency, Chennai,2017 |
| 2. | Jayaraj G, "Occupational Health Practice in Indian Industries", Occupational health foundation, Chennai, 2012 |
| 3. | Danuta Koradecka, "Hand book of Occupational Safety and Health", CRC Press, 2010 |

*SDG 3 – Good Health and Well Being

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## Course Contents and Lecture Schedule

| S.No | Topic | No.of Hours |
|---|---|---|
| **1** | **Basics of Occupational Health** | |
| 1.1 | History of Occupational Health | 1 |
| 1.2 | Triangle of occupational health | 1 |
| 1.3 | Occupational health | 1 |
| 1.4 | Occupational hygiene | 2 |
| 1.5 | Occupational wellbeing | 1 |
| 1.6 | Need for Occupational history | 2 |
| 1.7 | Industrial process and hazards | 1 |
| **2** | **Physical Health** | |
| 2.1 | Hazards, Types of hazards ,Physical, Chemical, Biological and Ergonomical hazards | 1 |
| 2.2 | Effect of hazard, Notifiable diseases | 1 |
| 2.3 | Hazard control measures –Occupational exposure limits | 2 |
| 2.4 | Permissible Exposure Limit(PEL),Recommended Exposure Limit(REL),Threshold Limit Value-Time Weighted Average, TLV | 1 |
| 2.5 | TWA, Short Term Exposure Limit (STEL) ,Long Term Exposure Limit, | 2 |
| 2.6 | Immediate Danger to Life and Health (IDLH)- Occupational health surveillance | 1 |
| **3** | **Mental Health** | |
| 3.1 | Psychosocial factors and hazards in occupation | 1 |
| 3.2 | Shift work | 2 |
| 3.3 | Fitting job to man | 1 |
| 3.4 | Effects of psychosocial factors fatigue | 2 |
| 3.5 | Anxiety and stress | 2 |
| 3.6 | Job rotation | 1 |
| 3.7 | Welfare activities | 2 |
| **4** | **Statutory Norms** | |
| 4.1 | National policy on Safety, health and environment at work place | 2 |
| 4.2 | Provisions pertaining to occupational health under the Factories Act,1948 and Tamil Nadu Factories Rules,1950 | 1 |
| 4.3 | Overview about Occupational Safety, health and Working Conditions Code 2020 | 2 |
| 4.4 | Introduction to American Conference for Governmental Industrial Hygienist (ACGIH) | 1 |
| 4.5 | National Institute of Occupational Safety and Health (NIOSH),overview about OSHA Standards. | 2 |
| **5** | **Safety Practices** | |
| 5.1 | Safety protocols to minimize hazards | 1 |
| 5.2 | Hazard control hierarchy | 1 |
| 5.3 | Risk matrix | 2 |
| 5.4 | Work design | 1 |
| 5.5 | Overview on Behavior based safety and safety culture. | 2 |

## Course Designers


1. Mrs.S.Chanderalaka -chanderalaka@ksrct.ac.in
2. Mr.Sanjay – sanjaym@ksrct.ac.in



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| 60 MC L05 | Digital Transformation in Manufacturing | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | OE | 3 | 0 | 0 | 3 |

**Objective**

- To grasp the fundamental principles of the technologies employed in Next-Gen Manufacturing Era.
- To explore the architectures, and various frameworks used in Industrial Revolution.
- To understand the applications of digital technologies for manufacturing.
- To understand various protocols for network security.
- To understand the Intelligent Factories concepts.
-

**Prerequisite**

Nil

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the theory and practice related to Industrial IoT System | Understand |
| CO2 | Understand the existing Frameworks in Industrial Revolution 4.0 and in Cloud manufacturing. | Understand |
| CO3 | Explore and apply Digital Twin technology in various industry contexts | Understand |
| CO4 | Share data and information in the digital thread across enterprise-level information system | Understand |
| CO5 | Enabling the effective deployment of intelligent factory technologies | Understand |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 2 | 3 | 2 | - | - | - | 2 | - | 3 | 3 | 3 |
| CO2 | 2 | 3 | 3 | 2 | 2 | 2 | - | - | - | 3 | - | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 2 | 3 | 2 | - | - | - | 2 | - | 2 | 3 | 3 |
| CO4 | 2 | 3 | 2 | 3 | 3 | 2 | - | - | - | 3 | - | 3 | 2 | 3 |
| CO5 | 2 | 3 | 3 | 2 | 3 | 2 | - | - | - | 2 | - | 2 | 3 | 3 |
| 3- Strong;2-Medium;1-Some | | | | | | | | | | | | | | |

