K.S. Rangasamy College of Technology

(Autonomous)

CURRICULUM AND SYLLABI

FOR

B.E. Electrical and Electronics Engineering

(For the batch admitted in 2025– 2026)

R2022

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

KSR Kalvi Nagar, Tiruchengode – 637 215,
Namakkal Dt. Tamil Nadu

Department of Electrical and Electronics Engineering

VISION

- To become a leader in providing education and training in the field of Electrical and Electronics Engineering to the aspiring graduates to be competent in their profession.

MISSION

- To enable graduates to acquire knowledge and skills necessary for employment and continued advancement in the field of Electrical and Electronics Engineering
- To engage in applied research in emerging technologies and provide professional services

Program Educational Objectives (PEOs) for B.E. (EEE) Programme

PEO1: Our graduates are professionally competent and apply the concepts of mathematics, science and engineering to solve problems in Electrical and Electronics Engineering and related fields.
PEO2: Our graduates stay relevant in their chosen profession through life-long learning and demonstrate social and ethical responsibility.
PEO3: Our graduates excel in project execution, working effectively both independently and collaboratively.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

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 the public 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 modeling 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 consequentresponsibilitiesrelevanttotheprofessionalengineeringpractice.

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 teamwork:
Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary 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 multi-disciplinary 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 on text of technological change

Program Specific Outcomes (PSOs) for B.E.(EEE) Programme

Engineering Graduates will be able to:

PSO1: Model and analyse electrical power systems using advanced softwares and implement with strict adherence to safety guidelines and standards

PSO2: Design and develop smart electrical and electronics systems providing solutions to real-time societal problems.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) WITH PROGRAMME OUTCOMES (POs)

The B.E .Electrical and Electronics 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
PEO1	3	3	3	3	3	-	3	-	1	2	3	2
PEO2	1	-	2	-	3	3	2	3	1	-	1	3
PEO3	-	3	3	2	3	2	-	2	3	3	3	-

Contributions: 1-Low, 2- Medium, 3-High

MAPPING-UG-ELECTRICAL AND ELECTRONICS ENGINEERING

Year	Sem	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I	I	Professional English-I	-	-	-	-	-	-	-	2	3	3	2	3	2.4	2.4
		Matrices and Calculus	3	2	-	-	2	-	-	-	-	-	-	-	-	3
		Basic Civil and Mechanical Engineering	3	2.8	2.6	2.8	2.8	2	2.2	2.2	2.5	2	-	-	2.6	2.3
		Engineering Graphics	3	2.8	3	-	3	-	-	3	-	-	-	-	2.8	2.8
		C Programming	3	3	3	-	3	-	-	-	2	2	-	2	3	3
		Environmental Studies and Climate Changes	3	2	-	-	3	2.6	2.8	2	-	-	-	2	-	-
		Heritage of Tamils / தமிழர் மரபு	-	-	-	-	-	-	3	3	-	2	-	3	-	-
		C Programming Laboratory	3	3	3	-	3	-	-	-	2	2	-	2	3	3
		Fabrication and Reverse Engineering Laboratory	3	2	3	-	-	2	2	-	3	-	-	3	2.6	2.6
I	II	Professional English-II	-	-	-	-	-	-	-	2	3	3	2	3	2.4	2.4
		Integrals, Partial Differential Equations and Laplace Transform	3	3	-	-	2	-	-	-	-	-	-	-	3	2
		Physics for Electrical Engineering	3	-	-	-	-	-	-	-	-	2	-	-	-	2
		Chemistry for Electronic Engineering	3	2.6	-	-	-	-	-	-	-	-	-	-	2.5	2
		Electric Circuit Analysis	3	3	3	3	3	-	-	-	3	2	2	2	3	3
		Tamils and Technology / தமிழரும் தொழில் நுட்பமும்	3	-	-	-	3	2	2.75	3	2.5	2.2	-	3	-	-
		Engineering Physics and Chemistry Laboratory	3	-	-	-	-	-	-	-	2	-	-	-	2.5	2.2
		Electric Circuit Laboratory	3	3	3	3	3	-	-	-	3	2	2	2	3	3
		Career Skill Development I	-	-	-	-	-	-	-	2	3	3	2	3	2	2
II	III	Transforms and Linear Algebra	3	2	-	-	2	-	-	-	-	-	-	-	3	-
		Electrical Machines - I	3	3	3	2	2	2	-	2	-	2	2	-	2.8	2.8
		Electromagnetic Fields	3	2	1	2	1	-	1	-	-	-	-	-	2	2
		Electron Devices and Circuits	3	2.4	3	2.8	2.2	3	2	2	2	2	2.2	2.5	2.6	2.6
		Data Structures	3	3	2	2.6	2	2	2	2.4	2.6	2	-	2	3	3
		Electrical Machines – I Laboratory	3	3	2	2.66	2	2	2	3	2.6	2	-	2	3	3
		Data Structures Laboratory	3	3	2	2.66	2	2	2	3	2.6	2	-	2	3	3
		Career Skill Development II	-	-	-	-	-	-	-	2	3	3	2	3	2	2
II	IV	Numerical and Statistical Methods	3	2	-	-	2	-	-	-	-	-	-	-	3	-

		Electrical Machines - II	3	3	3	3	2	-	-	-	2	2	2	2	2.8	2.8
		Linear Integrated Circuits and its Applications	3	2.4	3	2.8	2	2	-	-	2	2	2	2.4	3	2
		Digital Logic Design	3	1.8	1	-	3	-	-	-	-	-	2	1	-	2
		Universal Human Values	-	-	-	-	-	3	3	3	2.8	3	2	3	-	-
		Electrical Machines - II Laboratory	3	2.6	2.8	2.6	3	2	-	2	2	3	2	2.33	3	3
		Linear and Digital Integrated Circuits Laboratory	3	2.4	3	2.8	2	2	-	-	2	2	2	2.4	2	2
		Career Skill Development III	2.6	2.6	2.6	2.8	-	2.4	-	-	-	2	3	3	2.5	2.6
III	V	Transmission and Distribution	3	3	3	2.2	1	2	1	-	-	2	1	2	3	3
		Control Systems	3	3	2.8	2.6	2	2.3	2	2	1.8	2	2.5	2	3	2
		Measurements and Instrumentation	3	3	2	3	2	2	1	-	1.2	2	2.2	3	3	2
		Microprocessor and Microcontrollers	2.6	2.2	2.4	2.5	3	-	-	-	-	-	-	2.33	2	1.6
		Start-ups and Entrepreneurship	2.8	2.6	3	2.4	2.2	2.5	1.66	1.25	1.33	2	2.2	2.4	2	2
		Control and Virtual Instrumentation Laboratory	3	3	2	2.66	3	2	2	3	2.6	2	-	2	3	3
		Special Application Laboratory	3	2.6	2.8	2.5	3	1.5	-	2	1.5	3	2	2	2.8	2.8
		Design Thinking and Innovation Laboratory	3	3	2.8	3	-	-	-	3	3	3	-	3	3	2.8
		Career Skill Development IV	2.6	2.6	2.6	2.8	-	2.4	-	-	-	2	3	3	2.5	2.6
	VI	Power System Analysis and Stability	2.8	3	3	2.6	2	-	-	-	-	-	-	-	2.8	2.8
		Digital Signal Processing	3	3	3	2.6	-	-	-	-	-	-	-	-	2.8	2.8
		Power System Protection and Switchgear	3	3	2	2	2	2	2	2	2	2	2	2	3	2
		Power Electronics and Industrial Drives	3	3	3	2.4	3	-	-	-	-	-	-	2	2	3
		Power Electronics and Drives Laboratory	3	3	3	3	3	2	1	1	2	2	2	2	3	3
		Disaster Management	1	1	-	-	1	1.6	1.5	-	-	-	-	-	-	-
		Electrical Appliances Analysis Laboratory	3	2.6	2.66	3	3	2.66	3	1.6	2	2.66	3	2.6	2.33	2.33
		Design Thinking and Product Development Laboratory	3	3	3	3	2.66	3	3	3	3	3	3	3	3	2
		Comprehension Test	3	3	2	2	-	-	-	-	1	2	2	3	-	-

IV	VII	Engineering Economics and Financial Accounting	2.66	3	2.5	2.75	3	2	2.33	2	-	-	2.75	2.5	2.6	2.6
		Power System Operation and Control	3	3	3	3	3	-	2	1.8	2.2	2	1.8	3	3	2
		Electric Mobility	3	3	-	-	3	2.8	3	-	3	2	-	3	3	2
		Embedded Systems	3	3	3	-	-	3	3	-	3	3	2	-	3	3
		NCC/NSS/NSO/YRC/RRC/Fine Arts	3	2	1	1	3	3	3	3	3	3	-	-	-	-
		Research Skill Development	2	2	2	2	3	2	2	3	3	3	-	3	-	-
		Electrical System Design Laboratory	2.8	3	3	2.6	3	-	-	-	-	-	-	2	3	3
		Project Work Phase – I	2.4	3	3	3	3	2	2	1.8	3	3	3	3	3	2.8
	VIII	Project Work Phase - II	2.25	3	3	3	3	2	2	1.8	3	3	3	3	3	2.8

Rev.No. 00 / w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Elective I														
Renewable Energy Sources	3	3	3	3	3	3	3	2	2	2	3	3	3	3
Sensor Technology and Applications	2.8	2.8	2.8	-	2.8	2	2	2	2	2	2	2	2	2
Utilization and Conservation of Electrical Energy	3	3	3	2.2	1	-	-	-	-	-	-	-	3	1
Design of Electrical Apparatus	3	3	2	2	2	2	2	2	2	2	2	2	2	-
Embedded System Design	2.6	2.2	2.4	2.2	2.8	2	2.25	2.3	2.4	1.6	2	2	2.6	2.4
Network Analysis and Synthesis	3	3	3	3	3	-	-	-	3	2	2	2	3	3
Electric Vehicle Architecture	3	2.8	3	2.2	3	3	2	2	2.3	2.8	2.5	2.6	2.4	1.4
Elective II														
Solar Energy Systems	3	3	3	3	3	3	3	2	2	2	3	3	2	3
Principles of IoT and its Applications	3	3	3	2.25	2.25	-	-	-	-	3	3	3	3	2
HVDC and FACTS	3	2	2	2	2.6	-	-	-	2.2	2.25	2	2	3	2
Analysis of Electrical Machines	3	3	2	2	2	2	2	2	2	2	2	2	3	2
Embedded C Programming	2	1.6	2.2	2.2	1.8		2	1.5	2	1	1.5	1	2.4	2.4
VLSI Design	3	3	3	3	3	3	3	-	3	3	3	3	3	3
Design of Motors and Power Converters for Electric Vehicle	3	3	2	2	2	2	2	2	2	2	2	2	2	3
Elective III														
Wind energy Conversion Systems	3	2.6	2.4	2.6	3		2	2	2	-	-	1	3	2
Industrial Internet of Things	3	3	3	-	-	-	-	-	-	-	-	2	3	2
Substation Engineering and Substation Automation	3	2.4	2.6	2.66	2	2.3	2	2	2	-	-	2.6	3	2.2
Multilevel Power Converters	3	3	3	3	3	-	-	-	2	-	-	3	2	3
Embedded Processor	2	1.5	2.5	2	2	3	2	3	3	3	2.4	2.4	2.6	2.2
Neural Networks and Fuzzy Systems	3	2	-	-	2.4	2	-	-	-	2	-	-	3	2
Electric Vehicle Design, Mechanics and Control	3	2.4	3	3	3	3	3		3	-	2	-	3	3
Elective IV														
Energy Storage Systems	3	2.5	2.3	2	-	2.25	-	-	-	-	2	2	3	2
Industry 4.0	3	2	3	2	2.4	2	-	-	-	2	-	-	3	2
Smart Grid	3	2.6	2.6	2.6	2.6	-	-	-	-	-	-	-	2	3
Power Electronics for Renewable Energy Systems	3	2.4	2	2	3	2.8	3	1	2	1	1	2.4	2	2
IoT for Embedded Systems	3	3	3	3	2	3	3	-	-	2	2	3	3	2
PLC and SCADA	3	3	2	3	3	2.5	2.5	2	3	-	2.6	-	3	3
Batteries and its Management System for Electric Vehicles	3	2.4	3	2	3	1	1	2	1	-	2	1	1.5	1.66
Elective V														
Hybrid energy Technology	3	3	3	2	3	-	-	-	-	3	-	3	3	3
IoT for Industrial Automation	3	2	-	-	2.4	2	-	-	-	2	-	-	3	2
Restructured Power Market	3	2	2	-	2	3	2	-	-	-	2.5	2	3	2.2
Control of Power Electronics Circuits	3	3	3	3	3	-	-	1	2	2	1	2	2	3
Embedded Control for Electrical Drives	3	3	3	3	3	-	-	-	2	-	-	3	2	3
Virtual Instrumentation Systems	3	3	3	3	3	-	-	-	-	-	-	-	2	3
Design of Electric Vehicle Charging System	3	2.5	2	-	3	1	1	2	-	-	1	1	1.33	1.5

K.S. RANGASAMY COLLEGE OF TECHNOLOGY

Credit Distribution for B.E(EEE) Programme – 2025 –2029 Batch

S. No.	Category	Credits Per Semester								Total Credits	Percentage %
		I	II	III	IV	V	VI	VII	VIII		
1.	HS	2+1*	2+1*		-	-		3	-	7	4.26
2.	BS	4	12	4	4	-	-	-	-	24	14.63
3.	ES	14	-	5	-	-	-	-	-	19	15.24
4.	PC	-	06	13	13	18	18	12	-	80	45.12
5.	PE	-	-	-	-	3	3	6	3	15	9.14
6.	OE	-	-	-	3	3	3	-	-	9	5.48
7.	CG	-	-	-	-	-	-	2	8	10	6.09
8.	MC	MC I	-	-	MC II	MC III	MC IV	-	-	-	-
9.	AC	-	-	-	-	-	-	AC	-	-	-
10	GE	GE I	GE II	-	-	-	-	-	-	3*	-
Total		20	20	22	20	24	24	23	11	**164**	**100**

HS – HUMANITIES AND SOCIAL SCIENCES
BS – BASIC SCIENCE
ES – ENGINEERING SCIENCES
PC – PROFESSIONAL CORE
PE – PROFESSIONAL ELECTIVES
OE – OPEN ELECTIVES
CG - CAREER GUIDANCE COURSES
CT – COMREHENSION TEST
MC – MANDATORY COURSES
AC – AUDIT COURSES
GE – GENERAL ELECTIVE COURSES
Open Electives are courses offered by different departments that do not have any prerequisites and could be of interest to students of any branch

HUMANITIES AND SOCIAL SCIENCE (HS)

S. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1	60 EN 001	Professional English-I	HS	3	1	0	2	2	Basic knowledge of reading and writing in English.
2	60 EN 002	Professional English-II	HS	3	1	0	2	2	Professional English I.
3	61 GE 001	Heritage of Tamils / தமிழர் மரபு	HS	1	1	0	0	1*	Nil
4	60 GE 002	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	HS	1	1	0	0	1*	Nil
5	60 HS 001	Engineering Economics and Financial Accounting	HS	3	3	0	0	3	Nil
6	60 AB 001	National Cadet Corps (Air wing)	HS	4	2	0	2	3*	Nil
7	60 AB 002	National Cadet Corps (Army Wing)	HS	4	2	0	2	3*	Nil

* Additional credit

BASIC SCIENCE (BS)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 MA 001	Matrices and Calculus	BS	4	3	1	0	4	Nil
2.	60 MA 003	Integrals, Partial Differential Equations and Laplace Transform	BS	4	3	1	0	4	Nil
3.	60 PH 003	Physics for Electrical Engineering	BS	3	3	0	0	3	Nil
4.	60 CH 003	Chemistry for Electronic Engineering	BS	3	3	0	0	3	Nil
5.	60 CP 0P2	Engineering Physics and Chemistry Laboratory Laboratory	BS	4	0	0	4	2	Nil
6.	60 MA 008	Transforms and Linear Algebra	BS	4	3	1	0	4	Nil
7.	60 MA 015	Numerical and Statistical Methods	BS	4	3	1	0	4	Nil

ENGINEERING SCIENCES (ES)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 ME 003	Basic Civil and Mechanical Engineering	ES	3	3	0	0	3	Basic knowledge of higher Secondary Science.
2.	60 ME 002	Engineering Graphics	ES	6	2	0	4	4	Nil
3.	60 CS 001	C Programming	ES	3	3	0	0	3	Nil
4.	60 CS 0P1	C Programming Laboratory	ES	4	0	0	4	2	Nil
5.	61 ME 0P1	Fabrication and Reverse Engineering Laboratory	ES	4	0	0	4	2	Nil
6.	60 CS 003	Data Structures	ES	3	3	0	0	3	Nil
7.	61 CS 0P3	Data Structures Laboratory	ES	4	0	0	4	2	Nil

PROFESSIONAL CORE (PC)

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1	61 EE 201	Electric Circuit Analysis	ES	5	3	1	0	4	Integrals and Partial Differential Equations
2	61 EE 2P1	Electric Circuit Laboratory	ES	4	0	0	4	2	Nil
3.	60 EE 301	Electrical Machines – I	PC	5	3	1	0	4	Nil
4.	61 EE 302	Electromagnetic Fields	PC	3	3	0	0	3	Matrices and Calculus Integrals and Partial Differential Equations
5.	61 EE 303	Electron Devices and Circuits	PC	5	3	0	2	4	Nil
6.	60 EE 3P1	Electrical Machines – I Laboratory	PC	4	0	0	4	2	Nil

7.	60 EE 401	Electrical Machines - II	PC	4	2	1	0	3	Nil
8.	61 EE 402	Linear Integrated Circuits and its Applications	PC	3	3	0	0	3	Electron Devices and Circuits & Digital Logic Design
9.	60 EE 403	Digital Logic Design	PC	3	3	0	0	3	Electron Devices and Circuits
10.	61 EE 4P1	Electrical Machines - II Laboratory	PC	4	0	0	4	2	Nil
11.	60 EE 4P2	Linear and Digital Integrated Circuits Laboratory	PC	4	0	0	4	2	Electron Devices and Circuits& Digital Logic Design
12.	60 EE 501	Transmission and Distribution	PC	5	3	1	0	4	Electric Circuit Analysis Electrical Machines
13.	61 EE 502	Control Systems	PC	5	3	1	0	4	Integrals and Partial Differential Equations, Electrical Machines
14.	60 EE 503	Measurements and Instrumentation	PC	3	3	0	0	3	Nil
15.	60 EE 504	Microprocessor and Microcontrollers	PC	3	3	0	0	3	Digital Logic Design
16.	61 EE 5P1	Control and Virtual Instrumentation Laboratory	PC	3	0	0	3	1.5	Integrals and Partial Differential Equations
17.	60 EE 5P2	Special Applications Laboratory	PC	3	0	0	3	1.5	Digital Logic Design
18.	60 EE 5P3	Design Thinking and Innovation Laboratory	PC	2	0	0	2	1	Nil
19.	60 EE 601	Power System Analysis and Stability	PC	5	3	1	0	4	Generation, Transmission and Distribution

20.	60 EE 602	Digital Signal Processing	PC	5	3	1	0	4	Integrals and Partial Differential Equations
21.	60 EE 603	Power System Protection and Switchgear	PC	3	3	0	0	3	Generation Transmission and Distribution
22.	60 EE 604	Power Electronics and Industrial Drives	PC	3	3	0	0	3	Electron Devices and Circuits& Electrical Machines I & II
23.	60 EE 6P1	Power Electronics and Drives Laboratory	PC	3	0	0	3	1.5	Electron Devices And Circuits & Electrical Machines I & II
24.	60 EE 6P2	Electrical Appliances Analysis Laboratory	PC	3	0	0	3	1.5	Electron Devices and Circuits, Digital Logic Design & Linear Integrated Circuits
25.	60 EE 6P3	Design Thinking and Product Development Laboratory	PC	2	0	0	2	1	Nil
26.	60 EE 701	Power System Operation and Control	PC	4	2	1	0	3	Generation, Transmission and Distribution Power System Analysis and Stability
27.	60 EE 702	Electric Mobility	PC	3	3	0	0	3	Electrical Machines, Microprocessors and Microcontrollers, Measurements and Instrumentation
28.	60 EE 703	Embedded Systems	PC	5	3	0	2	4	Microprocessors and Microcontrollers
29.	60 EE 7P1	Electrical System Design Laboratory	PC	4	0	0	4	2	Generation Transmission and Distribution, Power System Analysis and Stability

PROFESSIONAL ELECTIVES (PE)
SEMESTER V, Professional Elective I

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 EE E11	Renewable Energy Sources	PE	3	3	0	0	3
2.	60 EE E12	Sensor Technology and Applications	PE	3	3	0	0	3
3.	60 EE E13	Utilization and Conservation of Electrical Energy	PE	3	3	0	0	3
4.	60 EE E14	Design of Electrical Apparatus	PE	3	3	0	0	3
5.	60 EE E15	Embedded System Design	PE	3	3	0	0	3
6.	60 EE E16	Network Analysis and Synthesis	PE	3	3	0	0	3
7.	60 EE E17	Electric Vehicle Architecture	PE	3	3	0	0	3

SEMESTER VI, Professional Elective II

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 EE E21	Solar Energy Systems	PE	3	3	0	0	3
2.	60 EE E22	Principles of IoT and its Applications	PE	3	3	0	0	3
3.	60 EE E23	HVDC and FACTS	PE	3	3	0	0	3
4.	60 EE E24	Analysis of Electrical Machines	PE	3	3	0	0	3
5.	60 EE E25	Embedded C Programming	PE	3	3	0	0	3
6.	60 EE E26	VLSI Design	PE	3	3	0	0	3
7.	60 EE E27	Design of Motor and Power Converters for Electric Vehicles	PE	3	3	0	0	3

SEMESTER VII, Professional Elective III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 EE E31	Wind Energy Conversion Systems	PE	3	3	0	0	3
2.	60 EE E32	Industrial Internet of Things	PE	3	3	0	0	3
3.	60 EE E33	Substation Engineering and Substation Automation	PE	3	3	0	0	3
4.	60 EE E34	Multilevel Power Converters	PE	3	3	0	0	3
5.	60 EE E35	Embedded Processor	PE	3	3	0	0	3
6.	60 EE E36	Neural Networks and Fuzzy Systems	PE	3	3	0	0	3
7.	60 EE E37	Electric Vehicle Design, Mechanics and Control	PE	3	3	0	0	3

SEMESTER VII, Professional Elective IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 EE E41	Energy Storage Systems	PE	3	3	0	0	3
2.	60 EE E42	Industry 4.0	PE	3	3	0	0	3
3.	60 EE E43	Smart Grid	PE	3	3	0	0	3
4.	60 EE E44	Power Electronics for Renewable Energy Systems	PE	3	3	0	0	3
5.	60 EE E45	IoT for Embedded Systems	PE	3	3	0	0	3
6.	60 EE E46	PLC and SCADA	PE	3	3	0	0	3
7.	60 EE E47	Batteries and its Management System for Electric Vehicle	PE	3	3	0	0	3

SEMESTER VIII, Professional Elective V

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 EE E51	Hybrid Energy Technology	PE	4	2	0	2	3
2.	60 EE E52	IoT for Industrial Automation	PE	4	2	0	2	3
3.	60 EE E53	Restructured Power Market	PE	4	2	0	2	3
4.	60 EE E54	Control of Power Electronic Circuits	PE	4	2	0	2	3
5.	60 EE E55	Embedded Control for Electrical Drives	PE	4	2	0	2	3
6.	60 EE E56	Virtual Instrumentation Systems	PE	4	2	0	2	3
7.	60 EE E57	Design of Electric Vehicle Charging System	PE	4	2	0	2	3

Note:

Students can opt for honor degree without specialization by completing 18 credits choosing the necessary courses from the list of the electives given above. Courses can be chosen any of the elective list as per the interest of the students.

SEMESTER VII & SEMESTER VIII, AUDIT COURSES (AC)

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

MANDATORY COURSES (MC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 MY 001	Environmental Studies and Climate Change	MC	4	2	0	0	0
2.	60 MY 002	Universal Human Values	MC	4	3	0	0	3*
3.	60 MY 003	Start-ups and Entrepreneurship	MC	4	2	0	0	0
4.	60 MY 004	Disaster Management	MC	4	2	0	0	0

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

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 EE L01	Energy Auditing and Conservation	OE	3	3	0	0	3
2.	60 EE L02	Graphical System Interface using LabVIEW	OE	3	3	0	0	3
3.	60 EE L03	Electric Vehicle Technology	OE	3	3	0	0	3
4.	60 EE L04	Sensor Technology	OE	3	3	0	0	3
5.	60 EE L05	Industrial Automation with PLC and SCADA	OE	3	3	0	0	3

INTEGRATED COURSES (IC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 EE E51	Hybrid Energy Technology	PE	4	2	0	2	3
2.	60 EE E52	IoT for Industrial Automation	PE	4	2	0	2	3
3.	60 EE E53	Restructured Power Market	PE	4	2	0	2	3
4.	60 EE E54	Control of Power Electronic Circuits	PE	4	2	0	2	3
5.	60 EE E55	Embedded Control for Electrical Drives	PE	4	2	0	2	3
6.	60 EE E56	Virtual Instrumentation Systems	PE	4	2	0	2	3
7.	60 EE E57	Design of Electric Vehicle Charging System	PE	4	2	0	2	3
8.	60 ME 002	Engineering Graphics	ES	6	2	0	4	4
9.	61 EE 303	Electron Devices and Circuits	PC	5	3	0	2	4
10.	60 EE 703	Embedded Systems	PC	5	3	0	2	4

CAREER GUIDANCE COURSES (CG)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 CG 0P1	Career Skill Development I	CG	2	0	0	2	1*
2.	60 CG 0P2	Career Skill Development II	CG	2	0	0	2	1*
3.	60 CG 0P3	Career Skill Development III	CG	2	0	0	2	1*
4.	60 CG 0P4	Career Skill Development IV	CG	2	0	0	2	1*
5.	60 CG 0P5	Comprehension Test	CG	2	0	0	2	1*
6.	60 EE 7P2	Project work - Phase I	CG	4	0	0	4	2
7.	60 EE 8P1	Project work - Phase II	CG	16	0	0	16	8
8.	60 CG 0P6	Internship	CG	315	0	0	0	1/2/3*

Total credits-164
Credits for internship-1/2/3*
One credit course-1

Verticals

	Sustainable Energy Technologies	Internet of Things	Power Systems	Converters and Drives	Embedded Systems	Diversified Courses	Electric Vehicle Technology
Elective - I	Renewable Energy Sources	Sensor Technology and Applications	Utilization and Conservation of Electrical Energy	Design of Electrical Apparatus	Embedded System Design	Network Analysis and Synthesis	Electric Vehicle Architecture
Elective - II	Solar Energy Systems	Principles of IoT and its Applications	HVDC and FACTS	Analysis of Electrical Machines	Embedded C-Programming	VLSI Design	Design of Motor and Power Converters for Electric Vehicles
Elective - III	Wind energy Conversion Systems	Industrial Internet of Things	Substation Engineering and Substation Automation	Multilevel Power Converters	Embedded Processor	Neural Networks and Fuzzy Systems	Electric Vehicle Design, Mechanics and Control
Elective - IV	Energy Storage Systems	Industry 4.0	Smart Grid	Power Electronics for Renewable Energy Systems	IoT for Embedded Systems	PLC and SCADA	Batteries and its Management System for Electric Vehicles
Elective - V	Hybrid energy Technology	IoT for Industrial Automation	Restructured Power Market	Control of Power Electronics Circuits	Embedded Control for Electrical Drives	Virtual Instrumentation Systems	Design of Electric Vehicle Charging System

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

(An Autonomous Institution affiliated to Anna University)

COURSES OF STUDY

(For the candidates admitted in 2025-2026)

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 ME 003	Basic Civil and Mechanical Engineering	ES	3	3	0	0	3
4.	60 ME 002	Engineering Graphics	ES	6	2	0	4	4
5.	60 CS 001	C Programming	ES	3	3	0	0	3
6.	60 MY 001	Environmental Studies and Climate Change	MC	2	2	0	0	0
7.	61 GE 001	Heritage of Tamils / தமிழர் மரபு	HS	1	1	0	0	1*
		PRACTICAL						
8.	60 CS 0P1	C Programming Laboratory	ES	4	0	0	4	2
9.	61 ME 0P1	Fabrication and Reverse Engineering Laboratory	ES	4	0	0	4	2
			Total	**31**	**15**	**1**	**14**	**20**

Heritage of Tamils* - additional 1 credit is offered and not accounted for CGPA

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 3 additional credits not accounted for CGPA and credit is offered based on the Internship duration

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 PH 003	Physics for Electrical Engineering	BS	3	3	0	0	3
4.	60CH 003	Chemistry for Electronic Engineering	BS	3	3	0	0	3
5.	61 EE 201	Electric Circuit Analysis	PC	5	3	1	0	4
6.	60 GE 002	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	HS	1	1	0	0	1*
		PRACTICAL						
7.	60 CP 0P2	Engineering Physics and Chemistry Laboratory	BS	4	0	0	4	2
8.	61 EE 2P1	Electric Circuit Laboratory	PC	4	0	0	4	2
9.	60 CG 0P1	Career Skill Development I	CG	2	0	0	2	1*
			Total	**30**	**14**	**2**	**12**	**20**

Tamils and Technology* - additional 1 credit is offered and not accounted for CGPA.

SEMESTER III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 MA 008	Transforms and Linear Algebra	BS	5	3	1	0	4
2.	60 EE 301	Electrical Machines – I	PC	5	3	1	0	4
3.	61 EE 302	Electromagnetic Fields	PC	3	3	0	0	3
4.	61 EE 303	Electron Devices and Circuits	PC	5	3	0	2	4
5.	60 CS 003	Data Structures	ES	3	3	0	0	3
PRACTICAL								
6.	60 EE 3P1	Electrical Machines – I Laboratory	PC	4	0	0	4	2
7.	61 CS 0P3	Data Structures Laboratory	ES	4	0	0	4	2
8.	60 CG 0P2	Career Skill Development II	CG	2	0	0	2	1*
9.	60 CG 0P6	Internship	CG	-	-	-	-	1/2/3*
			Total	**31**	**15**	**2**	**12**	**22**

SEMESTER IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 MA 015	Numerical and Statistical Methods	BS	5	3	1	0	4
2.	60 EE 401	Electrical Machines – II	PC	4	2	1	0	3
3.	61 EE 402	Linear Integrated Circuits and its Applications	PC	3	3	0	0	3
4.	60 EE 403	Digital Logic Design	PC	3	3	0	0	3
5.	60 EE L1*	Open Elective – I	OE	3	3	0	0	3
6.	60 MY 002	Universal Human Values	MC	3	3	0	0	3*
PRACTICAL								
7.	61 EE 4P1	Electrical Machines - II Laboratory	PC	4	0	0	4	2
8.	60 EE 4P2	Linear and Digital Integrated Circuits 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	**31**	**17**	**2**	**10**	**20**

UHV* - Additional credit is offered and not accounted for CGPA

SEMESTER V

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 EE 501	Transmission and Distribution	PC	5	3	1	0	4
2.	61 EE 502	Control Systems	PC	5	3	1	0	4
3.	60 EE 503	Measurements and Instrumentation	PC	3	3	0	0	3
4.	60 EE 504	Microprocessor and Microcontrollers	PC	3	3	0	0	3
5.	60 EE E1*	Professional Elective – I	PE	3	3	0	0	3
6.	60 EE L2*	Open Elective – II	OE	3	3	0	0	3
7.	60 MY 003	Start-ups and Entrepreneurship	MC	2	2	0	0	2*
PRACTICAL								
8.	61 EE 5P1	Control and Virtual Instrumentation Laboratory	PC	3	0	0	3	1.5
9.	60 EE 5P2	Special Applications Laboratory	PC	3	0	0	3	1.5
10.	60 EE 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**

Start-ups and Entrepreneurship* - Additional credit is offered and not accounted for CGPA

SEMESTER VI

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 EE 601	Power System Analysis and Stability	PC	5	3	1	0	4
2.	60 EE 602	Digital Signal Processing	PC	5	3	1	0	4
3.	60 EE 603	Power System Protection and Switchgear	PC	3	3	0	0	3
4.	60 EE 604	Power Electronics and Industrial Drives	PC	3	3	0	0	3
5.	60 MY 004	Disaster Management	AC	4	2	0	0	0
6.	60 EE E2*	Professional Elective – II	PE	3	3	0	0	3
7.	60 EE L3*	Open Elective – III	OE	3	3	0	0	3
8.	60 AB 00*	NCC/NSS/NSO/YRC/RRC/Fine Arts *	HS	4	2	0	2	3*
PRACTICAL								
9.	60 EE 6P1	Power Electronics and Drives Laboratory	PC	3	0	0	3	1.5
10.	60 EE 6P2	Electrical Appliances Analysis Laboratory	PC	3	0	0	3	1.5
11.	60 EE 6P3	Design Thinking and Product Development Laboratory	PC	2	0	0	2	1
12.	60 CG 0P5	Comprehension Test	CG	2	0	0	2	1*
13.	60 CG 0P6	Internship	CG	-	-	-	-	1/2/3*
			Total	**36**	**20**	**2**	**10**	**24**

Comprehension Test* - 1 additional credit is offered and not accounted for CGPA calculation.

SEMESTER VII

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 HS 002	Engineering Economics and Financial Accounting	HS	3	3	0	0	3
2.	60 EE 701	Power System Operation and Control	PC	4	2	1	0	3
3.	60 EE 702	Electric Mobility	PC	3	3	0	0	3
4.	60 EE 703	Embedded Systems	PC	5	3	0	2	4
5.	60 EE E3*	Professional Elective – III	PE	3	3	0	0	3
6.	60 EE E4*	Professional Elective – IV	PE	3	3	0	0	3
7.	60 AB 00*	NCC/NSS/NSO/YRC/RRC/Fine Arts *	HS	4	2	0	2	3*
8.	60 AC 001	Research Skill Development	AC	1	1	0	0	0
PRACTICAL								
9.	60 EE 7P1	Electrical System Design Laboratory	PC	4	0	0	4	2
10.	60 EE 7P2	Project Work Phase – I	CG	4	0	0	4	2
11.	60 CG 0P6	Internship	CG	0	0	0	0	1/2/3*
			Total	**30**	**18**	**1**	**10**	**23**

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 EE E5*	Professional Elective – V	PE	4	2	0	2	3
PRACTICAL								
2.	60 EE 8P1	Project Work Phase – II	CG	16	0	0	16	8
3.	60 CG 0P6	Internship	CG	0	0	0	0	1/2/3*
			Total	**20**	**2**	**0**	**18**	**11**

TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 164

Note: HS- Humanities and Social Sciences including Management Courses, BS- Basic Science Courses, ES- Engineering Science Courses, PC-Professional Core Courses, PE-Professional Elective Courses, GE- General Elective Courses, OE- Open Elective Courses, CG- Career Guidance Courses, AC- Audit Courses & MC- Mandatory Courses

K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
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B.E./B.Tech. Degree Programme
SCHEME OF EXAMINATIONS
(For the candidates admitted in 2025-2026)
FIRSTSEMESTER

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 ME 003	Basic Civil and Mechanical Engineering	2	40	60	100	45	100
4	60 ME 002	Engineering Graphics	2	40	60	100	45	100
5	60 CS 001	C Programming	2	40	60	100	45	100
6	60 MY 001	Environmental Studies and Climate Change	2	100	-	100	-	100
7	61 GE 001	Heritage of Tamils / தமிழர் மரபு	2	40	60	100	45	100
PRACTICAL								
8	60 CS 0P1	C Programming Laboratory	3	60	40	100	45	100
9	61 ME 0P1	Fabrication and Reverse 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 the theory end semester examination and 40 marks for practical end semester examination.

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	3	2
CO2	-	-	-	-	-	-	-	2	3	3	2	3	2	2
CO3	-	-	-	-	-	-	-	2	3	3	2	3	3	2
CO4	-	-	-	-	-	-	-	2	3	3	2	3	2	3
CO5	-	-	-	-	-	-	-	2	3	3	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(Re)	10	10	20
Understand	50	50	80
Apply (Ap)	-	-	-
Analyse (An)	-	-	-
Create (Cr)	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
Common to all Branches								
60 EN 001- Professional English I								
Semester	Semester			Total Hrs	**Credit**	Max Marks		
	L	T	P		C	CA	ES	Total
I	1	0	2	45	2	40	60	100

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

Rev.No. 00 / w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**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	Readingrelevant 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	**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	**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	**Classification and Recommendations**	
4.1	Listening to TED Talksand 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	1
5	**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

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

Rev.No. 00 / w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	2	-	-	-	-	-	-	-	2	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	2	-
CO3	3	2	-	-	2	-	-	-	-	-	-	-	2	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	2	-
CO5	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 (Re)	10	10	10
Understand (Un)	10	10	20
Apply (Ap)	40	40	70
Analyze (An)	-	-	-
Evaluate (Ev)	-	-	-
Create (Cr)	-	-	-
Total	60	60	100

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

Content	Hours
Matrices 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 **Hands-on:** **Matrix Operations - Addition, Multiplication, Transpose, Inverse and Rank**	**[9]**
Differentiation 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 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*** **Hands-on:** **Compute the Eigen values and Eigen vectors of a Matrix**	**[9]**
Differential Equations 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 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 **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 & 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**

Rev.No. 00 / w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1.	**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.	**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.	**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.	**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.	**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
	Total	60

Course Designer

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

Rev.No. 00 / w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
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BoS Chairman Signature

60 ME 003	Basic Civil and Mechanical Engineering	Category	L	T	P	Credit
		ES	3	0	0	3

Objectives

- To impart the fundamental knowledge about building materials and equipment's.
- To provide the crucial details about building components for the construction.
- To learn a process for analysis of static objects, concepts of force and motion of particles. It gives the knowledge on thermodynamics process, laws and entropy
- This course also highlights the different sources of energy and working principle of power plants and concept of fluids properties, Pascal's Law and Bernoulli's Equation application.
- It also gives the types of refrigeration & Air-conditioning and its application

Pre-requisites

- Basic knowledge of Higher Secondary Science

Course Outcomes

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

CO1	Describe the materials and tools needed for construction and its usage.	Understand
CO2	Identify and explain the substructure and superstructure of building.	Understand
CO3	Discuss on renewable sources of energy and their application for power generation.	Apply
CO4	Describe the basic fluid flow properties and losses in pipes.	Apply
CO5	Explain the components of refrigeration and air-conditioning systems and its 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	3	3	2	3	3	2	2	-	-	2	-
CO2	3	3	2	2	2	2	2	2	3	2	-	-	2	-
CO3	3	3	3	3	3	2	2	2	-	-	-	-	3	3
CO4	3	3	3	3	3	2	2	2	-	-	-	-	3	2
CO5	3	3	3	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	20	10	30
Understand	40	20	30
Apply (Ap)	-	30	40
Analyse (An)	-	-	-
Create (Cr)	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Electrical and Electronics Engineering								
60 ME 003 - Basic Civil and Mechanical Engineering								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	40	60	100

Content	Hours
Introduction and Civil Engineering Materials and Equipment Construction Materials : Concrete - Cement - Bricks – Stone –– Sand – Tiles – Wood – Steel – Plastic – Glass –Fiber – Paints – Varnishes – Distempers - Construction Equipment's: Earth moving equipment: – Excavators - Backhoe Loaders- Bulldozers - Front-End loaders - Crawler loaders- Trucks **-** Equipment for concreting: Batching –Mixing – Conveyors - Compaction.	[9]
Building Structures Structures: Substructure-Foundation – Types - Bearing capacity of soil - Requirement of good foundation- Superstructure: Column – Beam – Slab– Floors – Walls – Masonry : Brick masonry – Stone masonry – Bonds: English bond and Flemish bond.	[9]
Sources of Energy and Power Plants* Introduction – Energy- Classification of Energy Sources - Conventional Energy Sources: Working principle of Thermal, Gas, Diesel, Hydro-electric and Nuclear power plants. Non - Conventional Energy Sources: working principle of Solar, Wind, Tidal and Geothermal power plants.	[9]
Mechanics of Fluids Introduction – Application of Fluid Mechanics – Fluid Properties – Pascal's Law – Law of Hydrostatics –Euler's Equations – Bernoulli's Equation – Losses in Pipes	[9]
Refrigeration & Air Conditioning System Terminology of Refrigeration and Air conditioning. Principle of vapour compression and absorption system - Layout of typical domestic refrigerator - Window and Split type room Air conditioners– calculation of CoP (Simple problems).	[9]
Total Hours:	**45**

Text Book(s):

1.	Palanichamy, M.S. 'Basic of Civil Engineering' Tata Mc Graw Hill Education Pvt. Ltd, 2011
2.	Sharma S.C. "Construction Equipment and Management", 5^{th}edition, Khanna Publishers New Delhi, 2010.
3.	Pravin Kumar, 'Basic Mechanical Engineering', Pearson India Education Services Pvt. Ltd, 2nd Edition, Chennai, 2018
4.	Rajput, R.K., "A Textbook of Fluid Mechanics and Hydraulic Machines", S.Chand& company Ltd., 6th Edition, 2015

Reference(s):

1.	Jha J and Sinha S.K., "Construction and Foundation Engineering", Khanna Publishers, 7th edition, 2010.
2.	Saurabh K. Soni"Construction Management And Equipment",S.K. Kataria& Sons, 1st Edition 2014
3.	Venugopal K and Prahu Raja V, "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, 2015.
4.	Arora.C.P., 'Refrigeration and Airconditioning', Tata McGraw Hill Education Pvt. Ltd., 3rd Edition, New Delhi, 2008
5.	Arora, S. C., Domkundwar.S., 'A Course in Power Plant Engineering', Dhanpatrai& Co., New Delhi, 2014

* SDG 12 – Responsible Consumption and Production & SDG 7 – Affordable and Clean Energy

Course Contents and Lecture Schedule

S.No	Topic	No. of Hrs
1	**Introduction and Civil Engineering Materials and Equipment**	
1.1	Cement and Bricks	1
1.2	Stone and Sand	1
1.3	Tiles and Wood	1
1.4	Plastic and Glass	1
1.5	Fiber, Varnishes and Distempers	1
1.6	Backhoe Loaders and Bulldozers	1
1.7	Front-End loaders, Crawler loaders and Trucks	1
1.8	Batching and Mixing	1
2	**Building Structures**	
2.1	Foundation and Types	2
2.2	Bearing capacity of soil and Requirement of good foundation	1
2.3	Column and Beam	1
2.4	Slab, Floors and Walls	1
2.5	Brick masonry	1
2.6	Stone masonry	1
2.7	English bond	1
2.8	Flemish bond	1
3.0	**Sources of Energy and Power Plants**	
3.1	Introduction to energy resources and Classification	1
3.2	Working principle of Thermal and Gaspower plants	2
3.3	Working principle of Diesel and Hydro-electric power plants	2
3.4	Nuclear power plants	1
3.5	Working principle of Solar and Wind power plants	2
3.6	Tidal and Geothermal power plants.	1
4.0	**Mechanics of Fluids**	
4.1	Introduction of fluids	1
4.2	Various Fluid Properties	1
4.3	Application of Fluid Mechanics	1
4.4	Pascal’s Law	1
4.5	Law of Hydrostatics	1
4.6	Euler’s Equations	2
5.0	**Refrigeration and Air-Conditioning**	
5.1	Introduction to Refrigeration and Air-Conditioning and its Terminology	2
5.2	Working principle of vapour compression	1
5.3	Working principle of absorption system	1
5.4	Layout of typical domestic refrigerator	2
5.5	Window and Split air conditioners.	2
5.7	Calculation of CoP (Simple problems)	2

Course Designer

1. Dr.K.YUVARAJ -yuvarajk@ksrct.ac.in
2. Dr.S.Jeyaprakasam -sjeyaprakasam@ksrct.ac.in
3. Dr.K.Mohan -mohank@ksrct.ac.in
4. Mr.U.Vivek -viveku@ksrct.ac.