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 30 | 30 | 50 |
| Understand | 30 | 30 | 50 |
| Apply | - | - | - |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **B.E – Mechatronics Engineering** | | | | | | | | | |
| **60 MC L05 – Digital Transformation in Manufacturing** | | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | | |
| | L | T | P | | C | CA | ES | Total | |
| IV / V / VI / VII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 | |

| | |
|---|---|
| **Fundamentals of Smart Manufacturing Revolution**<br>Industry 4.0 - Introduction to the industrial internet - Industry 4.0 components – Industry 4.0 principles - Impact of industry 4.0 - Designing industrial internet systems - Applications in Automotive, Healthcare, Aerospace | **[9]** |
| **Frameworks**<br>Reference Architecture - Reference architecture model industry 4.0 - Purdue Enterprise Reference Architecture - IIoT reference architecture – Cloud Manufacturing - Architecture, models, and frameworks | **[9]** |
| **Digital Twin Technology**<br>Implementing Manufacturing Execution System - Digital Twin Modeling – Cyber Physical Systems - Digital Twin Shop floor - Digital Twin and Virtual Reality, Augmented Reality and Mixed Reality | **[9]** |
| **Network Technology and Security Framework**<br>Access network technology and protocols - Middleware transport protocols – Middleware software patterns - IIoT WAN technologies and protocols - Software design concepts – Middleware industrial internet of things platforms – Securing the industrial internet | **[9]** |
| **Future Intelligent Factories**<br>Blockchain in Supply Chain, Smart Logistics and Warehousing, Metaverse, OpenAI platforms API and cloud based integration for Industrial Applications - Sustainable and Green Manufacturing - AI applications in manufacturing | **[9]** |
| **Fundamentals of Smart Manufacturing Revolution** | 45 |

| **Text Book(s):** | |
|---|---|
| 1. | Zindani, Divya., Davim, J. Paulo., Kumar, Kaushik. Industry 4.0: Developments Towards the Fourth Industrial Revolution. Germany: Springer Singapore, 2019 |
| 2. | Tao, Fei., Nee, A.Y.C.., Zhang, Meng. Digital Twin Driven Smart Manufacturing. United Kingdom: Elsevier Science, 2019 |
| 3. | Gilchrist, Alasdair. Industry 4.0: The Industrial Internet of Things. United States: Apress, 2016. |
| **Reference(s):** | |
| 1. | Blokdyk, Gerardus. Cloud Manufacturing a Complete Guide – 2020 Edition. N.p.: Emereo Pty Limited, 2020. |
| 2. | Ackerman, Pascal. Industrial Cyber Security: Efficiently Secure Critical Infrastructure Systems. United Kingdom: Packt Publishing, 2017. |
| 3. | Knapp, Eric D.., Langill, Joel. Industrial Network Security: Securing Critical Infrastructure Networks for Smart Grid, SCADA, and Other Industrial Control Systems. Netherlands: Elsevier Science, |
| 4. | Macaulay, Tyson, Singer, Bryan L. Cybersecurity for Industrial Control Systems: SCADA, DCS, PLC, HMI, and SIS. United States: CRC Press, 2016. |

**SDG No.9**

w.e.f.25/05/2024
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Approved in Academic Council Meeting held on 25/05/2024