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Passed in BoS Meeting held on 11/06/2025
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BoS Chairman Signature

60 ME 002	Engineering Graphics	Category	L	T	P	Credit
		ES	2	0	4	4

Objectives

- 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, section of solids and development of different types of surfaces.
- To learn the concept of isometric projection.
- To learn the geometry and topology of engineered components

Pre-requisites

- Nil

Course Outcomes

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

CO1	Demonstrate the Impact of computer technologies on graphical communication	Apply
CO2	Convert the pictorial views in to orthographic views using drafting software	Apply
CO3	Draw the projection of simple solids, true shape of sections and development of surfaces	Apply
CO4	Construct the isometric projections of objects using drafting software.	Apply
CO5	Interpret a design project illustrating engineering graphical skills.	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	-	-	-	-	-	-	-	-	-	3	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 – Electrical and Electronics Engineering

60 ME 002- Engineering Graphics

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	2	0	4	90	4	40	60	100

Introduction to Computer Aided Drafting (CAD) software Theory of CAD software – Menu System, Tool bars (Standard, Object Properties, Draw, Modify and Dimension) – Drawing Area (Background, Crosshairs, Coordinate System) – Dialog boxes and windows – Shortcut menus (Button Bars) – The Command Line and Status Bar – Different methods of zoom – Select and erase objects	**[6+12]**
Orthographic Projection* Theory of projection – Terminology and Methods of projection – first angle and third angle projection – Conversion of pictorial views into orthographic views	**[6+12]**
Projection of Solids and Sections of Solids* Projections of simple solids: prism, pyramid, cylinder and cone (Axis parallel to one plane and perpendicular to other, axis inclined to one plane and parallel to other). Sections of simple solids: prism, pyramid, cylinder and cone in simple positions (cutting plane is inclined to one of the principal planes and perpendicular to the other) – True shape of sections **Development of Surfaces** Principle of development-Methods of development: Parallel line development-Cube, Prism and Cylinder. Radial line development – Pyramid and cone	**[6+12]**
Isometric Projection Principles of Isometric projection – Isometric scale, Isometric views, Conventions – Isometric views of lines, Planes, Simple and compound Solids – Conversion of Orthographic views in to Isometric view	**[6+12]**
Application of Engineering Graphics Geometry and topology of engineered components: Creation of engineering models and their presentation in standard 2D blueprint form, 3D wire-frame and shaded solids – Geometric dimensioning and Tolerance – Use of solid modeling software for creating associative models – Floor plans: windows, doors, and fixtures such as water closet (WC), bath sink, shower, etc. – Applying colour coding according to building drawing practice – Drawing sectional elevation showing foundation to ceiling – Introduction to Building Information Modelling (BIM).	**[6+12]**
Total Hours	**90**

Text Book(s):

1.	Bhatt N.D., ―Engineering Drawing‖, Charotar Publishing House Pvt. Ltd., 53rd Edition, Gujarat, 2019
2.	Venugopal K., "Engineering Graphics", New Age International (P) Limited, 2014.

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.	Basant Agarwal and C.M.Agarwal., "Engineering Drawing", McGraw Hill Education, 2013.
4.	Dhawan, R.K., "A Text Book of Engineering Drawing" 3 rd Revised Edition, S. Chand Publishing, New Delhi, 2012.

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule		
S. No.	Topics	No. Hrs
1.0	**Introduction to Computer Aided Drafting (CAD) software**	
1.1	Theory of CAD software	1
1.2	Menu System, Tool bars (Standard, Object Properties, Draw, Modify and Dimension)	4
1.3	Drawing Area (Background, Crosshairs, Coordinate System)	4
1.4	Dialog boxes and windows – Shortcut menus	4
1.5	The Command Line and Status Bar	1
1.6	Different methods of zoom – Select and erase objects.	4
2.0	**Orthographic Projection**	
2.1	Introduction to orthographic projections	2
2.2	Planes of projection,	2
2.3	Projection of points	2
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.	2
2.8	Practice class for pictorial views to orthographic views.	2
2.9	Practice class for pictorial views to orthographic views.	2
3.0	**Projection of Solids, Sections of solids and Development of surfaces**	
3.1	Projections of simple solids: prism	1
3.2	Projections of simple solids: cylinder	1
3.3	Projections of simple solids: pyramid	1
3.4	Projections of simple solids: Cone	1
3.5	Practice class for Projection of Solids	1
3.6	Axis of solid inclined to both HP and VP	2
3.7	Section of solids for Prism,	1
3.8	Section of solids for Cylinder,	1
3.9	Section of solids for Pyramid,	1
3.10	Section of solids for Cone	1
3.11	Auxiliary Views - Draw the sectional orthographic views of geometrical solids.	2
3.12	Draw the sectional orthographic views of objects from industry.	1
3.13	Development of surfaces of Right solids Prism,	1
3.14	Development of surfaces of Right solids Pyramid	1
3.15	Development of surfaces of Right solids Cylinder and Cone	2
4.0	**Isometric Projection**	
4.1	Principles of isometric projection	2
4.2	Isometric scale	2
4.3	Isometric projections of simple solids: Prism,	2
4.4	Isometric projections of simple solids: Pyramid,	2
4.5	Isometric projections of simple solids: Cylinder	2
4.6	Isometric projections of simple solids: Cone	2
4.7	Isometric projections of frustum	2
4.8	Isometric projections of truncated solids	2
4.9	Combination of two solid objects in simple vertical positions.	2
5.0	**Application of Engineering Graphics**	
5.1	Geometry and topology of engineered components:	2
5.2	Creation of engineering models and their presentation in standard 2D blueprint form,	2
5.3	3D wire-frame and shaded solids – Geometric dimensioning and Tolerance – Use of solid modeling software for creating associative models	4
5.4	Floor plans: windows, doors, and fixtures such as water closet (WC), bath sink, shower, etc.	2
5.5	Applying colour coding according to building drawing practice	2
5.6	Drawing sectional elevation showing foundation to ceiling	4
5.7	Introduction to Building Information Modelling (BIM).	2

Course Designer(s)

1. Dr.K.Mohan- mohank@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)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	10	10	20
Apply	40	40	60
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

Common to CSE,CIVIL, MCT, BT, MECH,ECE, FT, EEE, TXT

60 CS 001 –C Programming*

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	E	Total
I/II	3	0	0	45	3	40	60	100

Basics of C, I/O, Branching and Loops 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 Arrays: One Dimensional Arrays - Two Dimensional Arrays – Matrix Manipulation - Character arrays – Strings: String Manipulation with and without String Handling Functions.	[7]
Functions and Pointers 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. 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 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 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.	E.Balagurusamy, “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.	K N King, “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	**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	**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	**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	**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	**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

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60 MY 001	Environmental Studies and Climate Change	Category	L	T	P	Credit
		MC	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 (30 Marks)		Quiz (20 marks)		Seminar presentation (50 marks)
	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**

Rev.No. 00 / w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E. - Electrical and Electronics Engineering

60 MY 001- Environmental Studies and Climate Change

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

Pollution and its Impact on Climate Change* 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** 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*** 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 Recharge and Rainwater Harvesting.	[6]
Environment and Agriculture**** 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 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; Sixth edition (1 January 2018)

Reference(s):

1.	G.Tyler Miller Environmental Science 14^{th} Edition Cengage Publications, Delhi, 2013
2.	Gilbert M.Masters and Wendell P. Ela,"Environmental Engineering And Science", PHI Learning Private Limited, 3^{rd} 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 Well-being

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 – green house 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	*2*
1.3	Action plan on climate change - IPCC, UNFCCC, Kyoto Protocol, Montreal Protocol on Climatic Changes	*2*
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	*2*
2.3	Risk management: Collection, segregation, treatment and disposal methods.	*2*
2.4	Waste water treatment- ASP	1
3.0	**Sustainable development practices**	
3.1	Sustainable development goals (SDGs) **–** Green computing- Carbon trading - Green building – Eco- friendly plastic	*2*
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	*2*
4.0	**Environment and Agriculture**	
4.1	Organic farming – bio-pesticides	*2*
4.2	Composting, bio composting, vermi-composting	*2*
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)	*2*
5.3	World wide web (www), Environmental information system (ENVIS)	*2*

Course Designer(s)

1 Dr.T.A.Sukantha - sukantha@ksrct.ac.in
2 Dr.B.Srividhya - srividhya@ksrct.ac.in
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4 Ms.D.Kirthiga - kiruthiga@ksrct.ac.in

61 GE001	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	Insightthinai 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	-	-	-	-	-	-	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)	End Sem Examination (Marks)
Remember	-	-
Understand	100	100
Apply	-	-
Analyse	-	-
Evaluate	-	-
Create	-	-
Total	100	100

K.S.Rangasamy College of Technology - Autonomous R2022								
61 GE 001- Heritage of Tamils (Common to all Departments)								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	1	0	0	15	1#	40	60	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, 18^{th} Ed ,2022.
2.	முனைவர் இல. சுந்தரம், கணினித்தமிழ்,விகடன் பிரசுரம், 2^{nd} Ed 2021
3.	முனைவர் இரா.சிவானந்தம், மு.சேரன், கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம், தொல்லியல் துறை வெளியீடு, 6^{th} Ed ,2020.
4.	முனைவர் இரா.சிவானந்தம் , முனைவர் ஜெ.பாஸ்கர், பொருநை - ஆற்றங்கரை நாகரிகம், தொல்லியல் துறை வெளியீடு,1^{st} Ed ,2022
5.	ஈரோடு கதிர், உயர்தல் உரிமை, சிக்ஸ் ப்ளஸ் ஒன் ட்ரெயினிங் அகாடமி,1^{st} 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, 1^{st}, 2001.
8.	Dr.S.V.Subaramanian, Dr.K.D. Thirunavukkarasu, Historical Heritage of the Tamils, International Institute of Tamil Studies, 2^{nd}, 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,3^{rd} 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–AutonomousR2022

61 GE 001- தமிழர் மரபு (அனைத்து துறைகளும் பொதுவானது)

Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	1	0	0	15	1#	40	60	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,
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.

61 GE 001	தமிழர் மரபு (அனைத்து துறைகளும் பொதுவானது)	Category	L	T	P	Credit
		GE	1	0	0	1#

பாடத்தின் நோக்கங்கள்:

- தமிழ் மொழியின் இலக்கணச் செறிவைக் கற்றுணர்தல் ,வாழ்க்கைத் திறன்கள் **மற்றும்** நெறிமுறைகள் தெரிதல்.
- தமிழர் பண்பாட்டின் நுண்கலைகள் பற்றிய ஒரு மீள்பார்வை.
- தமிழர்களின் நாட்டுப்புறக்கலைகள் மற்றும் வீரவிளையாட்டுகள் குறித்து அறிதல்
- தமிழர்களின் திணைக் கோட்பாடுகள், சங்ககால வணிகம் மற்றும் சோழர்களின் வெற்றிகள் குறித்த தகவல்களை தெரிதல்.
- இந்திய சுதந்திரப் போராட்டத்தில் தமிழர்களின் பங்களிப்பை உணருதல்

முன்கூட்டிய துறை சார் அறிவு

- தேவை இல்லை

பாடம் கற்றதின் விளைவுகள்

- பாடத்தை வெற்றிகரமாக கற்றுமுடித்த பின்பு, மாணவர்களால் முடியும் விளைவுகள்

CO1	தமிழ் மொழியின் செந்தண்மை மற்றும் இலக்கியம் குறித்தும் . வாழ்க்கைத் திறன்கள் **மற்றும்** நெறிமுறைகள் குறித்தும் தெரிதல்	புரிதல்
CO2	தமிழர்களின் சிற்பக்கலை, ஓவியக்கலை மற்றும் இசைக்கருவிகள் குறித்த தெளிவு.	புரிதல்
CO3	தமிழர்களின் நாட்டுப்புறக்கலைகள் மற்றும் வீரவிளையாட்டுகள் குறித்த தெளிவு.	புரிதல்
CO4	தமிழர்களின் திணைக் கோட்பாடுகள், சங்ககால வணிகம் மற்றும் சோழர்களின் வெற்றிகள் குறித்த தகவல்கள்.	புரிதல்
CO5	இந்திய தேசிய இயக்கம், சுயமரியாதை இயக்கம் மற்றும் சித்த மருத்துவம் பற்றிய புரிதல்.	புரிதல்

Mapping with Programme Outcomes

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
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-Low															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)	End Sem Examination (Marks)
Remember	-	-
Understand	100	100
Apply	-	-
Analyse	-	-
Evaluate	-	-
Create	-	-
Total	100	100

Note: Those who **studied Tamil as language subject in +2** should write the exams (Model & End Semester Exams) **in** Tamil Languag**e** only. Those who **did not study Tamil as language subject in +2** and **other state students** can write the exams in English Language. It is mandatory.

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

K.S.Rangasamy College of Technology – Autonomous R2022								
Common to All Branches								
60 CS 0P1 - C Programming Laboratory								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	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 1DArray 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

Rev.No. 00 / w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

61 ME 0P1	Fabrication and Reverse Engineering Laboratory (Common to All branches)	Category	L	T	P	Credit
		ES	0	0	4	2

Objectives

- To provide hands-on training on Carpentry, Sheet metal, Fitting and Welding.
- To offer real time activity on plumbing connections and power tools in domestic applications.
- To provide hands-on training on CNC Wood Router and 3D Printing
- To provide hands-on training on household wiring and dismantling and assembling the home appliances.
- To offer real time activity on embedded programming using Arduino

Pre-requisites

-Nil-

Course Outcomes

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

CO1	Make a wooden model using carpentry, Sheet metal Process.	Apply
CO2	Mate a model using filing and joining using MS Plate and repair & maintenances of water lines, power tools for home applications.	Apply
CO3	Cultivate the skills necessary for developing innovative and desirable products, including the ability to integrate user needs, market trends and technological advancement into the design process.	Apply
CO4	Trouble shoot the electrical and electronic circuits, electrical appliances and facilitate the house wiring.	Apply
CO5	Acquire practical knowledge on embedded programming using Arduino.	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	3
CO2	3	2	3			2	2		3			3	3	3
CO3	3	2	3			2	2		3			3	3	3
CO4	3		3			2	2		3			3	3	3
CO5	3		3			2	2		3			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

K.S.Rangasamy College of Technology – Autonomous R2022								
(Common to All branches)								
61 ME 0P1 – Fabrication and Reverse Engineering Laboratory								
Semester	**Hours/Week**			**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. Making of Metal Model and Carpentry Process

a) Making of Tray using Sheet Metal Process

b) Making of T / Cross Joint using Carpentry Process.

2. Mating of Square Joint using the Filling Process

3. Fabrication of Welded model

4. Repair and Maintenance of Pipe Fitting for Home Applications

a) Assembly of GI pipes/PVC, Pipe Fitting and Cutting of Threads in GI pipes.

b) Fitting of Pipe with Clamps using Power Tools

5. Making of Model using CNC Wood Router

a) 2D profile cutting on plywood/MDF (6-12 mm) for press fit design

b) Machining of 3D geometry on soft material such as softwood

6. 3D Printing of scanned geometry using FDM or SLA Printer.

7. Dismantling and Assembling of

a) Iron Box

b) Mixer Grinder

c) Ceiling Fan

d) Table Fan

e) Water Heater

f) Induction Stove

8. Design and Execution of Residential house wiring with UPS.

a) 1 BHK

b) 2 BHK

9. Design and fabrication of domestic LED lamps

a) Schematic and PCB layout design of the given circuit and fabrication and testing of the same.

b) Soldering

10. Embedded programming using Arduino

Lab Manual

1.	"Fabrication and Reverse Engineering Laboratory Manual", Department of Mechanical Engineering, KSRCT.

*SDG 9 – Industry Innovation and Infrastructure

Course Designer(s)

1. Mr.S Sakthivel - sakthivel_s@ksrct.ac.in
2. Dr.G.Vijayagowri – vijayagowri@ksrct.ac.in
3. Mr. K.Raguvaran – raguvaran@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 EXAMINATIONSs
(For the candidates admitted in 2025-2026)
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 PH 003	Physics for Electrical Engineering	2	40	60	100	45	100
4	60 CH 003	Chemistry for Electronic Engineering	2	40	60	100	45	100
5	61 EE 201	Electric Circuit Analysis	2	40	60	100	45	100
6	60 GE 002	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	2	40	60	100	45	100
PRACTICAL								
7	60 CP 0P2	Engineering Physics and Chemistry Laboratory	3	60	40	100	45	100
8	61 EE 2P1	Electric Circuit Laboratory	3	60	40	100	45	100
9	60 CG 0P1	Career Skill Development I	3	10	-	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 the theory end semester examination and 40 marks for practical end semester examination.

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	2	2
CO3	-	-	-	-	-	-	-	2	3	3	2	3	3	2
CO4	-	-	-	-	-	-	-	2	3	3	2	3	2	3
CO5	-	-	-	-	-	-	-	2	3	3	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	10	20
Understand	50	50	80
Apply	-	-	-
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	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* **Listening:** Evaluative Listening: Advertisements, Product Descriptions, - Audio / video; filling a graphic organiser (choosing a product or service by comparison) **Speaking:** Marketing a product, persuasive speech techniques. **Reading:** Reading advertisements, user manuals and brochures. **Writing:** Professional emails, Email etiquette - compare and contrast essay. **Language Focus:** mixed tenses, prepositional phrases, same words used in different contexts and discourse markers	[9]
Expressing Causal Relations in Speaking and Writing* **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. **Speaking:** Describing and discussing the reasons of accidents or disasters based on news reports. **Reading:** longer technical texts– cause and effect essays, and letters / emails of complaint, **Writing:** Writing responses to complaints **Language Focus:** Active Passive Voice transformations, Infinitive and Gerunds – Word Formation (Noun-Verb-Adj-Adv), Adverbs.	[9]
Problem Solving* **Listening:** Listening to / watching movie scenes/ documentaries depicting a technical problem and suggesting solutions. **Speaking:** Group Discussion (based on case studies), - techniques and Strategies. **Reading:** Case Studies, excerpts from literary texts, news reports etc. **Writing:** Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay **Language Focus:** Error correction; If conditional sentences - Compound Words, Sentence Completion.	[9]
Reporting of Events and Research* **Listening:** Listening Comprehension based on new report and documentaries – **Speaking:** Interviewing, presenting oral reports, Mini presentations on select topics. **Reading:** Newspaper articles. **Writing:** Recommendations, Transcoding, Accident Report, Precis writing and Summarising, and Plagiarism **Language Focus:** Reported Speech – Modals - Conjunctions- use of Prepositions	[9]
The Ability to put Ideas or Information Coherently* **Listening:** Listening to TED Talks, Presentations, Formal job interviews, (analysis of the interview performance). **Speaking:** Participating in role plays, virtual interviews, making presentations with visual aids **Reading:** excerpts of interview with professionals **Writing:** Job / Internship application – Cover letter & Résumé **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. Sharma R. C. & Krishna Mohan, 'Business Correspondence and Report Writing', Tata McGraw Hill & Co. Ltd., New Delhi, 2001
4.	Arora V. N 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	**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	**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	**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	**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	1
5	**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 in Vector calculus.
- To get exposed to the fundamentals of analytic functions.
- To solve various types of partial differential equations.
- To familiarize the concepts in Laplace transform techniques.

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	3	-	-	2	-	-	-	-	-	-	-	2	-
CO2	3	3	-	-	2	-	-	-	-	-	-	-	2	-
CO3	3	3	-	-	2	-	-	-	-	-	-	-	2	-
CO4	3	3	-	-	2	-	-	-	-	-	-	-	2	-
CO5	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	10
Understand	10	10	20
Apply	40	40	70
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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

Content	Hours
MULTIPLE INTEGRALS 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. **Hands - on:** Evaluating double integrals, triple integrals, area as double integrals and volume as triple integrals.	[9]
VECTOR CALCULUS* 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). **Hands - on:** Evaluating Gradient, divergence and curls.	[9]
ANALYTIC FUNCTIONS AND INTEGRALS 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. **Hands - on:** Plotting and visualizing functions of single variable, two and three variables.	[9]
PARTIAL DIFFERENTIAL EQUATIONS* 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. **Hands - on:** Calculate homogeneous linear partial differential equations.	[9]
LAPLACE TRANSFORM 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. **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. Veerarajan T, "Engineering Mathematics", for Semesters I& II, 1st Edition, Tata McGraw Hill Publishing Co., New Delhi, 2019.

Reference(s):

1. Kreyszig Erwin, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons (Asia) Limited, New Delhi, 2016.
2. Kandasamy P, Thilagavathy K and Gunavathy K, "Engineering Mathematics - I", S.Chand & Company Ltd, New Delhi, 2017
3. Bali N P and Manish Goyal, "A text book of Engineering Mathematics",10th Edition, Laxmi Publications(P) Ltd, 2016.
4. Dr.P.N.Agrawal, Dr.D.N.Pandey ,"Integral Equations, Calculus of Variations and its Applications", NPTEL online video courses.

Course Contents and Lecture Schedule

S. No	Topic	No. Hrs
1	**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	**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	**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	**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	**LAPLACE TRANSFORM**	
5.1	Conditions for existence	1
5.2	Transforms of elementary functions	1
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
	Total	60

Course Designer

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Rev.No. 00 / w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

60 PH 003	Physics for Electrical Engineering (B.E. ECE&EEE)	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 semiconductor devices
- To enable the students in understanding the importance of quantum physics and its applications.
- To instill knowledge on physics of semiconductors, determination of charge carriers and device 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

Pre-requisites

- Nil

Course Outcomes

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

CO1	Recognize the basics of crystallography, different crystal growth techniques and its applications	Understand
CO2	Utilize the fundamentals of quantum mechanics and apply to one dimensional motion of particles	Apply
CO3	Acquire knowledge on basics of semiconductor physics and its applications in various devices	Understand
CO4	Realize the knowledge on magnetic and dielectric properties of materials and their applications	Understand
CO5	Infer the properties of new engineering materials and nano materials for potential 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	-	-	-	-	-	-	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	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	14	16
Understand	46	46	80
Apply	04	-	04
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Syllabus								
K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Electrical and Electronics Engineering								
60 PH 003-Physics for Electrical Engineering (B.E. ECE&EEE)								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Content	Hours
CRYSTAL STRUCTURE OF SOLIDS* Lattice - Unit cell – crystal systems and Bravais lattice - Miller indices - d spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - Coordination number - Packing factor for HCP structure – Production of single crystal silicon by melt growth techniques (Bridgman and Czochralski) - Basic Properties of Silicon Wafers - wafer orientation – wafer cleaning – pattern alignment - imperfections in crystals.	[9]
QUANTUM MECHANICS* Black body radiation – Dual nature of light - de-Broglie hypothesis – Properties of matter waves - Time-dependent and time independent Schrodinger equation for wave function - Applications: Particle in a box (one dimensional and three dimensional) – Physical significance of wave function- Uncertainty principle – Applications - Electron microscope - Scanning electron microscope.	[9]
SEMICONDUCTING MATERIALS Properties-Elemental and Compound Semiconductors - Carrier Concentration in intrinsic and Extrinsic semiconductors- Experimental determinations of resistivity of semiconductor by four probe method - Hall Coefficient-Experimental Determination of Hall Coefficient- Semiconductor devices – P-N Junction diode, **Solar Cell, LED**.**	[9]
MAGNETIC AND DIELECTRIC MATERIALS* 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 Capacitor and Transformer.	[9]
ADVANCED MATERIALS AND NANOTECHNOLOGY* Advanced Materials: Metallic glasses – preparation, properties and applications - Shape memory alloys (SMA) - characteristics, properties of NiTi alloy applications. 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- Application -Single electron phenomena and Single electron transistor (SET)	[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.2021
3	D. R. Joshi “Engineering Physics” McGraw Hill Education Private Limited, New Delhi. 2010

Reference(s):

1.	S.O. Pillai “A Textbook Of Engineering Physics” New Age International (P) Limited, New Delhi, 2014
2.	B. B. Laud “ Lasers and Non-Linear Optics” New Age International Publications, New Delhi, 2015
3.	Palanisamy, P.K., “Physics of Materials”, Scitech Publications, Chennai. 2012

* SDG:4- Quality Education

** SDG:7 - Sustainable and modern energy for all

Course Contents and Lecture Schedule

S. No.	Topics	No. of Hrs
1.0	**CRYSTAL STRUCTURE OF SOLIDS**	
1.1	Lattice - Unit cell – crystal systems and Bravais lattice	1
1.2	Miller indices - d spacing in cubic lattice	1
1.3	Calculation of number of atoms per unit cell	1
1.4	Atomic radius - Coordination number -Packing factor for HCP structure	1
1.5	Production of single crystal silicon by melt growth techniques	1
1.6	(Bridgman and Czochralski)	1
1.7	Basic Properties of Silicon Wafers	1
1.8	Wafer orientation–wafer cleaning	1
1.9	Pattern alignment-imperfections in crystals	1
2.0	**QUANTUMMECHANICS**	
2.1	Black body radiation	1
2.2	Dual nature of light - de-Broglie hypothesis	1
2.3	Properties of matter waves	1
2.4	Time-dependent and time independent Schrodinger equation for wave function	1
2.5	Applications: Particle in a box (one dimensional and three dimensional)	1
2.6	Physical significance of wave function-Uncertainty principle	1
2.7	Applications of Schrodinger equation	1
2.8	Electron microscope	1
2.9	Scanning electron microscope	1
3.0	**SEMICONDUCTINGMATERIALS**	
3.1	Properties of semiconductor	1
3.2	Elemental and Compound Semiconductors	1
3.3	Carrier Concentration in intrinsic and Extrinsic semiconductors	1
3.4	Experimental determinations of resistivity of semiconductor	1
3.5	Four probe method	1
3.6	Hall Coefficient	1
3.7	Experimental Determination of Hall Coefficient	1
3.8	Semiconductor devices–P-N Junction diode	1
3.9	Solar Cell, LED	1
4.0	**MAGNETIC ANDDIELECTRICMATERIALS**	
4.1	Origin of magnetic moment-Bohrmagnetron	1
4.2	Classification of magnetic materials	1
4.3	Domain theory-Hysteresis-soft and hard magnetic materials	1
4.4	Applications-Giant Magneto Resistance (*GMR*)	1
4.5	Electronic Polarization, Ionic Polarization	1
4.6	Orientational and space charge polarization	1
4.7	Frequency and Temperature dependence of polarization	1
4.8	Breakdown mechanisms	1
4.9	Applications of dielectrics in Capacitor and Transformer	1
5.0	**ADVANCEDMATERIALSANDNANOTECHNOLOGY**	
5.1	Metallic glasses – preparation, properties and applications	1
5.2	Shape memory alloys (SMA)	1
5.3	Characteristics, properties of NiTi alloy applications	1
5.4	Properties- Top-down process: Ball Milling method	1
5.5	Bottom-up process: Vapour Phase Deposition	1
5.6	Carbon Nano Tube(CNT):Properties	1
5.7	Preparation by electric arc method	1
5.8	CNT-Application	1
5.9	Single electron phenomena and Single electron transistor (SET)	1

60 CH 003	Chemistry for Electronic Engineering (Common to EEE & ECE)	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 its applications
- To study the types of batteries and fuel cells.
- To explain the characteristics and application of chemical sensors
- To study the working principles of smart materials and its applications

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 electro chemistry.	Understand
CO3	Illustrate the significance of the types of batteries and fuel cells.	Understand
CO4	Categorize the types of sensors for various applications.	Apply
CO5	Identify the properties, principles, and applications of various smart materials in modern technologies.	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	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	2	2
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	20	20	20
Understand	30	40	60
Apply	10	-	20
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Electrical and Electronics Engineering

60 CH 003 - Chemistry for Electronic Engineering
(Common to EEE & ECE)

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

Water Technology* 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 ** Electrode Potential - Nernst Equation - Derivation and Problems - Reversible and Irreversible Cells - Types of Electrodes and its Applications - Reference Electrodes - pH, Conductometric and Potentiometric Titrations - Principles of Electro Plating and Electro Less Plating- Fabrication Process of Printed Circuit Board.	[9]
Energy Storage Devices ** ,* &** **** 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]
Chemical Sensors*** Sensors - Chemical Sensors - Characteristics - Elements and Characterization - Potentiometric Sensors - Amperometric Sensors - Sensors Based on Electrochemical Methods - Electrochemical Biosensors – Optical Biosensors: Enzyme Sensors - Bio Affinity Sensors - DNA Sensors. Chemical Sensors as Detectors and Indicators: Indicators for Titration Processes - Separation Methods - Nano Technology in Chemical Sensors.	[9]
Electronic Materials *** Liquid Crystal Polymers - Organic Light Emitting Diode - Polythiopene - Working and Applications - Conductive Polymers and Semi Conducting Polymers - Principle and Applications - Organic Dielectric Material [Polystyrene, Pmma] - Smart Screen Materials: Inorganic Rare Earth Metals [Yttrium, Lanthanum, Cerium] - Conductive Components: Indium Tin Oxide [Properties and Applications] - Touch Screen [Resistive and Capacitive] - Magnetic Storage [Iron Oxide, Cobalt Alloy] – Optical Storage [Photo Chromic Materials] - Solid Storage.	[9]
Total Hours:	**45**

Text Book(s):

1.	O.G. Palanna “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 2017.

Reference(s):

1.	Jain. P.C. and Monica Jain, “Engineering Chemistry”, Dhanpatrai publishing co. New Delhi, 14th Edition, 2015.
2.	Peter Grundler “Chemical Sensors” ISBN 978-3-540-45742-8 Springer Berlin Heidelberg New York, 2007.
3.	O.V. Roussak 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.
5.	Hagen Klauk, “Organic Electronics: Materials, Manufacturing and Applications”, Wiley-VCH, 2006

* SDG 6: Improve Clean Water and Sanitation
** SDG 9 Industry, Innovation and Infrastructure
***SDG 9 Industry, innovation and infrastructure

Course Contents and Lecture Schedule

S. No.	Topic	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 water by EDTA method	**1**
1.4	Internal conditioning (Colloidal, Phosphate, Calgon and Carbonate)	**1**
1.5	External conditioning (Zeolite process)	**1**
1.6	Demineralization process	**1**
1.7	Desalination methods - Reverse Osmosis	**1**
1.8	and Electro dialysis	**1**
1.9	Flash Evaporation	**1**
2.0	**ELECTROCHEMISTRY**	
2.1	Electrode potential - Nernst Equation - derivation and problems	**2**
2.2	Reversible and irreversible cells	**1**
2.3	Types of Electrodes and its applications	**1**
2.4	Reference electrodes - pH	**1**
2.5	Conductometric and Potentiometric titrations	**1**
2.6	Principles of electro plating and electro less plating-	**2**
2.7	Fabrication process of Printed Circuit Board.	**1**
3.0	**ENERGY STORAGE DEVICES**	
3.1	Batteries - Types of Batteries.	**2**
3.2	Fabrication and Working of Alkaline Battery	**1**
3.3	Lead-Acid Battery	**1**
3.4	Ni-Cd-Lithium Ion Batteries	**1**
3.5	Fuel Cells: Hydrogen-Oxygen fuel cell	**1**
3.6	Microbial fuel cell (MFC).	**1**
3.7	Organic Solar Cells-working principle and applications organic transistors	**1**
3.8	Construction-working principle and applications in electronic Industries.	**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.	**1**
5.0	**ELECTRONIC MATERIALS**	
5.1	Liquid crystal polymers - Organic Light Emitting Diode (OLED) - [polythiopene] - working and applications	**2**
5.2	Conductive polymers and Semi conducting polymers: principle and applications	**2**
5.3	Organic: Organic dielectric material [Polystyrene, PMMA].	**1**
5.4	Smart screen materials: Inorganic Rare earth metals [yttrium, lanthanum, cerium]	**1**
5.5	Conductive components: Indium tin oxide [properties and applications] - touch screen [resistive and capacitive]	**1**
5.6	magnetic storage [Iron oxide, cobalt alloy]	**1**
5.7	Optical storage [photo chromic materials] - solid storage.	**1**

Course Designer(s)

Dr.T.A.SUKANTHA
Dr.B.SRIVIDHYA
Dr.K.PRABHA
Dr.S.MEENACHI
Mr.K.TAMILARASU
Ms.D.KIRTHIGA

61 EE 201	Electric Circuit Analysis	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To gain knowledge in applying basics laws in electric circuits
- To familiarize to apply network theorems in DC and AC circuits
- To gain knowledge and understand the time and frequency responses
- To facilitate the knowledge on coupled circuits and three phase electric circuits
- To gain knowledge on two port networks

Pre-requisites

- Algebraic operations on complex numbers

Course Outcomes

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

CO1	Apply ohm‘s law and Kirchhoff‘s law to solve electric circuits.	Apply
CO2	Apply network theorems to determine behavior of the given DC and AC circuit	Apply
CO3	Compute the time and frequency response of electric circuits	Analyze
CO4	Determine the behavior of coupled circuits and compute power, line/phase voltage and currents of three phase circuits.	Apply
CO5	Interrelate the various parameters of two port network and concept of graph theory.	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	2	2	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	-	-	-	**3**	2	2	2	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	-	-	-	**3**	2	2	2	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	-	-	-	**3**	2	2	2	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	-	-	-	**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	10	10	20
Understand	10	10	20
Apply	40	20	40
Analyse	-	20	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Electrical and Electronics Engineering

61 EE 201- Electric Circuit Analysis

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

BASIC CIRCUITS ANALYSIS Fundamentals concepts of R, L and C elements-Energy Sources- Ohm's Law -Kirchhoff 's Laws – DC Circuits – Resistors in series and parallel circuits - A.C Circuits – Average and RMS Value – Complex Impedance – Phasor diagram - Real and Reactive Power, Power Factor, Energy - Mesh current and node voltage methods of analysis.	[12]
NETWORK REDUCTION AND THEOREMS FOR DC AND AC CIRCUITS Network reduction: voltage and current division, source transformation – star delta conversion. Theorems – Superposition, Thevenin's and Norton's Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman's theorem – Tellegan's theorem	[12]
RESONANCE AND TRANSIENT RESPONSE ANALYSIS Series and Parallel Resonance - Frequency response curves –Quality factor and Band width. Introduction to Laplace transforms and inverse Laplace transforms- standard test signals - Transient response of RL, RC and RLC circuits using Laplace transform for Source free, Step input and Sinusoidal input.	[12]
COUPLED CIRCUITS AND THREE PHASE CIRCUITS Comparison between electric and magnetic circuits - Self and Mutual Inductances Coefficient of coupling - Dot rule - Series aiding, Series opposing, Parallel aiding and Parallel opposing - Analysis of Coupled circuits - Simple problems. Three Phase three wire, four wire balanced and unbalanced circuits with star/delta loads - Power and Power factor measurements by two wattmeter method.	[12]
TWO PORT NETWORKS AND GRAPH THEORY* Two port networks: Z, Y, ABCD, h parameters and their inter relationships. – Filters and their types - Link currents by tie set matrix - Tree branch voltages by cut - set matrix. Graph of a network - Duality - Branch - Tree - Co tree - Twigs - Links - Incidence matrix	[12]
Total Hours:	**60**

Text Book(s):

1.	William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, 9thedition, New Delhi, 2020.
2.	Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition,McGraw Hill, 2019.

Reference(s):

1.	Chakrabarti A, "Circuits Theory (Analysis and synthesis), DhanpatRai& Sons, New Delhi, 2020.
2.	Joseph A. Edminister, Mahmood Nahvi, "Electric circuits", Schaum's series, McGraw-Hill, First Edition, 2019.
3.	M E Van Valkenburg, "Network Analysis",Prentice-Hall of India Pvt Ltd, New Delhi, 2015.
4.	Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley &Sons, Inc. 2018.

* - SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule

S.No	Topics	No. of Hours
1	**BASIC CIRCUITS ANALYSIS**	
1.1	Fundamentals concepts of R, L and C elements-Energy Sources	1
1.2	Ohm’s Law -Kirchhoff ‘s Laws	1
1.3	DC Circuits – Resistors in series and parallel circuits	1
1.4	A.C Circuits – Average and RMS Value – Complex Impedance – Phasor diagram	1
1.5	Real and Reactive Power, Power Factor, Energy	1
1.6	Mesh current methods of analysis	1
1.7	Node voltage methods of analysis	2
	Tutorial onA.C Circuits	2
	Tutorial on Mesh and Nodal Voltage methods	2
2	**NETWORK REDUCTION AND THEOREMS FOR DC AND AC CIRCUITS**	
2.1	Voltage and current division	1
2.2	Source transformation	1
2.3	Star delta conversion	2
2.4	SuperpositionTheorem	1
2.5	Thevenin’s and Norton’s Theorem	2
2.6	Maximum power transfer theorem	1
2.7	Reciprocity Theorem	1
2.8	Millman's theorem & Tellegan’s theorem	1
	Tutorial on Theorem	2
3	**RESONANCE AND TRANSIENT RESPONSE ANALYSIS**	
3.1	Series and Parallel Resonance	1
3.2	Frequency response curves	1
3.3	Quality factor and Bandwidth	1
3.4	Introduction to Laplace transforms and inverse Laplace transforms standard test signals	1
3.5	Transient response of RL, RC for Source free	1
3.6	Transient response of RLC for Source free	1
3.7	Transient response of RL, RC for Step input	1
3.8	Transient response of RLCfor Step input	1
3.9	Transient response of RL, RC for Sinusoidal input	1
3.10	Transient response of RLC for Sinusoidal input	1
	Tutorial onTransient response	2
4	**COUPLED CIRCUITS AND THREE PHASE CIRCUITS**	
4.1	Comparison between electric and magnetic circuits	1
4.2	Self and Mutual Inductances Coefficient of coupling	1
4.3	Dot rule - Series aiding, Series opposing, Parallel aiding and Parallel opposing	1
4.4	Analysis of Coupled circuits	1
4.5	Three Phase three wire, four wire balanced circuits with star/delta loads	1
4.6	Three Phase three wire, four wire unbalanced circuits with star/delta loads	2
4.7	Power and Power factor measurements by two wattmeter method	1
	Tutorial on Coupled circuits	2
	Tutorial on three phase circuits	2
5	**TWO PORT NETWORKS AND GRAPH THEORY**	
5.1	Two port networks: Z, Y, ABCD, h parameters	1
5.2	Relationships between Z parameters to other parameters	1
5.3	Relationships between y parameters to other parameters	1
5.4	Relationships between ABCD parameters to other parameters	1
5.5	Graph of a network –Branch – Incidence matrix- Tree – Co tree – Twigs – Links	1
5.6	Duality	1
5.7	Link currents by tie set matrix	1
5.8	Tree branch voltages by cut – set matrix.	1
5.9	Filters and their types	1
	Tutorial on two port networks	2
	Tutorial on Graph Theory	2

Course Designer : Ms.N.Kayalvizhi -kayalvizhi@ksrct.ac.in

60 GE 002	Tamils and Technology (Common to all Branches)	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)	End Sem Examination (Marks)
Remember	-	-
Understand	80	80
Apply	20	20
Analyse	-	-
Evaluate	-	-
Create	-	-
Total	100	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
Common to all Branches								
60 GE 002 – Tamils and Technology*								
Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	1	0	0	15	1	40	60	100

WEAVING AND CERAMIC TECHNOLOGY Weaving Industry during Sangam Age – Ceramic Technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.	[3]
DESIGN AND CONSTRUCTION TECHNOLOGY 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 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 Dam,Tank,Ponds,Sluice,Significance of KumizhiThoompu of CholaPeriod,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 & TAMIL COMPUTING 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**

Text Book(s):

1.	தமிழக வரலாறு- மக்களும்பண்பாடும்கே. கே .பிள்ளை(வெளியீடு: தமிழ்நாடு பாட நூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2.	கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3.	கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு).
4.	பொருநை–ஆற்றங்கரை நாகரீகம் (தொல்லியல் துறை வெளியீடு).
5.	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print).
6.	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr.S.V.Subaramanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10.	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author).
11.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
12.	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

* - SDG4 Quality Education

60 GE 002	**Tamils and Technology** (Common to all Branches)	**Category**	**L**	**T**	**P**	**Credit**
		GE	**1**	**0**	**0**	**1#**

பாடத்தின் நோக்கங்கள்:

- தமிழர்களின் சங்க கால நெசவு, பனை வனைதல் மற்றும் கட்டிட தொழில் நுட்பம் குறித்து அறிதல்.
- தமிழர்களின் சங்க கால வேளாண்மை, நீர்ப்பாசனம் மற்றும் உற்பத்தி முறைகள் குறித்த கற்றல்.
- நவீன அறிவியல் தமிழ் மற்றும் கணித்தமிழ் குறித்த புரிதல்.

முன் கூட்டிய துறை சார் அறிவு:

தேவை இல்லை

பாடம் கற்றதின் விளைவுகள்:

பாடத்தை வெற்றிகரமாக கற்று முடித்த பின்பு, மாணவர்களால் முடியும் விளைவுகள்

CO1	சங்க காலத்தமிழர்களின் நெசவு மற்றும் பானை வனைதல் தொழில் நுட்பம் குறித்த கற்றுணர்தல்	புரிதல்
CO2	சங்க காலத்தமிழர்களின் கட்டிட தொழில் நுட்பம் கட்டுமானப்பொருட்கள் மற்றும் அவற்றை விளக்கும் தளங்கள் குறித்த அறிவு.	புரிதல்
CO3	சங்க காலத்தமிழர்களின் உலோகத் தொழில், நாணயங்கள் மற்றும் மணிகள் சார்ந்த தொல்லியல் சான்றுகள் பற்றிய அறிவு.	புரிதல்
CO4	சங்க காலத்தமிழர்களின் வேளாண்மை, நீர்ப்பாசன முறைகள் மற்றும் முத்து குளித்தல் குறித்த தெளிவு.	புரிதல்
CO5	நவீனஅறிவியல்தமிழ்மற்றும்கணித்தமிழ்குறித்தபுரிந்துகொள்ளலும்மற்றும்பயன்படுத்துதலும்.	பகுப்பாய்வு

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)**	**End Sem Examination (Marks)**
Remember	-	-
Understand	80	80
Apply	20	20
Analyse	-	-
Evaluate	-	-
Create	-	-
Total	100	100

K. S. Rangasamy College of Technology – Autonomous (R2022)								
60GE 002–தமிழரும்தொழில்நுட்பமும்								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	1	0	0	15	1#	40	60	100

நெசவு மற்றும் பானைத் தொழில்நுட்பம்: சங்க காலத்தில் நெசவுத்தொழில் – பானைத் தொழில்நுட்பம்- கருப்பு சிவப்பு பாண்டங்கள்– பாண்டங்களில் கீறல் குறியீடுகள்.	3
வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டு மானங்கள் & சங்க காலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு – சங்ககாலத்தில் கட்டுமானப் பொருட்களும் நடுகல்லும்– சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்ல புரச்சிற்பங்களும், கோவில்களும்–சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிறவழிபாட்டுத்தலங்கல் – நாயக்கர் காலக்கோயில்கள்–மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டி நாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ –சாரோ செனிக் கட்டிடக்கலை.	3
உற்பத்தித் தொழில் நுட்பம்: கப்பல் கட்டும் கலை – உலோகவியல் –இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல் எஃகு–வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள்- நாணயங்கள் அச்சடித்தல்- மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள் கண்ணாடி மணிகள்– சுடுமண்மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	3
வேளாண்மை மற்றும் நீர் பாசனத் தொழில்நுட்பம்: அணை, ஏரி, குளங்கள், மதகு–சோழர்காலக்குமுழித்தூம்பின்முக்கியத்துவம்- கால்நடைபராமரிப்பு–கால்நடைகளுக்கானவடிவமைக்கப்பட்டகிணறுகள்– வேளாண்மைமற்றும்வேளாண்மைசார்ந்தசெயல்பாடுகள்–கடல்சார்அறிவு–மீன்வளம்–முத்து மற்றும் முத்துக் குளித்தல்–பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவு சார்சமூகம்.	3
அறிவியல் தமிழ் மற்றும் கணித்தமிழ் அறிவியல் தமிழின் வளர்ச்சி –கணித்தமிழ் வளர்ச்சி –தமிழ் நூல்களை மின்பதிப்பு செய்தல்– தமிழ் மென்பொருட்கள் உருவாக்கம் –தமிழ் இணையக் கல்விக்கழகம்– தமிழ் மின்நூலகம்– இணையத்தில் தமிழ்அகராதிகள்– சொற் குவைத்திட்டம்.	3
Total Hours	**15**

Text Book(s):

1.	தமிழக வரலாறு- மக்களும் பண்பாடும் கே. கே .பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள்கழகம்).
2.	கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன்பிரசுரம்).
3.	கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரீகம் (தொல்லியல்துறைவெளியீடு).
4.	பொருநை – ஆற்றங்கரை நாகரீகம் (தொல்லியல்துறைவெளியீடு).
5.	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print).
6.	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr.S.V.Subaramanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,Tamil Nadu)
10.	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author).
11.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
12.	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

60 CP 0P2	Engineering Physics and Chemistry Laboratory (CSE,IT, AIML, EEE,ECE,VLSI)	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	Analyze the properties of semiconducting materials for its potential applications	Apply
CO2	Realize the interference and diffraction phenomena by Airwedge and laser experiments	Apply
CO3	Recognize the magnetic properties by experimental verification	Apply
CO4	Apply different techniques of qualitative and quantitative chemical analysis to generate experimental skills and apply these skills to various analyses	Apply
CO5	Explain and analyze instrumental techniques for chemical analysis	Analyze

Mapping with Programme Outcomes (EEE)

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	-	-	-	-	-	-	-	2	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	2	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	2	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	2	-	-	-	-	-
CO5	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	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								
60 CP 0P2 - Engineering Physics And Chemistry Laboratory (CSE,IT, AIML, EEE,ECE,VLSI)								
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 (Physics):

1. Determination of Hall coefficient of a given semiconductor and its charge carrier density
2. V-I Characteristics of Zener diode and Solar cell
3. Air wedge - Determination of thickness of a thin sheet/wire
4. a) Laser- Determination of the wave length of the laser using grating
   b) Optical fibre -Determination of numerical aperture and acceptance angle
5. Magnetic field along the axis of current carrying coil – Stewart and Gee

*** SDG: 4- Quality Education**

List of Experiments (Chemistry):

1. Estimation of HCl by pH meter.
2. Estimation of mixture of acids by conductivity meter
3. Determination of ferrous ion by Potentiometric titration.
4. Determination of corrosion by weight loss method.
5. Estimation of ferrous ion by spectrophotometer.