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## Course Contents and Lecture Schedule

| S.No | Topic | No.of Hours |
|---|---|---|
| **1** | **Fundamentals of Smart Manufacturing Revolution** | |
| 1.1 | Industry 4.0. | 1 |
| 1.2 | Introduction to the industrial internet. | 1 |
| 1.3 | Industry 4.0 components. | 1 |
| 1.4 | Industry 4.0 principles - Impact of industry 4.0. | 2 |
| 1.5 | Designing industrial internet systems. | 2 |
| 1.6 | Applications in Automotive, Healthcare, Aerospace | 2 |
| **2** | **Frameworks** | |
| 2.1 | Reference Architecture. | 1 |
| 2.2 | Reference architecture model industry 4.0. | 1 |
| 2.3 | Purdue Enterprise Reference Architecture. | 2 |
| 2.4 | IIoT reference architecture. | 1 |
| 2.5 | Cloud Manufacturing. | 2 |
| 2.6 | Architecture, models, and frameworks. | 1 |
| **3** | **Digital Twin Technology** | |
| 3.1 | Implementing Manufacturing Execution System. | 1 |
| 3.2 | Digital Twin Modeling. | 2 |
| 3.3 | Cyber Physical Systems. | 2 |
| 3.4 | Digital Twin Shop floor . | 2 |
| 3.5 | Digital Twin and Virtual Reality, Augmented Reality and Mixed Reality | 2 |
| **4** | **Network Technology and Security Framework** | |
| 4.1 | Access network technology and protocols. | 2 |
| 4.2 | Middleware transport protocols. | 1 |
| 4.3 | Middleware software patterns - IIoT WAN technologies and protocols. | 2 |
| 4.4 | Software design concepts. | 1 |
| 4.5 | Middleware industrial internet of things platforms – Securing the industrial internet. | 2 |
| **5** | **Future Intelligent Factories** | |
| 5.1 | Blockchain in Supply Chain. | 1 |
| 5.2 | Smart Logistics and Warehousing. | 1 |
| 5.3 | Metaverse, OpenAI platforms API and cloud based integration for Industrial Applications. | 2 |
| 5.4 | Sustainable and Green Manufacturing. | 1 |
| 5.5 | AI applications in manufacturing. | 2 |

## Course Designers

1. Dr.P.Mohanram – mohanram@ksrct.ac.in

| 60 MC L06 | Safety and Risk Analytics | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | OE | 3 | 0 | 0 | 3 |

## Objectives

- The concepts, methodologies, mathematics, techniques and algorithms needed for this course are drawn from engineering approaches, statistics, safety analytical tools.
- The primary focuses of this course is to learn from data, predict the future and take data driven decision making.
- To develop analysis and apply basic dater and improve the quality of information
- To apply safety analytical tools in establishing safety management system
- To collect and disseminate big data and improve safety performance

## Pre-requisites

- Nil

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand The Types, Sources and Characteristics of Safety Data and Their Integration for Organization-Wide Safety Centric Data Model, | Understand |
| CO2 | Perform Safety Data Visualization and Exploration along with Safety Performance Evaluation and Monitoring | Understand |
| CO3 | Draw Safety Predictive Models and Behavioural Safety Analytics | Apply |
| CO4 | Understand Injury Epidemiology | Understand |
| CO5 | Recommend on Safety Related Decision Making. | Apply |

## Mapping with Programme Outcomes

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO2 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO3 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO4 | 3 | 3 | - | - | - | 3 | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO5 | 3 | 3 | - | - | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember | 30 | 20 | 30 |
| Understand | 30 | 30 | 60 |
| Apply | - | 10 | 10 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Total | 60 | 60 | 100 |

w.e.f.25/05/2024
Passed in the BoS Meeting Held on 21/05/2024
Approved in Academic Council Meeting held on 25/05/2024