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

Case studies/Activity report

1. Activity using chemdraw software.
2. Activity report on cheminformatic structure.
3. Case study on ion selective electrodes.
4. Assembling of cell or battery.

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
2. Dr.B.Srividhya - srividyab@ksrct.ac.in
3. Dr.S.Meenachi - meenachi@ksrct.ac.in

61 EE 2P1	Electric Circuit Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

Objective(s):

- To impart hands on experience in verification of circuit laws.
- To verify a given network by applying various Network Theorems
- To simulate electric circuit transients using Pspice/Matlab/e-Sim / Scilab
- To design resonance circuit.
- To measure three phase voltages, current, active power and power factor.

Pre-requisites

- Nil

Course Outcomes

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

CO1	Use experimental methods to verify the fundamental electrical laws and theorems for the given DC/AC circuit	Apply
CO2	Analyze transient behavior of the given RL/RC/RLC circuit using simulation	Analyse
CO3	Analyze frequency response of the given RLC circuit	Analyse
CO4	Determine the power and power factor of the given three-phase circuit using simulation	Apply
CO5	Analyze the different two port network and their interrelations.	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	2	2	3	3
CO2	3	3	3	3	3	-	-	-	3	2	2	2	3	3
CO3	3	3	3	3	3	-	-	-	3	2	2	2	3	3
CO4	3	3	3	3	3	-	-	-	3	2	2	2	3	3
CO5	3	3	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	-	-	-	-
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 - Electrical and Electronics Engineering								
61 EE 2P1– Electric Circuit 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. Experimental verification of fundamental laws using series and parallel electrical circuit
2. Experimental verification of theorems.
3. Simulation of R-C, R-L and RLC electric circuit transients*
4. Design and implementation of resonance circuits.
5. Simulation of three phase star & delta circuit for power and Power factor calculations*
6. Determination of different parameters of Two-port network and verification of their interrelations.

* - SDG – 9 – Industry Innovation and Infrastructure

Course Designer(s)

1. N.Kayalvizhi – kayalvizhi@ksrct.ac.in

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	2
CO3	-	-	-	-	-	-	-	2	3	3	2	3	2	-
CO4	-	-	-	-	-	-	-	2	3	3	2	3	2	-
CO5	-	-	-	-	-	-	-	2	3	3	2	3	-	-
3 - Strong; 2 - Medium; 1 - Some														

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Syllabus

K.S.Rangasamy College of Technology–AutonomousR2022								
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**	**-**	**100**

Listening 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 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 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 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 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

* - SDG4 – Quality Education

Course Contents and Lecture Schedule

S.No	Topics	No. of Hours
1.	**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	Reading relevant to technical contexts and emails	1
1.5	Listen to a product and process descriptions	1
2	**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	**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	**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	**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

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 2025-2026)
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 008	Transforms and Linear Algebra	2	40	60	100	45	100
2	60 EE 301	Electrical Machines – I	2	40	60	100	45	100
3	61 EE 302	Electromagnetic Fields	2	40	60	100	45	100
4	61 EE 303	Electron Devices and Circuits	2	50	50	100	45	100
5	60 CS 003	Data Structures	2	40	60	100	45	100
PRACTICAL								
6	60 EE 3P1	Electrical Machines – I Laboratory	3	60	40	100	45	100
7	61 CS 0P3	Data Structures Laboratory	3	60	40	100	45	100
8	60 CG 0P2	Career Skill Development II	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 the theory end semester examination, 50 marks for theory cum practical end semester examination and 40 marks for practical end semester examination.

60 MA 008	Transforms and Linear Algebra	Category	L	T	P	Credit
		BS	3	1	0	4

Objectives

- To provide exposure and ability to use Fourier series
- To familiarize the basic concepts of Fourier transform.
- To impart the basic concepts of Z- transform.
- To learn fundamentals of the linear transformation.
- To acquire knowledge about vector spaces.

Pre-requisites

- NIL

Course Outcomes

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

CO1	Obtain the Fourier series expansion for the periodic functions.	Apply
CO2	Apply Fourier transform techniques for the continuous functions.	Apply
CO3	Employ Z-transform techniques to solve the difference equations.	Apply
CO4	Articulate the various concepts of linear transformation in real world applications.	Apply
CO5	Implement the concepts of vector space to find dimension, rank and basis.	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	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	2	-
CO3	3	2	-	-	2	-	-	-	-	-	-	-	2	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	2	-
CO5	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	10	10
Understand	10	10	20
Apply	40	40	70
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Rev.No. 00/ w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E – Electrical and Electronics Engineering								
60 MA 008 -Transforms and Linear Algebra								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	1	0	60	4	40	60	100

Fourier Series* Dirichlet's conditions – Fourier series – Odd and even functions – Half range Fourier series – Root mean square value of a function – Parseval's identity – Harmonic analysis. **Hands-on:** Generate the Fourier series of f(x) in (- π, π) and (- l, l), plot and visualize.	[9]
Fourier Transform** Fourier transform pair – Fourier transform of simple functions – Fourier sine and cosine transform – Properties – Convolution theorem – Parseval's identity. **Hands-on:** Compute the Fourier transform of f(x), plot and visualize.	[9]
Z -Transform** Z-transform – Region of convergence – Elementary properties – Initial and final value theorems – Inverse Z - transform – Partial fraction method – Residue method – Convolution theorem – Solution of difference equation. **Hands-on:** Creating discrete signals and applying Z-Transforms using built-in functions	[9]
Linear Transformation*** System of Linear equations - Row reduction and Echelon forms - Vector equations – Linear combinations of vectors – Linear independence - Introduction to linear transformation – Matrix of a linear transformation–Transformation from R^n to R^m. **Hands-on:** Solving system of linear equations	[9]
Vector Space** Vector space -Subspace - Null space – Row and column space - Linear independent sets- Basis- Dimension - Rank - Change of basis. **Hands-on:** Find a basis and dimension for the vector subspace	[9]
Total Hours:45+05+10	**60**

Text Book(s):

1.	Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi, 2013.
2.	S David C. Lay, "Linear Algebra and its Applications", 4th Edition, Pearson Education, 2011

Reference(s):

1.	Kreyszig E., "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons (Asia) Limited, New Delhi, Reprint 2012.
2.	Veerarajan T., "Engineering mathematics-III", Tata McGraw Hill Publishing Company Limited, New Delhi.
3.	Howard Anton and Chris Rorres, 'Elementary Linear Algebra', 10th Edition, John Wiley & Sons, 7th Edition,2010.
4.	Gilbert Strang, 'Linear Algebra and Its Applications', Brooks/Cole/Cengage, 4th Edition 2006.
5.	Kenneth Hoffman and Ray Kunze, "Linear Algebra", Second Edition, Pearson Publisher, 1971.

*** SDG:4-Quality Education**

**** SDG:9 - Industry, Innovation, and Infrastructure**

***** SDG 11 - Sustainable Cities and Communities**

Rev.No. 00/ w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

Course Contents and Lecture Schedule		
S. No.	**Topic**	**No. of Hours**
1	**Fourier Series**	
1.1	Dirichlet’s conditions	1
1.2	Fourier series	1
1.3	Odd and even functions	1
1.4	Half range Fourier series	1
1.5	Root mean square value of a function	2
1.6	Parseval’s identity	2
1.7	Harmonic analysis	1
1.8	Tutorial	2
1.9	Hands - on	1
2	**Fourier Transform**	
2.1	Fourier transform pair	1
2.2	Fourier transform of simple functions	1
2.3	Fourier sine and cosine transform	2
2.4	Properties	2
2.5	Convolution theorem	2
2.6	Parseval’s identity – Problems.	1
2.7	Tutorial	2
2.8	Hands - on	1
3	**Z -Transform**	
3.1	Z-transform , Region of convergence	2
3.2	Elementary properties	1
3.3	Initial and final value theorems	1
3.4	Inverse Z –transform	1
3.5	Partial fraction method	1
3.6	Residue method	1
3.7	Convolution theorem	1
3.8	Solution of difference equations using Z –transform.	1
3.9	Tutorial	2
3.10	Hands - on	1
4	**Linear Transformation**	
4.1	System of Linear equations	1
4.2	Row reduction and Echelon forms	1
4.3	Vector equations	1
4.4	Linear combinations of vectors	1
4.5	Linear independence	2
4.6	Introduction to linear transformation	1
4.7	Matrix of a linear transformation	1
4.8	Transformation from R^n to R^m.	1
4.9	Tutorial	2
4.10	Hands - on	1
5	**Vector Spaces**	

5.1	Vector space	1
5.2	Subspace	1
5.3	Null space	1
5.4	Row and column space	1
5.5	Linear independent sets	2
5.6	Basis, Dimension	1
5.7	Rank - Change of basis.	2
5.8	Tutorial	2
5.9	Hands - on	1
		60

Course Designer(s)

1. Dr.N. Uthirasamy - uthirasamy@ksrct.ac.in

60 EE 301	Electrical Machines - I	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To know the construction, principle of operation and performance of DC machines
- To Learn the characteristics, performance, methods of speed control and testing methods of DC motors
- To analyze the losses in dc machines to improve the efficiency by conducting various tests.
- To outline the principle of operation, construction of single phase transformers.
- To illustrate the methods of testing of single-phase transformer.

Pre-requisites

- NIL

Course Outcomes

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

CO1	Analyze different types of DC generators their characteristics, industrial applications, effect of armature reaction and its assessment	Analyze
CO2	Describe the principle of DC motor, electrical characteristics and industrial application, purpose of starter and its design.	Apply
CO3	Apply various testing methods for the assessment of the performance characteristics of DC machines.	Apply
CO4	Elucidate the construction, operating principle and equivalent circuit of transformers.	Apply
CO5	Identify various testing methods of single phase transformer and types of connections in three phase transformers.	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	2	2	-	2	-	2	-	-	3	3
CO2	3	3	3	2	2	2	-	2	-	2	2	-	3	3
CO3	3	3	3	2	2	-	-	2	-	2	-	-	3	2
CO4	3	3	3	2	2	-	-	2	-	2	-	-	3	3
CO5	3	3	3	2	2	2	-	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	10
Understand	10	10	20
Apply	30	40	50
Analyse	10	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Rev.No. 00/ w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
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BoS Chairman Signature

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E – Electrical and Electronics Engineering								
60 EE 301– Electrical Machines - I								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**E**	**Total**
III	**3**	**1**	**0**	**60**	**4**	**40**	**60**	**100**

Content	Hours
MODULE I DC GENERATORS Basics of electromechanical energy conversion system – Operating principle – Construction – Types of Winding – EMF equation – Methods of Excitation – Types – Armature reaction – Commutation – Methods of Improving commutation – Open and Load Characteristics – Parallel operation – **Applications*** **Hands on practice:** Design and simulation of DC machine characteristics.	[9]
MODULE II DC MOTORS Principle of operation – Back EMF –Torque and power developed equations – Types – Electrical and Mechanical Characteristics – Starting Methods - Types of Starters– **Applications***	[9]
MODULE III SPEED CONTROL AND TESTING OF DC MACHINES **Speed control of DC motors*** – Braking of DC motors – Plugging, Dynamic and Regenerative braking – Specifications – Losses and efficiency –Testing of DC machines – Brake test, Retardation test, Swinburne's test and Hopkinson's test on DC motors. **Hands on practice:** Design and simulation of speed control of DC motor Design and simulation of regulation on3 phase transformers	[9]
MODULE IV TRANSFORMERS Construction – Principle of operation – No load and load condition – Equivalent circuit parameters – Losses and efficiency – Voltage regulation - Parallel operation Autotransformer – saving of copper – **Application*** - Field Visit. **Hands on practice:** Design and simulation of regulation on3 phase transformers	[9]
MODULE V TESTING OF TRANSFORMERS AND THREE PHASE TRANSFORMERS Specifications - All day efficiency – Testing – Load test, OC and SC test, Sumpner's test, polarity test – Three phase transformers – Connections – Scott connection -OLTC –Selection of OLTC – Role of OLTC for voltage transformers – BIS Specifications on Distribution Transformers.	[9]
Total Hours:45+Tutorial 15	**60**

Text Book(s):

1.	D.P.KothariandI.J.Nagrath,"ElectricMachines",TataMcGrawHillPublishingCompanyLtd,2006.
2.	B.L. Therajaand A.K.Theraja,"A text book of Electrical Technology-VolumeII(AC & DC Machines) S.Chand &CompanyLtd.,NewDelhi,2006.

Reference(s):

1.	A.E. Fitzgerald, Charles Kingsley, Stephen. D.Umans, "Electric Machinery", Tata McGraw Hill publishing CompanyLtd,2003.
2.	K.MurugeshKumar, "DCMachinesandTransformers",VikaspublishinghousePvtLtd,2004.
3.	Stephen J. Chapman, "Electric Machinery Fundamentals", 4th edition, McGraw Hill Education Pvt. Ltd, 2010.
4.	P.C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons;3rd Edition, 2013.

* - SDG9 - Industry, Innovation, and Infrastructure

Rev.No. 00/ w.e.f. 25/07/2025
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Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

Course Contents and Lecture Schedule

S.No	Topics	No. of Hours
MODULE I DC GENERATORS		
1.1	Basics of electromechanical energy conversion system	1
1.2	Operating principle - Construction	2
1.3	Types of Winding - EMF equation	1
1.4	Methods of Excitation - Types	1
1.5	Armature reaction	1
1.6	Commutation - Methods of Improving commutation	2
1.7	Characteristics of DC generators – No load and Load Characteristics	2
1.8	Parallel operation	1
1.9	Applications	1
DC MOTORS		
2.1	Principle of operation - Back EMF	1
2.2	Types of DC motor: - Shunt motor -Series motor - Compound motor	2
2.3	Torque equation and Power developed equations - Condition for maximum toque	1
2.4	Starting Methods - Types of starters	2
2.5	Characteristics of DC shunt motor	1
2.6	Characteristics of DC series and compound motor	2
SPEED CONTROL AND TESTING OF DC MACHINES		
3.1	Speed control of D.C. shunt motor - Flux control - Armature control	1
3.2	Braking of DC motors - Plugging	1
3.3	Dynamic - Regenerative braking	2
3.4	Specifications of DC Motor	1
3.5	Losses and efficiency	1
3.6	Testing of DC machines - Brake test - Retardation test - Swinburne's test	2
3.7	Applications – DC Motors	1
TRANSFORMERS		
4.1	Constructional details of transformer: - Core type - shell type	1
4.2	Principle of operation - EMF equation	1
4.3	Transformer - On no-load - On with R,L&C Loads - Vector Diagrams	1
4.4	Equivalent circuit parameters – Introduction only	1
4.5	Losses and efficiency	1
4.6	Voltage Regulation	1
4.7	Parallel operation of single-phase transformers	1
4.8	Auto transformer - Saving of copper	1
4.9	Transformer - Applications	1
4.10	Field Visit	
TESTING OF TRANSFORMERS AND THREE PHASE TRANSFORMERS		
5.1	Specifications - All day efficiency	1
5.2	Testing - Load test - Condition for maximum efficiency	1
5.3	OC and SC test - Equivalent circuit - referred to primary and referred to secondary	1
5.4	Sumpner's test – Regulation - Power factor - Efficiency	1
5.5	Polarity test	1
5.6	Three phase transformers - Types	1
5.7	Types of Connections - Y/Y - Δ/Δ - Y/Δ - Δ/Y	1
5.8	Scott Connection	1
5.9	OLTC - Selection of OLTC - Role of OLTC for voltage Regulation, - UP and Down regulation	1
5.10	BIS Specifications on Distribution Transformers.	1

Course Designer

1. Dr.P.Aravindan aravindan@ksrct.ac.in
2. Mr.M.Dhanapal dhanapalm@ksrct.ac.in

61 EE 302	Electromagnetic Fields	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To provide the basic skills required to understand the concept of different coordinate systems
- To familiarize about the electric field in material space and learn to solve boundary value problems
- To expose the various concepts of magneto-static field
- To impart knowledge on the concepts of Faraday's law, induced emf and Maxwell's equations.
- To identify, formulate and solve fields and electromagnetic waves propagation problems.

Pre-requisites

- Engineering Physics

Course Outcomes

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

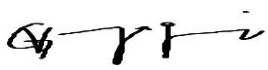
CO1	Compute different coordinate systems related to magnetic fields	Apply
CO2	Discuss the behavior of Electric fields in matter and Polarization concepts	Apply
CO3	Apply the principles of magneto statics to the solutions of problems relating to magneto-static field	Apply
CO4	Summarize the concepts of electrodynamics & to derive and discuss the Maxwell's equations.	Apply
CO5	Apply Maxwell's equations to solutions of problems relating to wave propagation.	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	2	1	-	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	-	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	10	30
Understand	20	20	30
Apply	20	10	30
Analyse	10	20	10
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100



BoS Chairman Signature

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Electrical and Electronics Engineering								
61 EE 302 –Electromagnetic Fields								
Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Electrostatic I Vector algebra, Coordinate systems, Vector calculus- Gradient, Divergence and Curl, theorems and applications, Sources and effects of electromagnetic fields, Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and its applications. **Hands-on practice:** • Representation of planes in X-Y and Z co-ordinates • Calculate and plot the divergence and gradient of vector field	[9]
Electrostatic II Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectric -Dielectric polarization – Dielectric strength - Electric fields in multiple dielectrics – Boundary conditions, capacitance, Energy density, Poisson's and Laplace's equations – solutions by Direct Integration method, Applications. **Hands-on practice:** • Dielectrics, Capacitance and Electric Energy	[9]
Magnetostatic Fields Lorentz force, magnetic field intensity (H) – Biot-Savart's Law – Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials – permeability, Magnetization, Magnetic field in multiple media – Boundary conditions, Poisson's Equation, Magnetomotive force, Torque, Magnetic circuits - self Inductances and mutual inductances.	[9]
Maxwell's Equations Faraday's law, Lenz's law; Transformer and Motional Electromotive forces, Maxwell's equations, displacement current, Maxwell's equations in final forms, time varying potential, time harmonic field - Relation between field theory and circuit theory, Applications.	[9]
Electromagnetic Waves* Derivation of Wave Equation, Wave parameters; velocity, intrinsic impedance, propagation constant. Wave propagation in lossy dielectrics - Plane waves in lossless dielectrics, free space and good conductors – Group velocity, Electromagnetic power flow and Poynting vector – Normal incidence at a Plane conducting boundary – Normal incidence at a plane dielectric boundary.	[9]
Total Hours:	**45**

Text Book(s):

1.	Mathew N. O. Sadiku, S.V.Kulkarni, 'Principles of Electromagnetics', 6th Edition, OxfordUniversity Press, 2015, Asian Edition
2.	William H. Hayt and John A. Buck, 'Engineering Electromagnetics', Tata McGraw Hill ,8th Revised edition, 2014

Reference(s):

1.	Bhag Singh Guru and Huseyin R. Hiziroglu "Electromagnetic field theory fundamentals", Cambridge University Press; Second Revised Edition, 2009.
2.	Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International, Editions, Fifth Edition, 2010.
3.	AshutoshPramanik, 'Electromagnetism – Theory and Applications', PHI Learning Private Limited, New Delhi, Second Edition-2009
4.	Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum's Outline Series), Tata McGraw Hill, 2010

* - SDG 9 – Industry Innovation and Infrastructure

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BoS Chairman Signature

Course Content and Lecture Schedule

S. No.	Topics	No. of Hours
1	**Electrostatic I**	
1.1	Vector algebra, Coordinate systems	2
1.2	Vector calculus- Gradient, Divergence and Curl , theorems and applications	2
1.3	Sources and effects of electromagnetic fields	1
1.4	Coulomb's Law	1
1.5	Electric field intensity	1
1.6	Field due to discrete and continuous charges	1
1.7	Gauss's law and its applications	1
2	**Electrostatic II**	
2.1	Electric potential	1
2.2	Electric field and equipotential plots	1
2.3	Uniform and Non-Uniform field, Utilization factor	1
2.4	Electric field in free space, conductors, dielectric	1
2.5	Dielectric polarization -Dielectric strength	1
2.6	Electric fields in multiple dielectrics	1
2.7	Boundary conditions, capacitance, Energy density	1
2.8	Poisson's and Laplace's equations	1
2.9	Solutions by Direct Integration method, Applications	1
3	**Magnetostatic Fields**	
3.1	Lorentz force, magnetic field intensity (H	1
3.2	Biot-Savart's Law – Ampere's Circuit Law	1
3.3	H due to straight conductors, circular loop, infinite sheet of current	1
3.4	Magnetic flux density (B) – B in free space, conductor, magnetic materials	2
3.5	permeability, Magnetization, Magnetic field in multiple media	1
3.6	Boundary conditions, Poisson's Equation, Magnetomotive force	1
3.7	Torque, Magnetic circuits	1
3.8	Self Inductances and mutual inductances	1
4	**Maxwell's Equations**	
4.1	Faraday's law, Lenz's law	1
4.2	Transformer and Motional Electromotive forces	2
4.3	Maxwell's equations, displacement current	2
4.4	Maxwell's equations in final forms	2
4.5	Time varying potential, time harmonic field	1
4.6	Relation between field theory and circuit theory, Applications	1
5	**Electromagnetic Waves**	
5.1	Derivation of Wave Equation, Wave parameters; velocity, intrinsic impedance, propagation constant	2
5.2	Wave propagation in lossy dielectrics	1
5.3	Plane waves in lossless dielectrics,free space and good conductors	3
5.4	Plane wave reflection and refraction	1
5.5	Skin depth	1
5.6	Poynting theorem	1

Course Designer(s)

1. N.Kayalvizhi - kayalvizhi@ksrct.ac.in
2. N.Rajasekaran -rajasekaran.n@ksrct.ac.in

61 EE 303	Electron Devices and Circuits	Category	L	T	P	Credit
		PC	3	0	2	4

Objective

- To comprehend the working and characteristics of semiconductor diodes and apply them in real time applications
- To analyze various circuit configurations of BJT and MOSFET determine their characteristic parameters using equivalent circuits in order to design small signal amplifiers
- To familiarize the basic concepts of multi stage amplifier and its characteristics
- To enlighten the applications of feedback amplifier and oscillators.

Prerequisite

Nil

Course Outcomes

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

CO1	Comprehend the working and characteristics of semiconductor diodes and apply them in real-time applications.	Apply
CO2	Analyze various circuit configurations of BJTs and determine their characteristic parameters using equivalent circuits to design small signal amplifiers.	Analyze
CO3	Analyze various circuit configurations of MOSFETs and determine their characteristic parameters using equivalent circuits to design small signal amplifiers.	Analyze
CO4	Familiarize with the basic concepts of multi-stage amplifiers and their characteristics.	Understand
CO5	Enlighten the applications of feedback amplifiers and oscillators.	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	-	-	-	2	-	3	-	3	3
CO2	3	2	3	3	2	-	2	-	-	-	2	2	3	3
CO3	3	3	3	2	2	-	2	2	-	-	2	2	3	3
CO4	3	2	3	3	2	3	2	2	-	-	2	3	2	2
CO5	3	2	3	3	3	-	-	-	2	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	20	--	20	-	-	20	-
Understand	40	--	40	-	-	80	-
Apply	--	50	-	50	50	-	50
Analyse	--	50	-	50	50	-	50
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

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BoS Chairman Signature

K.S.Rangasamy College of Technology – Autonomous R2022								
BE - Electrical and Electronics Engineering								
61 EE 303 Electron Devices and Circuits								
Semester	Hours/Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	2	75	4	50	50	100

Diode and its applications: Review of Network and Semiconductor Basics - PN Junction Diodes - Forward and Reverse Biasing - Reverse Saturation Current - Diode current components - Cut-in voltage - VI Characteristics. Diode Parameters - Data sheets - Diode Models. Rectification - Half-wave - Full-wave and Bridge – Filters. Zener Diodes -Shunt voltage regulator. Varactor Diodes - Schottky Diodes - Tunnel Diodes and LEDs.	[9]
BJT and its characteristics: Transistors - BJTs - PNP and NPN transistors - Effects - Transistor Currents - Amplifying action of a transistor. Transistor Characteristics - CC,CB,CE configuration -h-parameter analysis CE configuration- Biasing - Quiescentpoint – Load line – Fixed base bias-voltage biasing.	[9]
MOSFET and its characteristics: Field Effect Transistors - MOSFET - Enhancement and Depletion Modes - Regions of Operation. MOSFET Characteristics - MOSFET Amplifier - MOSFET as a switch.	[9]
Multistage Amplifiers and Differential Amplifier*: Cascade amplifier, Differential amplifier - Common mode and Difference mode analysis -Single tuned amplifiers - Gain and frequency response - Neutralization methods, power amplifiers - Class A, B, AB, C, Tuned amplifier. Types (Qualitative analysis).	[9]
Feed Back Amplifiers and Oscillators*: Feedback: Positive and Negative feedback, Principles of Negative Voltage Feedback In Amplifiers, Gain of Negative Voltage Feedback Amplifier, Advantages of Negative Voltage Feedback, Effects of Negative Current Feedback, Oscillators- The Hartley Oscillator, The Colpitts Oscillator, Wien Bridge Oscillator, Quartz Crystal Oscillators	[9]
Practicals: (MATLAB /SCILAB/ any other open source) 1. VI Characteristics of PN junction diode. 2. VI Characteristics of Zener diode. 3. Input and Output Characteristics of BJT. 4. Drain Characteristics of MOSFET. 5. Transfer Characteristics of MOSFET. 6. Half wave Rectifier. 7. Full wave Rectifier. 8. Wien Bridge Oscillator. 9. Colpitts Oscillator. 10. Differential amplifier.	[30]
Total Hours	75

Text Book(s):

1.	S Salivahanan, N. Suresh Kumar, ¯Electronic Devices and Circuits‖, Tata McGraw Hill Education (India) Private Limited, Third Edition, 2012.
2.	David A. Bell, ¯Electronic Devices and Circuits‖, 4th edition, Prentice-Hall of India Pvt.Ltd ,2008.

Reference(s):

1.	Anil K.Maini, Varsha Agrawal, ¯ Electronic Devices and Circuits‖ , Wiley India Pvt. Ltd., 2012
2.	Thomas L. Floyd, ‗Electronic Devices‘, 10th Edition, Pearson Education, 2018.
3.	Jacob Millman, Christos Halkias, Chetan Parikh ¯Millman's Integrated Electronics - Analog and Digital Circuit and Systems‖ McGraw Hill Education,2nd Edition,2017
4.	Analog Circuits, NPTEL: https://nptel.ac.in/courses/117/101/117101106/ https://nptel.ac.in/courses/108/106/108106084/

* - SDG – 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule

S. No	Topic	No. of Hours
1	**Diode and its applications:**	
1.1	Review of Network and Semiconductor Basics -	1
1.2	PN Junction Diodes - Forward and Reverse Biasing - Reverse Saturation Current	1
1.3	Diode current components - Cut-in voltage - VI Characteristics.	1
1.4	Diode Parameters - Data sheets - Diode Models.	1
1.5	Rectification - Half-wave - Full-wave and Bridge -	2
1.6	Filters. Zener Diodes -	2
1.7	Shunt voltage regulator.	2
1.8	Varactor Diodes - Schottky Diodes - Tunnel Diodes and LEDs	2
2	**BJT and its characteristics:**	
2.1	Transistors - BJTs - PNP and NPN transistors -	1
2.2	Effects - Transistor Currents -	1
2.3	Amplifying action of a transistor.	1
2.4	Transistor Characteristics -	1
2.5	CC,CB,CE configuration -	1
2.6	h-parameter analysis	1
2.7	Biasing - Quiescent point -	1
2.8	Load line - Fixed base bias. voltage biasing.	2
3	**MOSFET and its characteristics:**	
3.1	Field Effect Transistors -	1
3.2	MOSFET - Enhancement and Depletion Modes - Regions of Operation.	2
3.3	MOSFET Characteristics -	1
3.4	MOSFET Amplifier -	1
3.5	MOSFET as a switch.	1
4	**Multistage Amplifiers and Differential Amplifier:**	
4.1	Cascade amplifier, Differential amplifier -	2
4.2	Common mode and Difference mode analysis -	1
4.3	Single tuned amplifiers -	1
4.4	Gain and frequency response - Neutralization methods,	2
4.5	power amplifiers	1
4.6	Class A, B, AB, C,	1
4.7	Tuned amplifier. Types (Qualitative analysis).	1
5	**Feed Back Amplifiers and Oscillators:**	
5.1	Feedback: Positive and Negative feedback	1
5.2	Principles of Negative Voltage Feedback In Amplifiers	2
5.3	Gain of Negative Voltage Feedback Amplifier	1
5.4	Advantages of Negative Voltage Feedback,	1
5.5	Effects of Negative Current Feedback,	1
5.6	Oscillators- The Hartley Oscillator, The Colpitts Oscillator,	2
5.7	Wien Bridge Oscillator, Quartz Crystal Oscillators	1

Course Designer

Dr. D. Srividhya – srividhya@ksrct.ac.in

60 CS 003	Data Structures	Category	L	T	P	Credit
		ES	3	0	0	3

Objectives

- To choose the appropriate data structure for a specified application
- To design and implement abstract data types such as Linked List, Stack, Queue and Trees
- To Learn and implement the Hashing techniques
- To design a Priority Queue ADT and its applications
- To demonstrate various Sorting, Searching and Graph algorithms

Pre-requisites

- Basic knowledge of mathematics and programming language in C

Course Outcomes

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

CO1	Apply linear data structures to solve real time applications	Apply
CO2	Experiment with trees and its operations	Apply
CO3	Apply algorithm for solving problems like Sorting and Searching	Apply
CO4	Implement Priority Queue with its operations and Hashing Techniques	Apply
CO5	Analyse Shortest Path and Minimum Spanning Tree algorithms and Bi-connectivity	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	2	2	2	-	-	2	2	-	-	2	3	3
CO2	3	3	2	3	2	-	-	2	3	-	-	2	3	3
CO3	3	3	2	2	2	2	-	2	3	2	-	2	3	3
CO4	3	3	2	3	2	-	-	3	2	2	-	2	3	3
CO5	3	3	2	3	2	2	2	3	3	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	10	10	10
Understand	10	15	20
Apply	40	35	50
Analyse	-	-	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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BoS Chairman Signature

Syllabus

K. S. Rangasamy College of Technology – Autonomous R2022								
Common to CS,IT,AD, AM,EE								
60 CS 003 – Data Structures								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
III	**3**	**0**	**0**	**45**	**3**	**40**	**60**	**100**

Lists, Stacks and Queues* Abstract Data Type (ADT)–The List ADT–The Stack ADT–The Queue ADT.	[12]
Trees* Preliminaries–BinaryTrees–TheSearchTreeADT–BinarySearchTrees–AVLTrees–TreeTraversals–B–Trees–B+Trees.	[9]
Sorting and Searching* Preliminaries – Insertion Sort – Shell Sort – Heap Sort – Merge Sort – Quick Sort – External Sorting –Searching: Sequential Search-Binary Search –Hashed List Searches.	[7]
Hashing and Priority Queues(Heaps) **Hashing – Hash Function – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing – Priority Queues(Heaps)–Model***–Simple Implementations–Binary Heap–Applications of Priority Queues –d-Heaps.	[7]
Graphs* Definitions–TopologicalSort–Shortest-PathAlgorithms–UnweightedShortestPaths–Dijkstra's Algorithm – Minimum Spanning Tree – Prim's Algorithm, Kruskal's Algorithm – Applications of Depth-First Search –Undirected Graphs–Bi connectivity.	[10]
Total Hours:	45

Text Book(s):	
1.	M.A. Weiss, "Data Structures and Algorithm Analysis in C" ,Second Edition, Pearson Education Asia, 2008.
2.	Y.Langsam,M.J.AugensteinandA.M.Tenenbaum,"DataStructuresusingC",PearsonEducation Asia, 2009.
Reference(s):	
1.	Rajesh K. Sukla, "Data Structure using C & C++", Wiley India,2012.
2.	A. Tannenbaum, "Data Structure using C" ,Pearson Education, 2003.
3.	Goodrich and Tamassia, "Data Structures and Algorithms in C++", Second Edition, John Wiley and Sons, 2011
4.	Reema Thareja," Data Structures using C", Second Edition, Oxford Higher Education,2014.

* - SDG 4 – Quality Education

Course Contents and Lecture Schedule

Module No.	Topics	No. of Hours
1	**Lists, Stacks and Queues**	
1.1	Abstract Data Type (ADT)	2
1.2	List ADT	4
1.3	Stack ADT	3
1.4	Queue ADT	3
2	**Trees**	
2.1	Preliminaries	1
2.2	Binary Trees	1
2.3	The Search Tree ADT	1
2.4	Binary Search Trees	1
2.5	AVL Trees	1
2.6	Tree Traversals	1
2.7	B-Trees	2
2.8	B+Trees	1
3	**Sorting and Searching**	
3.1	Preliminaries, Insertion Sort	1
3.2	Shell Sort, Heap sort	1
3.3	Merge Sort, Quick sort	1
3.4	External Sorting	1
3.5	Sequential Searching	1
3.6	Binary Searching	1
3.7	Hashed List Searches	1
4	**Hashing and Priority Queues(Heaps)**	
4.1	Hashing, Hash Function	1
4.2	Separate Chaining, Open Addressing	1
4.3	Rehashing, Extendible Hashing	1
4.4	Priority Queues (Heaps)	1
4.5	Simple Implementations, Binary Heap	1
4.6	Applications of Priority Queues	1
4.7	d –Heaps	1
5	**Graphs**	
5.1	Graph Definitions - Topological Sort	1
5.2	Shortest-Path Algorithms	1
5.3	Un-weighted Shortest Paths	1
5.4	Dijkstra’s Algorithm	1
5.5	Minimum Spanning Tree	1
5.6	Prim’s Algorithm	1
5.7	Kruskal’s Algorithm	1
5.8	Applications of Depth-First Search	1
5.9	Undirected Graphs	1
5.10	Biconnectivity	1

Course Designer

1. Ms.K.Poongodi - poongodik@ksrct.ac.in

60 EE 3P1	Electrical Machines - I Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

Objectives

- To determine or predetermine the internal and external characteristics of the given DC generators from the test data
- To determine or predetermine the performance characteristics of the given DC generators from the test data
- To determine or predetermine the performance characteristics of the given DC motors from the test data
- To determine or predetermine the performance of speed control of DC motor by different techniques
- To determine or predetermine the regulation and efficiency of given transformers from the test data

Pre-requisites

- Electric Circuit Analysis

Course Outcomes

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

CO1	Test and analyze the performance of separately and self-excited DC generators	Analyze
CO2	Test and analyze the performance of DC compound and DC series generators	Analyze
CO3	Predetermine and analyze the performance of DC machines.	Analyze
CO4	Control the speed of the DC motor by applying different techniques.	Analyze
CO5	Test and analyze the performance of transformers.	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	2	-	-	-	-	-	2		-	2	3	3
CO2	3	3	2	3	-	-	-	-	3		-	2	3	3
CO3	3	3	2	2	2	2	-	-	3	2	-	2	3	3
CO4	3	3	2	3	2		-	3	2	2	-	2	3	3
CO5	3	3	2	-	2	2	2	3	3	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

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E – Electrical and Electronics Engineering								
60 EE 3P1 – Electrical Machines - I Laboratory								
Semester	Hours/Week			Total	Credit	Maximum Marks		
	L	T	P	Hrs	C	CA	ES	Total
III	0	0	4	60	2	60	40	100

List of Experiments:

1. Determination of Open circuit and load characteristics of D.C separately excited generator
2. Determination of Open circuit and load characteristics of D.C shunt generator
3. Determination of Load characteristics of D.C compound generator with differential and cumulative connections
4. **Determination of Load characteristics of D.C series generator***
5. Determination of performance characteristics of D.C shunt and compound motor
6. Determination of performance characteristics of D.C series motor
7. Implementation of Swinburne's test and speed control of D.C shunt motor
8. **Determination of regulation and efficiency of three-phase transformer using load test***
9. Implementation of Open circuit and short circuit tests on single-phase transformer
10. Execution of Sumpner's test on transformer
11. Study of LabVIEW packages.

*SDG 9 – Industry Innovation and Infrastructure

Course Designer(s)

1. Dr.P.Aravindan aravindan@ksrct.ac.in
2. Mr.M.Dhanapal dhanapal@ksrct.ac.in

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BoS Chairman Signature

61 CS 0P3	Data Structures Laboratory	Category	L	T	P	Credit
		ES	0	0	4	2

Objectives

- To design and implement simple linear and nonlinear data structures
- To strengthen the ability to identify and apply the suitable data structure for the given real world problem
- To program for storing data as tree structure and implementation of various traversal techniques
- To implement sorting and searching techniques
- To gain knowledge of graph applications
-

Pre-requisites

- Programming knowledge in C language

Course Outcomes

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

CO1	Demonstrate the implementation of Linear Data structures and its applications	Apply
CO2	Investigate Balanced Parenthesis and Postfix expressions with the help of Stack ADT	Apply
CO3	Implement Non-Linear Data Structure	Apply
CO4	Implement sorting and searching techniques	Apply
CO5	Implement Hashing Techniques, Shortest Path and Minimum Spanning Tree Algorithm	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	2	-	-	-	-	-	2	-	-	2	3	3
CO2	3	3	2	3	-	-	-	-	3	-	-	2	3	3
CO3	3	3	2	2	2	2	-	-	3	2	-	2	3	3
CO4	3	3	2	3	2	-	-	3	2	2	-	2	3	3
CO5	3	3	2	-	2	2	2	3	3	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	40	15	80	80
Analyse	10	10	20	20
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

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BoS Chairman Signature

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E – Electrical and Electronics Engineering								
61 CS 0P3 – Data Structures 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. Implementation of List Abstract Data Type (ADT)*
2. Implementation of Stack ADT*
3. Implementation of Queue ADT*
4. Implementation of stack applications: *
    (a) Program for ‘Balanced Parenthesis’
    (b) Program for ‘Evaluating Postfix Expressions’
5. Implementation of Search Tree ADT*
6. Implementation of Sorting Algorithms*
7. Develop a program for various Searching Techniques *
8. Implementation of Hashing Techniques *
9. Implementation of Shortest Path Algorithm*
10. Implementation of Minimum Spanning Tree Algorithm*

*-SDG4 - Quality Education

Course Designer(s)

1. K.Poongodi - poongodik@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	2
CO3	-	-	-	-	-	-	-	2	3	3	2	3	2	-
CO4	-	-	-	-	-	-	-	2	3	3	2	3	2	-
CO5	-	-	-	-	-	-	-	2	3	3	2	3	-	-
3 - Strong; 2 - Medium; 1 - Some														

Syllabus								
K.S. Rangasamy College of Technology–AutonomousR2022								
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	00	100

Listening* Evaluative Listening: Advertisements, Product Descriptions, - Audio / video; filling a graphic organiser (choosing a product or service by comparison) - Listening to longer technical talks and completing– gap filling exercises. Listening technical information from podcasts – Listening to process/event descriptions to identify cause & effects, documentaries depicting a technical problem and suggesting solutions - Listening to TED Talks	**[6]**
Speaking* 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* 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* 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* 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

* - SDG4 – Quality Education

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours	Mode of content Delivery
1	**Listening**		
1.1	Evaluative Listening: Advertisements, Product Descriptions	1	Activity Based
1.2	Listening to longer technical talks and completing– gap filling exercises.	1	Activity Based
1.3	Listening technical information from podcasts	1	Activity Based
1.4	Listening to process/event descriptions to identify cause & effects and documentaries depicting a technical problem and suggesting solutions	1	Activity Based
1.5	Listening to TED Talks	1	Activity Based
2	**Speaking**		
2.1	Marketing a product, persuasive speech techniques	1	Activity Based
2.2	Describing and discussing the reasons of accidents or disasters based on news reports,	1	Activity Based
2.3	Group Discussion (based on case studies)	1	Activity Based
2.4	Presenting oral reports, Mini presentations on select topics with visual aids	1	Activity Based
2.5	participating in role plays and virtual interviews	1	Activity Based
3	**Reading**		
3.1	Reading advertisements, user manuals and brochures	1	Activity Based
3.2	Reading- longer technical texts– cause and effect essays, and letters / emails of complaint	1	Activity Based
3.3	Case Studies, excerpts from literary texts, news reports etc.	1	Activity Based
3.4	Company profiles	1	Activity Based
3.5	Statement of Purpose (SoPs)	1	Activity Based
4	**Writing**		
4.1	Professional emails, Email etiquette	1	Activity Based
4.2	Compare and contrast essay	1	Activity Based
4.3	Writing responses to complaints	1	Activity Based
4.4	Precis writing, Summarizing and Plagiarism	1	Activity Based
4.5	Job / Internship application – Cover letter & Résumé	1	Activity Based
5	**Verbal Ability II**		
5.1	Reading Comprehension (Inferential fillups) and Theme Detection	1	Activity Based
5.2	Spotting Errors	1	Activity Based
5.3	Verbal Analogies	1	Activity Based
5.4	Change of Voice and Change of Speech	1	Activity Based
5.5	One word substitution	1	Activity Based

Course Designer

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

Rev.No. 00/ w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

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 2025-2026)
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 MA 015	Numerical and Statistical Methods	2	40	60	100	45	100
2	60 EE 401	Electrical Machines – II	2	40	60	100	45	100
3	61 EE 402	Linear Integrated Circuits and its Applications	2	40	60	100	45	100
4	60 EE 403	Digital Logic Design	2	40	60	100	45	100
5	60 EE L1*	Open Elective – I	2	40	60	100	45	100
6	60 MY 002	Universal Human Values	2	100	-	100	-	100
PRACTICAL								
7	61 EE 4P1	Electrical Machines - II Laboratory	3	60	40	100	45	100
8	60 EE 4P2	Linear and Digital Integrated Circuits Laboratory	3	60	40	100	45	100
9	60 CG 0P3	Career Skill Development III	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 the theory end semester examination and 40 marks for practical end semester examination.

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BoS Chairman Signature

60 MA 015	Numerical and Statistical Methods	Category	L	T	P	Credit
		BS	3	1	0	4

Objectives

- To interpret various techniques to solve equations numerically.
- To outline the basics concepts of initial value problems.
- To impart basics of descriptive statistics.
- To familiarize various distributions and testing of hypothesis.
- To illustrate the fundamentals of analysis of variance.

Pre-requisites

- NIL

Course Outcomes

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

CO1	Employ various iteration techniques for solving algebraic, transcendental and system of linear equations.	Apply
CO2	Compute the solution for initial value problems using single and multi-step methods.	Apply
CO3	Compute measures of central tendency, measures of dispersion and correlation.	Apply
CO4	Articulate the concepts of standard distributions and various methods for testing the statistical hypothesis.	Apply
CO5	Apply the concepts of ANOVA to test the equality of means for more than two populations.	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	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	2	-
CO3	3	2	-	-	2	-	-	-	-	-	-	-	2	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	2	-
CO5	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	10	10
Understand	10	10	20
Apply	40	40	70
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S. Rangasamy College of Technology – Autonomous R2022									
B.E – Electrical and Electronics Engineering									
60 MA 015 - Numerical and Statistical Methods									
Semester	Hours/Week			Total Hours	Credit	Maximum Marks			
	L	T	P		C	CA	ES	Total	
IV	3	1	0	60	4	40	60	100	

Content	Hours
Solution of Equations and Eigen value problem* 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. **Hands-on:** Solve the system of equations using Gauss Seidel method.	[9]
Numerical Solution of Ordinary Differential Equations** Single step methods: Taylor's series method - Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods: Milne's predictor and corrector method - Adam's predictor and corrector method. **Hands-on:** Solve the first order linear differential equations by Runge – Kutta method.	[9]
Empirical Statistics*** Measures of central tendency: Mean, Median, Mode- Measures of dispersion: Range -Quartile deviation - Standard deviation - Correlation - Rank correlation. **Hands-on:** Calculate mean, median, mode and range for discrete frequency distribution.	[9]
Standard Distributions and Testing of Hypothesis**** Binomial distribution - Poisson distribution - Exponential 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. **Hands-on:** Apply Student's t - test, F- test and Chi-square test to real dataset.	[9]
Design of Experiments** Analysis of variance: One way classification – Completely randomized design – Two-way classification – Randomized block design – Latin square design. **Hands-on:** Perform One-way ANOVA.	[9]
Total Hours:(45+05+10)	**60**

Text Book(s):

1.	Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2.	Kapoor V.K and Gupta S.C, "Fundamentals of Mathematical Statistics ", Sultan Chand & sons, 12th Edition, New Delhi, 2020.