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| Syllabus | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
| **B.E – Mechatronics Engineering** | | | | | | | | |
| **60 MC L06-Safety and Risk Analytics** | | | | | | | | |
| **Semester** | **Hours/Week** | | | **Total Hours** | **Credit** | **Maximum Marks** | | |
| | L | T | P | | C | CA | ES | Total |
| IV / V / VI / VII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Basics of Safety and Risk*** <br> Introduction to safety and risk management – Hazard triangle- Safety ontology – qualitative Risk assessment – quantitative risk assessment | [9] |
| **Safety Data Quality Assessment and Preprocessing*** <br> Creation of safety database -Hazard and risk data- Incident Investigation data – Behavioural and organizational safety data- Data dimensions and information quality – missing data handling – data transformation – data reduction | [9] |
| **Descriptive Safety Analytics*** <br> Probability distribution – sample and statistics – safety data visualization data tool – data exploration- Predictive safety analytics - Predictive risk analytics -Prescriptive safety analytics-Behavioral safety analytics and injury epidemiology | [9] |
| **Safety Performance Evaluation and Monitoring*** <br> Leading and lagging indicators for measuring safety performance – Control charts for safety performance and evaluation and monitoring – safety capability analysis | [9] |
| **Analysis of Safety Reports and Narratives*** <br> Safety report and use of text analytics –Preprocessing of text data — Document classification using KNN- Topic modelling -Risk quantification. | [9] |
| **Total Hours:** | **45** |

**Text Book(s):**

| | |
|---|---|
| 1. | H Kumamoto and E J Henley, “Probabilistic Risk Assessment and Management for Engineers and Scientists”, IEEE Press. 2020 |
| 2. | James, G., Witten, D., Hastie, T., and Tibshirani, R., “An Introduction to Statistical Learning”, Springer. 2021 |

**Reference(s):**

| | |
|---|---|
| 1. | Christopher M Bishop, “Pattern Recognition and Machine Learning”, Springer. 2018 |
| 2. | Tan, P. N., Steinbach, M., & Kumar, V, “Introduction to Data Mining”, Pearson Education India. 2016 |
| 3. | Weiss S M, Indurkhya N, Zhang T and Damerau F J, “Predictive Methods for Analysing Unstructured Information”, Springer, 2021 |
| 4. | Ronold A.Howard All E.Abbas, “Foundations of Decision Analysis”, 1st Edition. Published by Pearson 2023 |

*SDG 3 – Good Health and Well Being

| Course Contents and Lecture Schedule | | |
|---|---|---|
| **S. No.** | **Topics** | **No. of hours** |
| **1.0** | **Basics of Safety and Risk** | |
| 1.1 | Introduction to Safety and Risk Management | 2 |
| 1.2 | Hazard Triangle- Safety Ontology | 1 |
| 1.3 | Qualitative Risk Assessment | 3 |
| 1.4 | Quantitative Risk Assessment | 3 |
| **2.0** | **Safety Data Quality Assessment and Pre Processing** | |
| 2.1 | Creation of Safety Database -Hazard and Risk Data | 1 |
| 2.2 | Incident Investigation Data | 2 |
| 2.3 | Behavioral and Organizational Safety Data | 2 |
| 2.4 | Data Dimensions and Information Quality | 2 |
| 2.5 | Missing Data Handling – Data Transformation – Data Reduction | 2 |
| **3.0** | **Descriptive Safety Analytics** | |
| 3.1 | Probability Distribution – Sample and Statistics | 2 |
| 3.2 | Safety Data Visualization Data Tool – Data Exploration | 2 |
| 3.3 | Predictive Safety Analytics - Predictive Risk Analytics | 2 |
| 3.4 | Prescriptive Safety Analytics | 2 |
| 3.5 | Behavioral Safety Analytics and Injury Epidemiology | 1 |
| **4.0** | **Safety Performance Evaluation and Monitoring** | |
| 4.1 | Leading and Lagging Indicators for Measuring Safety Performance | 2 |
| 4.2 | Control Charts for Safety Performance | 3 |
| 4.3 | Evaluation and Monitoring | 2 |
| 4.4 | Safety Capability Analysis | 2 |
| **5.0** | **Analysis of Safety Reports and Narratives** | |
| 5.1 | Safety Report and Use of Text Analytics | 1 |
| 5.2 | Preprocessing of Text Data | 2 |
| 5.3 | Document Classification Using KNN | 2 |
| 5.4 | Topic Modelling | 2 |
| 5.5 | Risk Quantification | 2 |

**Course Designer(s)**

1. Dr.V.Sundararaju-sundararaju@ksrct.ac.in



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