Reference(s):

1.	Faires, J D and Burden R, "Numerical Methods", Thomson publications, 4th Edition, New Delhi, 2012.
2.	S.P.Gupta, "Statistical Methods", Sultan Chand & sons, 46thRevised Edition, New Delhi, 2021.
3.	Veerarajan,T., "Probability, Statistics and Random Processes (with Queueing Theory and Queueing Networks)", Tata McGraw-Hill 4th Edition, New Delhi, 2015.
4.	Richard A.Johnson, "Miller & Freund's Probability and Statistics for Engineers", Pearson Education India, 9th Edition, New Delhi, 2016.
5.	P Kandasamy, K Thilagavathy and K Gunavathi, 'Numerical Methods', S.Chand& Company Ltd, 3rd Edition , 2006.

*** SDG 9 - Industry, Innovation, and Infrastructure ** SDG 4 - Quality Education**
*****SDG 2 - Zero Hunger **** SDG 3 - Good Health and Well-being**

Course Contents and Lecture Schedule

S. No.	Topic	No. of Hours
1	**System of Linear equations and Eigen value problems**	
1.1	Solution of algebraic and transcendental equations: Newton Raphson method	2
1.2	Method of False position Solution of linear system by Gaussian elimination	2
1.3	Gauss-Jordan, Gauss-Jacobi	2
1.4	Gauss-Seidel methods	2
1.5	Eigen value of a matrix by Power method	1
1.6	Tutorial	2
1.7	Hands-on	1
2	**Numerical Solution of Ordinary Differential Equations**	
2.1	Single step methods: Taylor series method	2
2.2	Euler methods	1
2.3	Fourth Order Runge – Kutta method for solving first order equations	2
2.4	Multistep methods: Milne’s predictor	
2.5	Adam’s predictor and corrector methods.	2
2.6	Tutorial	2
2.7	Hands-on	1
3	**Empirical Statistics**	
3.1	Measures of central tendency: Mean, Median and Mode –	2
3.2	Measures of dispersion: Range, Quartile deviation	2
3.3	Standard deviation	1
3.4	Correlation	2
3.5	Rank correlation	2
3.6	Tutorial	2
3.7	Hands-on	1
4	**Standard Distributions and Testing of Hypothesis**	
4.1	Binomial, Poisson distributions	2
4.2	Exponential distributions	2
4.3	Type I and Type II errors - Test of significance of small samples	2
4.4	Student’s 't' test – Single mean – Difference of means	1
4.5	F- test	1
4.6	Chi-square test – Goodness of fit – Independence of attributes	1
4.7	Tutorial	2
4.8	Hands-on	1
5	**Design of Experiments**	
5.1	Analysis of variance: One way classification	2
5.2	Completely randomized design	2
5.3	Two-way classification	2
5.4	Randomized block design	2
5.5	Latin square design	2
5.6	Tutorial	2
5.7	Hands-on	1
	Total	60

Course Designer:

1. Dr. N. Uthirasamy - uthirasamy@ksrct.ac.in

Rev.No. 00/ w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

60 EE 401	Electrical Machines - II	Category	L	T	P	Credit
		PC	2	1	0	3

Objectives

- To describe the construction, working principle and performance of synchronous Generator
- To Illustrate the construction, working principle and performance of synchronous motor
- To describe the working principle induction motor and determine their applications from their characteristics
- To classify the starting and speed control methods of induction motor
- To describe the Construction, principles of operation and performance of single phase induction motor and the various special machines

Pre-requisites

- NIL

Course Outcomes

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

CO1	Determine the performance characteristics of Synchronous Generator by EMF, MMF and ZPF methods	Apply
CO2	Illustrate the principle of operation and determine the performance characteristics of Synchronous Motor by power flow equations	Apply
CO3	Classify the types and determine the performance characteristics of Single-Phase Induction Motor by Equivalent Circuit parameters	Apply
CO4	Discuss the operating principle and determine the performance characteristics of Three Phase Induction Motor	Apply
CO5	Illustrate the principle of operation and applications of special electrical machines	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	3
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO3	3	3	2	2	2	-	-	-	-	-	-	-	3	2
CO4	3	3	2	2	2	-	-	-	-	-	-	-	3	3
CO5	3	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	10	10	20
Apply	20	20	40
Analyse	10	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

* - SDG 12 – Responsible Production and Consumption

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E – Electrical and Electronics Engineering								
60 EE 401 – Electrical Machines - II								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
IV	**2**	**1**	**0**	**45**	**3**	**40**	**60**	**100**

SYNCHRONOUS GENERATOR Construction - Armature Winding - Winding Factors - EMF Equation - Armature Reaction - Voltage Regulation -Predetermination of Regulation by Synchronous Impedance, MMF and Potier Methods - Power Flow Equations -Parallel Operations - Synchronization and Synchronizing Power - Synchronizing to Infinite Busbar.	9
SYNCHRONOUS MOTOR Construction - Principle of Operation – Slip test – Two reaction theory - Methods of Starting - Phasor Diagrams - Power Flow Equations - Effect of Varying Field Current and Load - V and Inverted V Curves-Synchronous Condenser-Hunting and Suppression Techniques.	9
SINGLE PHASE INDUCTION MOTOR Construction - Principle of Operation - Double Field Revolving Theory - Types - Methods of Starting – Equivalent Circuit- Applications. **Hands on Practices:** • Simulation of speed control of single phase induction motor	9
THREE PHASE INDUCTION MACHINES Construction - Specific loading - output equation - main dimensions (D&L) - Types - Principle of Operation -EquivalentCircuit-PhasorDiagram-PoweracrossAir-gap,TorqueandPowerOutput-Slip-TorqueCharacteristics - No-Load and Blocked Rotor Tests - Circle Diagram - Methods of Starting of Induction Motors -Cogging and Crawling-Speed Control-Braking- Induction Generators. **Hands on Practices:** • Simulation of speed control of three phase induction motor	9
SPECIAL MACHINES Working principles and construction: Stepper motor - Types - Permanent magnet DC motor - Permanent magnet synchronous motor – Repulsion motor – Switched reluctance motor – Hysteresis motor –Universal motor Printed Circuit Board Motor — Applications-**Economic Benefits of Energy-Efficient Electrical Machines*** -A Case Study. **Hands on Practices:** • Simulation of speed control of special machines	9
Total Hours:	45

Text Book(s):

1.	D.P.Kothari and I.J.Nagrath, 'Electric Machines',Tata Mc Graw Hill Publishing Company Ltd, 5th Edition,2017.
2.	B.L.Theraja and A.K.Theraja, "A text book of Electrical Technology – Volume II (AC & DC Machines)",S.Chand & Company Ltd., New Delhi,2009.

Reference(s):

1.	A.E.Fitzgerald, Charles Kingsley, Stephen. D. Umans, 'Electric Machinery', Tata Mc Graw Hill Publishing Company Ltd, 2013.
2.	K.Murugesh Kumar, 'Induction & Synchronous Machines' ,Vikas Publishing House Pvt. Ltd, 2000.
3.	B.R.Gupta and VSinghal, "Fundamentals of Electrical Machines "New Age International Publishers, New Delhi, 2005.
4.	Jimmie J.Cathey , "Electric Machines Analysis Design Applying Matlab", Mc Graw Hill Companies New Delhi, 2001

Course Contents and Lecture Schedule

S. No	Topics	No. of Hours
1	**SYNCHRONOUSGENERATOR**	
1.1	Construction	1
1.2	Armature Winding	1
1.3	Winding Factors, EMF Equation	1
1.4	Armature Reaction, Voltage Regulation	1
1.5	Predetermination of Regulation by Synchronous Impedance, MMF and Potier Methods	1
1.6	Power Flow Equations	1
1.7	Parallel Operations - Synchronization and Synchronizing Power	1
1.8	Synchronizing to Infinite Busbar	1
1.9	Slip Test	1
2	**SYNCHRONOUSMOTOR**	
2.1	Construction	1
2.2	Principle of Operation	1
2.3	Slip test – Two reaction theory	1
2.4	Methods of Starting	1
2.5	Phasor Diagrams	1
2.6	Power Flow Equations	1
2.7	Effect of Varying Field Current and Load - V and Inverted V Curves	1
2.8	Synchronous Condenser	1
2.9	Hunting and Suppression Techniques	1
3	**SINGLEPHASEINDUCTION MOTOR**	
3.1	Construction	1
3.2	Principle of Operation	1
3.3	Double Field Revolving Theory	2
3.4	Types - Methods of Starting	2
3.5	Equivalent Circuit	1
3.6	Applications	1
3.7	MATLAB simulink model for single phase induction motor drive	1
4	**THREEPHASEINDUCTION MACHINES**	
4.1	Construction	1
4.2	Specific loading - output equation	1
4.3	main dimensions (D&L)	1
4.4	Types - Principle of Operation	1
4.5	Equivalent Circuit – Phasor Diagram	1
4.6	Power across Air-gap, Torque and Power Output	1
4.7	Slip – Torque Characteristics	1
4.8	No-Load and Blocked Rotor Tests - Circle Diagram	1
4.9	Methods of Starting of Induction Motors -Cogging and Crawling	1
4.10	Speed Control-Braking- Induction Generators	
5	**SPECIALMACHINES**	
5.1	Working principles and construction: Stepper motor	1
5.2	Types - Permanent magnet DC motor - Permanent magnet synchronous motor	2
5.3	Repulsion motor	1
5.4	Switched reluctance motor	1
5.5	Hysteresis motor	1
5.6	Universal motor Printed Circuit Board Motor	1
5.7	Applications-Economic Benefits of Energy	1
5.8	Efficient Electrical Machines-A Case Study.	1

61 EE 402	Linear Integrated Circuits and its Applications	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To familiarize the basic fundamentals of Op-ampand the factors that affect the response of Op-amp
- To provide knowledge of various applications of Op-amp
- To provide exposure on the functions of various active filters and waveform generators
- To familiarize the knowledge of comparator and types of data converters
- To gain knowledge on the application of special function ICs

Pre-requisites

- Electron Circuits

Course Outcomes

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

CO1	Understand and analyze the IC 741 operational amplifier and its characteristics	Apply
CO2	Design the solution for linear & non-linear applications using IC741	Apply
CO3	Elucidate and design the active filters and waveform generators	Apply
CO4	Comprehend & differentiate the working principle of various data converters and Oscillators	Understand
CO5	Identify the needs of voltage regulators and timers	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	2	2	-	-	2	2	2	2	3	2
CO2	3	2	3	3	2	2	-	-	2	2	2	2	3	2
CO3	3	3	3	2	2	2	-	-	2	2	2	2	3	2
CO4	3	2	3	3	2	2	-	-	2	2	2	3	3	2
CO5	3	2	3	3	2	2	-	-	2	2	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	20	30
Understand	20	20	30
Apply	20	20	40
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E- Electrical and Electronics Engineering								
61 EE 402- Linear Integrated Circuits and its Applications								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
IV	**3**	**0**	**0**	**45**	**3**	**40**	**60**	**100**

OP–AMP FUNDAMENTALS AND CHARACTERISTICS Introduction to Integrated circuits – types, development – Operational Amplifier- Block diagram, Schematic symbol, packages and power Supply Connection - Ideal Op-amp- Equivalent circuit, Characteristics – Open-loop configurations: Voltage transfer characteristics – Closed-loop configurations: Negative feedback, Inverting and Non-inverting amplifiers, Voltage follower -Non-ideal Op-Amp effects (Input offset voltage, Input bias current, etc.)-DC Characteristics: Input Bias Current, Input Offset Current, Input Offset Voltage, Thermal Drift - AC Characteristics: Frequency Response & Slew Rate.	[9]
BASIC APPLICATIONS OF OP–AMP Scaling, Summer, Subtractor, Differentiator and Integrator – Instrumentation Amplifier – Voltage to Current Converter, Current to Voltage Converter – Introduction to Precision Diode- Precision Rectifiers (Half-Wave, Full-Wave Rectifiers)- Half Wave Rectifier, Full Wave Rectifier -Peak Detectors – Sample and Hold Circuit – Clippers and Clampers	[9]
ACTIVE FILTERS AND WAVEFORM GENERATOR Active filters-Low Pass, High Pass, Band pass and Band Reject Filters ; Square wave generator, Triangular wave generator, Saw tooth wave generator. Active Filter Design using Modern ICs (e.g., LM324) **Hands on Practices: (MATLAB / SCI LAB / Any other Open Source)** • Simulation of Inverting and Non inverting amplifier using SIMULINK Simulation of Differentiator and Integrator using SIMULINK	[9]
COMPARATORS AND CONVERTERS Comparators – Inverting and Non-inverting, Zero Crossing Detector, Window detector, Schmitt Trigger, Comparator Characteristics. Comparators in Digital Systems and Signal Conditioning. Data Converters D/A Converter: Weighted Resistor Type ,R-2RLadderType, Inverted R-2R Ladder Type, A/D Converter: Successive Approximation Type, Flash Type and Dual Slope Type	[9]
SPECIALIZED IC APPLICATIONS 555 Timer Circuit- Functional Block, Characteristics & Applications – Astable and Monostable Multivibrators, Schmitt trigger, 566 – Voltage Controlled Oscillator Circuit, 565 – Phase Locked Loop Circuit Functioning, Applications – Frequency Multiplier and Frequency shift keying. IC Voltage Regulators- Linear Regulator, IC 723 general purpose regulator: current limit protection, current fold back, current boosting - Switching Regulator.	[9]
Total Hours	45

Text Book(s):

1.	D.RoyChoudry ,Shail Jain , ‘Linear integrated Circuits’, 5th Edition, New Age International Pvt Ltd, 2018.
2.	Sergio Franco., ‘Design with Operational Amplifiers and Analog Integrated Circuits’, 4th Edition, Tata McGraw-Hill, 2014.

Reference(s):

1.	Ramakant A., Gayakwad, ‘Op – Amps and Linear Integrated Circuits’, 4 th Edition, Prentice Hall, 2015
2.	Gray and Meyer, ‘Analysis and Design of Analog Integrated Circuits’, 5th Edition, Wiley International, 2017.
3.	J.Michael Jacob, ‘Applications and Design with Analog Integrated Circuits’, Prentice Hall, 1993.
4.	K.R.Botkar, ‘Integrated Circuits’, 8th Edition, Khanna Publishers, 2010.
5.	NPTEL, http://nptel.ac.in/courses/117107094/

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

Course Contents and Lecture Schedule

S. No	Topics	No. of Hours
1	**OP–AMP FUNDAMENTALS AND CHARACTERISTICS**	
1.1	Introduction to Integrated circuits - types, development	1
1.2	Operational Amplifier– Block diagram, Schematic symbol, packages and power Supply Connection	1
1.3	Ideal Op–amp- Equivalent circuit, Characteristics – Open-loop configurations: Voltage transfer characteristics	1
1.4	Closed-loop configurations: Negative feedback	1
1.5	Inverting and Non-inverting amplifiers, Voltage follower	2
1.6	DC Characteristics: Input Bias Current, Input Offset Current	2
1.7	Input Offset Voltage, Thermal Drift	2
1.8	AC Characteristics: Frequency Response & Slew Rate	2
2	**BASIC APPLICATIONS OF OP–AMP**	
2.1	Scaling, Summer, Subtractor	1
2.2	Differentiator and Integrator	1
2.3	Instrumentation Amplifier	1
2.4	Voltage to Current Converter, Current to Voltage Converter	1
2.5	Introduction to Precision Diode- Precision Rectifiers – Half Wave Rectifier, Full Wave Rectifier	2
2.6	Peak Detectors – Sample and Hold Circuit	1
2.7	Clippers and Clampers	2
3	**ACTIVE FILTERS AND WAVEFORM GENERATOR**	
3.1	Active filters-Low Pass, High Pass Filters	1
3.2	Band pass and Band Reject Filters	2
3.3	Square wave generator	1
3.4	Triangular wave generator	1
3.5	Saw tooth wave generator	1
4	**COMPARATORS AND CONVERTERS**	
4.1	Comparators – Inverting and Non-inverting, Zero Crossing Detector	2
4.2	Window detector, Schmitt Trigger, Comparator Characteristics	1
4.3	Data Converters D/A Converter: Weighted Resistor Type	1
4.4	R–2RLadderType, Inverted R–2R LadderType	2
4.5	A/D Converter: Successive Approximation Type	1
4.6	Flash Type and Dual Slope Type	2
5	**SPECIALIZED IC APPLICATIONS**	
5.1	555 Timer Circuit– Functional Block, Characteristics & Applications	1
5.2	Astable and Monostable Multivibrators ,Schmitt trigger	2
5.3	566 – Voltage Controlled Oscillator Circuit	1
5.4	565 – Phase Locked Loop Circuit Functioning, Applications	1
5.5	Frequency Multiplier and Frequency shift keying	1
5.6	IC Voltage Regulators – Linear Regulator, IC 723 general purpose regulator: current limit protection, current fold back, current boosting	2
5.7	Switching Regulator.	1

60 EE 403	Digital Logic Design	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To understand and implement the basics of Boolean algebra and implement to minimize the Boolean functions
- To design and analyze combinational logic circuits
- To learn the concept of sequential circuits
- To introduce the concept of HDL and develop application oriented logic circuit

Pre-requisites

- Basics of Electronics

Course Outcomes

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

CO1	Explain various number systems and characteristics of digital logic families	Apply
CO2	Design and analyze combinational logic circuits and memory devices	Analyze
CO3	Design and analyze synchronous sequential circuits	Analyze
CO4	Analyze asynchronous sequential circuits	Analyze
CO5	Design and verify the digital circuits using HDL	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	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	3	-	-	-	-	-	-	-	-	2
CO3	3	2	1	-	3	-	-	-	-	-	-	-	-	2
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	3	-	-	-	-	-	2	1	-	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	10
Understand	20	20	30
Apply	20	20	40
Analyse	10	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

Syllabus								
K. S. Rangasamy College of Technology – Autonomous R2022								
B.E – Electrical and Electronics Engineering								
60 EE 403 –Digital Logic Design								
Semeste	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
IV	**3**	**0**	**0**	**45**	**3**	**40**	**60**	**100**

Number System and Digital Logic Families Review of Number Systems- representation-conversions–error detection and error correction codes–Boolean postulates and laws – De-Morgan's Theorem – Logic Gates- Minimization of Boolean expressions – Sum of Products (SOP) – Product of Sums (POS)- Canonical forms – Minimization using Karnaugh map –Implementation of Boolean expressions using universal gates – TTL and CMOS Logic families and their characteristics	[9]
Combinational Logic Circuits and Memory Devices Combinational logic circuits-adders, subtractors, BCD adder, parity generator, decoders, encoders, multiplexers, demultiplexers, Realization of Boolean expressions using multiplexers. Memories – Types, organization, expansion – Static and dynamic RAMs – PLDs. **Hands on Practice:** Logic gates, Adder, Subtractor, Multiplexer, Decoder, Flip-flops & Counters	[9]
Synchronous Sequential Circuits Flip flops: SR, JK, T, D and Master slave – Characteristic table and equation – Application table – Edge triggering – Level Triggering –Ripple counters – Synchronous counters –Modulo–n counter– Analysis of clocked sequential circuits: state equation – State table – State diagram – State reduction & assignment –: Shift registers	[9]
Asynchronous Sequential Circuits Analysis procedure – Transition table – Flow table – Race conditions –Design of fundamental mode circuits – Primitive flow table – Reduction of state and flow table – Race free state assignment – Hazards - Design of hazard free switching circuits	[9]
Introduction to HDL* Design flow of VLSI, Different modelling styles in Verilog HDL, Structural, Dataflow and behavioural modelling of combinational and sequential logic circuits	[9]
Total Hours	45

Text Book(s):

1. M. Morris Mano, Michael D. Ciletti, 'Digital Design', 6th Edition, Pearson Education, New Delhi, 2023.
2. Ciletti M.D, 'Advanced Digital Design with the Verilog HDL', 2nd Edition, Pearson Education, 2021.

Reference(s):

1. Anand Kumar, 'Fundamentals of Digital Circuits', 4th Edition, Prentice Hall, 2016.
2. Kharate G K, 'Digital Electronics', 1st Edition, Oxford University Press, 2022.
3. S. Salivahanan and S. Arivazhagan, 'Digital Circuits and Design', 4thEdition, Oxford University press, 2016.
4. Sanjay Kumar Suman, Bhayalakshmi L, Porselvi S' Digital Principles & System Design ', Vijay Nicole Imprint, 1st Edition, 2021.

* - SDG – 9 – Industry Innovation and Infrastructure

Rev.No. 00/ w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

Course Contents and Lecture Schedule

S.No	Topics	No. of Hours
1	**Number System and Digital Logic Families**	
1.1	Review of Number Systems-representation-conversions	2
1.2	Error detection and error correction codes	1
1.3	Boolean postulates and laws – De-Morgan's Theorem	1
1.4	Logic Gates	1
1.5	Minimization of Boolean expressions – Sum of Products (SOP) – Product of Sums (POS)-Canonical forms	1
1.6	Minimization using Karnaugh map	1
1.7	Implementation of Boolean expressions using universal gates	1
1.8	TTL and CMOS Logic families and their characteristics	1
2	**Combinational Logic Circuits and Memory Devices**	
2.1	Combinational logic circuits-adders	1
2.2	Subtractors, BCD adder	1
2.3	Decoders, encoders	1
2.4	Multiplexers - Realization of Boolean expressions using multiplexers	1
2.5	Demultiplexers	1
2.6	Memories – Types, organization, expansion	1
2.7	Static and dynamic RAMs	1
2.8	PLDs	2
3	**Synchronous Sequential Circuits**	
3.1	Flip flops: SR, JK, T, D	2
3.2	Characteristic table and equation	1
3.3	Excitation table – Edge triggering – Level Triggering, Master slave	
3.4	Ripple counters, Modulo–n counter	2
3.5	Synchronous counters-Design of Synchronous FSM	1
3.6	Analysis of clocked sequential circuits: state equation – State table	1
3.7	State diagram,State reduction & assignment	1
3.8	Shift registers	1
4	**Asynchronous Sequential Circuits**	
4.1	Analysis procedure	1
4.2	Transition table – Flow table – Race conditions	2
4.3	Design of fundamental mode circuits	2
4.4	Primitive flow table – Reduction of state and flow table	1
4.5	Race free state assignment	2
4.6	Hazards - Design of hazard free switching circuits	1
5	**Introduction to HDL**	
5.1	Design flow of VLSI	1
5.2	Different modelling styles in Verilog HDL	2
5.3	Structural modelling of combinational	1
5.4	Data flow modelling of combinational logic circuits	1
5.5	Behavioural modelling of combinational logic circuits	1
5.6	Structural modelling of sequential logic circuits	1
5.7	Data flow modelling of sequential logic circuits	1
5.8	Behavioural modelling of sequential logic circuits	1

Course Designers:

1. Dr.G.Vijaya gowri -vijayagowri@ksrct.ac.in

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60 MY 002	Universal Human Values	Category	L	T	P	Credit
		MC	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	-	No End Semester Examination
Understand	10	10	-	
Apply	20	20	-	
Analyse	20	20	-	
Evaluate	-	-	-	
Create	-	-	-	
Total	60	60	-	

BoS Chairman Signature

Syllabus								
K.S.Rangasamy College of Technology–Autonomous R2022								
Common to All Branches								
60 MY 002 - Universal Human Values								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
IV	**3**	**0**	**0**	**45**	**3**	**100**	**00**	**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**

Course Contents and Lecture Schedule

S. No	Topics	No. of Hours
1	**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	**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	**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	**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	**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
	Total	45

Course Designer(s)

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

61 EE 4P1	Electrical Machines – II Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

Objectives

- Estimate the voltage regulation of alternator from test data and analyze the effect of various factors such as armature resistance, armature reactance, leakage reactance and power factor on regulation.
- Formulate of two reaction model of salient pole synchronous machines from test data and predetermine the voltage regulation using quadrature axis and direct axis reactance.
- Study the performance of single-phase induction motor from test data and analyze the effect of speed, power factor line current and efficiency under different loading conditions.
- Study the performance of three phase induction motor from test data and analyze the effect of speed, power factor line current and efficiency under different loading conditions
- Gain knowledge and analyse the induction machine performance from Equivalent circuit and Circle diagram

Pre-requisites

- Nil

Course Outcomes

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

CO1	Inspect the regulation of alternators from various methods.	Apply
CO2	Measure parameters of synchronous motor under no load condition and distinguish between V and inverted V curves.	Apply
CO3	Analyze the performance of induction motors with no load and full load condition	Apply
CO4	Interpret the no load losses of three phase induction motor	Apply
CO5	Analyse the Induction motor performance from Equivalent circuit and Circle diagram	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	-	-	-	-	-	-	-	-	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	2
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO5	3	3	2	2	-	-	-	-	-	-	-	-	2	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	50	25	100	100
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

K.S.Rangasamy College of Technology – Autonomous R2022								
BE Electrical and Electronics Engineering								
61 EE 4P1 - Electrical Machines – II Laboratory								
Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	0	0	4	60	2	60	40	100

List of Experiments*:

Regulation of three-phase alternator by EMF, MMF and ZPF

2. Load test on three-phase alternator.

3. Regulation of three-phase salient pole alternator by slip test.

4. V and Inverted V curves of Three Phase Synchronous Motor

5. Load test on three-phase squirrel cage induction motor.

6. Load test on three-phase slip ring induction motor.

7. No load and blocked rotor test on three-phase induction motor

8. Separation of No-load losses of three-phase induction motor

9. Load test on single-phase induction motor.

10. Determination of Equivalent circuit of single-phase induction motor

*SDG 9 – Industry Innovation and Infrastructure

Course Designer(s)

1.Dr.M.K.Elango elango@ksrct.ac.in

2. S,Jaividhyajaividhya@ksrct.ac.in

60 EE 4P2	Linear and Digital Integrated Circuits Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

Objectives

- To apply operational amplifiers in linear and nonlinear applications.
- To familiarize the knowledge of active filtersand Timer.
- To acquire the basic knowledge of special function IC.
- To familiarize the basic operation of combinational circuits using basic gates and universal gates for arbitrary functions
- To provide knowledge of basic operation of Sequential Circuits.

Pre-requisites

- Nil

Course Outcomes

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

CO1	Design and Implement the various linear and Nonlinear application of op-amp.	Apply
CO2	Design and Implement the various application of Active filter and Timer.	Apply
CO3	Design and Implement the application of special function IC.	Apply
CO4	Design and Implement the combinational circuits using basic gates and universal gates.	Apply
CO5	Design and Implement the Sequential Circuits.	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	2	2	-	-	2	2	2	2	2	2
CO2	3	2	3	3	2	2	-	-	2	2	2	2	2	2
CO3	3	3	3	2	2	2	-	-	2	2	2	2	2	2
CO4	3	2	3	3	2	2	-	-	2	2	2	3	2	2
CO5	3	2	3	3	2	2	-	-	2	2	2	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	-	-	-	-
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								
BE Electrical and Electronics Engineering								
60 EE 4P2- Linear and Digital Integrated Circuits 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. Application circuits using op-amp.
2. Application circuits using NE555 Timer
3. Application circuits using active filter.
4. Design and implementation of IC Voltage regulators.
5. Design and implementation of combinational circuits using logic gates.
6. Design and implementation of sequential logic circuits

Design Hackathon will be conducted at the end of the semester.

*SDG 9 – Industry Innovation and Infrastructure

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	2	2
CO2	3	3	3	3	-	2	-	-	-	2	3	3	3	3
CO3	2	2	2	2	-	3	-	-	-	2	3	3	-	3
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								
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 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 Number system - Squares & cubes - Divisibility - Unit digits - Remainder Theorem - HCF & LCM - Geometric and Arithmetic progression - Surds & indices	**[6]**
Critical Reasoning 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 Average - Ratio and proportion – Ages – Partnership– Percentage - Profit & loss – Discount - Mixture and Allegation	**[6]**
Quantitative Aptitude – Part 3 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, 6thedition, 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	**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	**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	**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	**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	**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
	Total	**30**

Course Designer:

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 2025-2026)
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 EE 501	Transmission and Distribution	2	40	60	100	45	100
2	61 EE 502	Control Systems	2	40	60	100	45	100
3	60 EE 503	Measurements and Instrumentation	2	40	60	100	45	100
4	60 EE 504	Microprocessor and Microcontrollers	2	40	60	100	45	100
5	60 EE E1*	Professional Elective – I	2	40	60	100	45	100
6	60 EE L2*	Open Elective – II	2	40	60	100	45	100
7	60 MY 003	Start-ups and Entrepreneurship	2	100	-	100	-	100
PRACTICAL								
7	61 EE 5P1	Control and Virtual Instrumentation Laboratory	3	60	40	100	45	100
8	60 EE 5P2	Special Applications Laboratory	3	60	40	100	45	100
9	60 EE 5P3	Design Thinking and Innovation Laboratory	3	60	40	100	45	100
10	60 CG 0P4	Career Skill Development IV	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 the theory end semester examination and 40 marks for practical end semester examination.

Rev.No. 00/ w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

60 EE 501	Transmission and Distribution	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To impart knowledge about the configuration of the electrical power systems
- To study the line parameters and interference with neighbouring circuits.
- To understand the design and performance analysis of transmission lines
- To learn about different insulators and underground cables
- To understand and analyze the mechanical design of transmission lines

Pre-requisites

- Basic Knowledge on electric circuits

Course Outcomes

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

CO1	Understand the structure of power system and its types of distribution	Understand
CO2	Compute resistance, Inductance and Capacitance of various types of Transmission lines	Apply
CO3	Model the transmission lines to determine the line performance	Apply
CO4	Understand about various insulators and cables	Understand
CO5	Do Mechanical design of transmission lines and grounding	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	2	1	-	-	-	1	2	3	3
CO2	3	3	3	2	1	2	1	-	-	-	1	2	3	3
CO3	3	3	3	2	1	2	1	-	-	-	1	2	3	3
CO4	3	3	3	3	1	2	1	-	-	2	1	2	3	3
CO5	3	3	3	2	1	2	1	-	-	2	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	10	20	30
Understand	20	20	30
Apply	30	20	40
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

<table>
<tr><th colspan="10">Syllabus:</th></tr>
<tr><th colspan="10">K.S.Rangasamy College of Technology – Autonomous R 2022</th></tr>
<tr><th colspan="10">B.E - Electrical and Electronics Engineering</th></tr>
<tr><th colspan="10">60 EE 501 - Transmission and Distribution</th></tr>
<tr><th rowspan="2">Semester</th><th colspan="3">Hours/Week</th><th rowspan="2">Total Hours</th><th>Credit</th><th colspan="3">Maximum Marks</th></tr>
<tr><th>L</th><th>T</th><th>P</th><th>C</th><th>CA</th><th>ES</th><th>Total</th></tr>
<tr><td>V</td><td>3</td><td>1</td><td>0</td><td>60</td><td>4</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="8">STRUCTURE OF POWER SYSTEM
Structure of Electric Power System*- Generation, Transmission And Distribution - overhead and underground systems, - Types of AC and DC distributors–distributed and concentrated loads–voltage tolerances – interconnection. Standard voltages for transmission & distributions - distribution Voltage drop and power loss calculations; Distribution system voltage regulation; Metering. Comparison between AC &DC Transmission, Types of DC links.
Hands on practice using MATLAB:
1.Modelling of transmission line parameter</td><td>[9]</td></tr>
<tr><td colspan="8">TRANSMISSION LINE PARAMETERS
Parameters of single and three phase transmission lines with single and double circuits-Resistance, inductance and capacitance of solid, stranded and bundled conductors, conductor types-Symmetrical and unsymmetrical spacing and transposition-application of self and mutual GMD; skin and proximity effects-Effects of earth on the capacitance of the transmission line - interference with neighbouring communication circuits, corona discharge, factors affecting corona</td><td>[9]</td></tr>
<tr><td colspan="8">MODELLING AND PERFORMANCE OF TRANSMISSION LINES
Classification of lines–short line, medium line and long line-Evaluation of A,B,C,D constants equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance and surge impedance loading; transmission efficiency and voltage regulation, real and reactive power flow in lines, Power-circle diagrams, methods of voltage control ;Ferranti effect.</td><td>[9]</td></tr>
<tr><td colspan="8">INSULATORS AND CABLES
Insulators-Types; Insulation Materials, Insulation coordination of HV systems; voltage distribution in insulator string, improvement of string efficiency, Underground cables-Types of cables, Parameters of cable, Grading of cables, Power factor and heating of cables, Capacitance of 3-core belted cable, D.C cables- Sizing of cables based on the applications.</td><td>[9]</td></tr>
<tr><td colspan="8">MECHANICAL DESIGN OF LINES AND GROUNDING
Mechanical design of transmission line - sag and tension calculations for different weather conditions, Tower spotting, Types of towers, Sub-station Layout (AIS, GIS), Substation Equipment-Switching Configurations-Lightning Protection - Methods of grounding, Role of NGT & NGR, Generator & Transformers Neutral Grounding Practices.
Hands on practice using MATLAB:
1.Modelling of Distribution system
2.Sag calculation of Conductors
3.Modelling of long transmission line</td><td>[9]</td></tr>
<tr><td colspan="8" align="right">Total Hours(45 + Tutorial 15)</td><td>60</td></tr>
<tr><td colspan="9">Text book(s):</td></tr>
<tr><td>1.</td><td colspan="8">Mehta V. K. & Rohit Mehta, “Principles of Power Systems”, S.Chand& company LTD., 2006.</td></tr>
<tr><td>2.</td><td colspan="8">Soni M. L. P.V.Gupta, U.S.Bhatnagar, A.Chakrabarthy, “A Text Book on Power System Engineering”, Dhanpat Rai & Co Pvt. Ltd. Reprint 2009.</td></tr>
<tr><td colspan="9">Reference(s):</td></tr>
<tr><td>1.</td><td colspan="8">Stevenson W. D & J.J. Grainger, “Power System Analysis” Mc Graw hill Education Private Limited, Reprint 2015.</td></tr>
<tr><td>2.</td><td colspan="8">Wadhwa C. L., “Electrical power systems”, New Age International (P) Limited, 2006.</td></tr>
<tr><td>3.</td><td colspan="8">Gupta.B.R, “Power System Analysis and Design”, S.Chand, 2017.</td></tr>
<tr><td>4.</td><td colspan="8">Turan Gonen, “Electric Power Distribution system, Engineering”, 2nd Edition, Taylor & Francis, 2007.</td></tr>
</table>

*SDG -7 (Affordable and Clean Energy)

Course Contents and Lecture Schedule

S. No.	Topics	No. of Hours
1.STRUCTURE OF POWER SYSTEM		
1.1.	Structure of electric power system, generation, transmission and distribution	1
1.2.	Types of AC and DC distributors	1
1.3.	distributed and concentrated loads,voltage tolerances, interconnection	1
1.4.	Standard voltages for transmission & distributions, distribution Voltage drop and power loss calculations	1
1.5.	Overhead and underground systems	2
1.6.	Distribution system voltage regulation, Metering	1
1.7.	Comparison between AC &DC Transmission	1
1.8.	Types of DC links	1
2.TRANSMISSION LINE PARAMETERS		
2.1.	Parameters of single and three phase transmission lines with single and double circuits	2
2.2.	Resistance, inductance and capacitance of solid, stranded and bundled conductors	2
2.3.	Conductor types, Symmetrical and unsymmetrical spacing and transposition	1
2.4.	Application of self and mutual GMD	1
2.5.	Skin and proximity effects-Effects of earth on the capacitance of the transmission line	1
2.6.	Interference with neighbouring communication circuits, corona discharge	1
2.7.	Factors affecting corona	1
3.MODELLING AND PERFORMANCE OF TRANSMISSION LINES		
3.1.	Classification of lines–short line, medium line and long line	1
3.2.	Evaluation of A,B constants equivalent circuits, phasor diagram	1
3.3.	Evaluation of C,D constants equivalent circuits, phasor diagram	1
3.4.	Attenuation constant, phase constant, surge impedance and surge impedance loading	1
3.5.	Transmission efficiency and voltage regulation	1
3.6.	Real and reactive power flow in lines	1
3.7.	Power-circle diagrams	1
3.8.	Methods of voltage control	1
3.9.	Ferranti effect	1
4.INSULATORS AND CABLES		
4.1.	Insulators-Types, Insulation Materials, D.C cables	1
4.2.	Insulation coordination of HV systems	1
4.3.	Voltage distribution in insulator string, improvement of string efficiency	1
4.4.	Underground cables-Types of cables	2
4.5.	Parameters of cable, Grading of cables	1
4.6.	Power factor and heating of cables	1
4.7.	Capacitance of 3-core belted cable	1
4.8.	Sizing of cables based on the applications.	1
5.1.	Mechanical design of transmission line	1
5.2.	Sag and tension calculations for different weather conditions	2
5.3.	Tower spotting, Types of towers, Sub-station Layout (AIS, GIS)	1
5.4.	Substation Equipments; Switching Configurations; Lightning Protection	2
5.5.	Methods of grounding	1
5.6.	Role of NGT & NGR	1
5.7.	Generator & Transformers Neutral Grounding Practices	1

Course Designer(s)

1. Dr.R.Balamurugan – balamurugan@ksrct.ac.in

61 EE 502	Control Systems	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To recognize the basic components of control systems and to obtain the mathematical model of a system
- To explore on the time response of the systems.
- To analyze the stability of the system in frequency domain.
- To design the suitable compensator for the given specifications.
- To grasp the concept of state space representation of the system.

Pre-requisites

- Electrical Circuit Analysis, Electrical Machines – I, Electrical Machines – II, Integrals and Partial Differential Equation.

Course Outcomes

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

CO1	Derive the transfer function and determine the overall gain of a system.	Apply
CO2	Analyse the performance of the system in time domain with standard inputs.	Analyze
CO3	Analyse the stability of the system in frequency domain using Bode plot and Polar plot.	Analyze
CO4	Analyze the stability of the system and design a suitable compensator for the given specifications	Analyze
CO5	Formulate the state space model and examine the controllability and observability of a 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	3	2	-	-	-	-	-	-	2	3	2
CO2	3	3	3	3	2	-	-	-	-	-	-	2	3	2
CO3	3	3	3	3	2	-	-	-	-	-	-	2	3	2
CO4	3	3	3	3	2	-	-	-	-	-	-	2	3	2
CO5	3	3	3	1	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	10	10	10
Understand	20	20	30
Apply	20	20	30
Analyse	10	10	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus:

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E – Electrical and Electronics Engineering								
61 EE 502 – Control Systems								
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 Basic elements in control systems- open and closed loop systems- Transfer function- Modeling of Electrical and Mechanical systems - analogous systems – Servo motors and synchros - **AC and DC servo motors*** - Block diagram reduction techniques – Signal flow graphs.	[9]
Time Response Time response– Types of test input – Time domain specifications - First and Second order system response –– Error coefficients - Steady state error – Generalized error series - Root locus construction - Time response analysis**. Effects of P, PI, PD and PID modes of feedback control*.**	[9]
Frequency Response Frequency response –Correlation between frequency domain and time domain specifications - Bode plot – Polar plot – Constant M and N circles – Nichols chart – Determination of closed loop response from open loop response.	[9]
Stability Analysis and Compensator Design Concepts of stability – Characteristic equation - Routh Hurwitz criterion- Nyquist stability criterion. Performance criteria – Effect of Lag, lead and lag-lead compensation – Design of lag, lead and lag-lead compensator using **Bode plot*.**	[9]
State Variable Analysis Concepts of state, state variable and state model – state space representation – physical variable - phase variables – canonical variables - Transfer function from state model - controllability and observability using Kalman's test.	[9]
Hands on training on modeling of Controllers using simulink.	
Total Hours(45+15T)	60

Text Book(s):

1.	Nagrath I. J & Gopal M, "Control Systems Engineering", 6th edition New Age International Publishers, 2018.
2.	Anand Kumar. A, "Control Systems", 2nd edition 'Prentice Hall of India Pvt. Ltd., New Delhi, 2014.

Reference(s):

1.	Gopal M., "Control Systems, Principles & Design", 4rd edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2012.
2.	Kuo B. C, "Automatic Control Systems", Prentice Hall of India Ltd., New Delhi, 2014.
3.	Ogata K, "Modern Control Engineering", 5th edition, Pearson Education, New Delhi, 2015.
4.	Manke B. S, "Linear Control Systems with MATLAB Applications", Khanna Publishers, 2017.

SDG -9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule

S. No	Topics	No. of Hours
1	**Systems and Their Representation**	
1.1	Basic elements in control systems, open and closed loop systems	1
1.2	Transfer function, Modeling of Electrical and Mechanical systems	1
1.3	Analogous systems	1
1.4	Servo motors,	1
1.6	Synchros.	2
1.7	AC and DC servo motors	1
1.8	Block diagram reduction techniques	1
1.9	Signal flow graphs.	1
2	**Time Response**	
2.1	Time response, Types of test input & Time domain specifications	1
2.2	First and Second order system response	1
2.3	Error coefficients	1
2.4	Steady state error	1
2.5	Generalized error series	1
2.6	Root locus construction	1
2.7	Time response analysis, Effects of P, PI, PD and PID modes of feedback control.	1
2.8	Hands on training on modeling of Controllers using simulink.	1
2.9	Hands on training on modeling of Controllers using simulink.	1
3	**Frequency Response**	
3.1	Frequency response	1
3.2	Correlation between frequency domain and time domain specifications	1
3.3	Bode plot	2
3.4	Polar plot	2
3.5	Constant M and N circles	1
3.6	Nichols chart	1
3.7	Determination of closed loop response from open loop response.	1
4	**Stability Analysis and Compensator Design**	
4.1	Concepts of stability, Characteristic equation	1
4.2	Routh Hurwitz criterion	1
4.3	Nyquist stability criterion	1
4.4	Performance criteria	1
4.5	Effect of Lag, lead and lag-lead compensation	1
4.6	Lag compensation design using Bode plot	1
4.7	Lead compensation design using Bode plot	1
4.8	Lag-lead compensation design using Bode plot	1
4.9	Design of lag, lead and lag-lead compensator using Root locus	1
5	**State Variable Analysis**	
5.1	Concepts of state	1
5.2	State variable and state model	2
5.3	State space representation.	1
5.4	Physical variable	1
5.5	Phase variables	1
5.6	Canonical variables.	1
5.7	Transfer function from state model	1
5.8	Controllability and observability using Kalman's test.	1

Course Designer(s)

1. Dr.T.Venkatesan - venkatesan@ksrct.ac.in
2. Mr.S.Shree ram senthil -shreeramsenthil@ksrct.ac.in

60 EE 503	Measurements and Instrumentation	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To educate the fundamental concepts and characteristics of measurement and errors.
- To impart the knowledge on the functional aspects of measuring instruments.
- To infer the importance of various bridge circuits used with measuring instruments.
- To educate the fundamental working of sensors and transducers and their applications.
- To summarize the overall measurement and instrumentation with the knowledge on digital instrumentation principles.

Pre-requisites

- Nil

Course Outcomes

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

CO1	Comprehend the basic concepts of measurements and instrumentation.	Apply
CO2	Analyze the working of various electrical and electronic instruments.	Apply
CO3	Realize the different methods of measurement of resistance, inductance and capacitance.	Apply
CO4	Illustrate about various transducers and their characteristics	Understand
CO5	Explain the concept of digital instrumentation and virtual instrumentation	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	-	-	-	-	-	1	-	2	3	3	2
CO2	3	3	2	-	-	-	-	-	1	-	2	3	3	2
CO3	3	3	2	-	-	-	-	-	1	-	2	3	3	2
CO4	3	3	2	**3**	2	2	1	-	2	2	3	3	3	2
CO5	3	3	2	-	-	-	-	-	1	-	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	20	40
Understand	20	20	40
Apply	20	20	20
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Rev.No. 00 / w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

Syllabus:

K.S. Rangasamy College of Technology – Autonomous R2022								
BE - Electrical and Electronics Engineering								
60 EE 503- Measurements and Instrumentation								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
V	**3**	**0**	**0**	**45**	**3**	**40**	**60**	**100**

CONCEPTS OF MEASUREMENTS Instruments: classification, applications – Elements of a generalized measurement system - Static and dynamic characteristics - Errors in measurement -Statistical evaluation of measurement data.	[9]
MEASUREMENT OF PARAMETERS IN ELECTRICAL SYSTEMS Classification of instruments – moving coil and moving iron meters – Induction type, dynamometer type watt meters – Energy meter – Power factor meter - Instrument transformers (CT & PT).	[9]
AC/DC BRIDGES AND INSTRUMENTATION AMPLIFIERS Wheatstone bridge, Kelvin double bridge, Megger – Maxwell, Hay, Wien and Schering bridges – Errors and compensation in A.C. bridges - Instrumentation Amplifiers. **Hands on practice:** Simulation of AC & DC bridges using Virtual Lab	[9]
TRANSDUCERS FOR MEASUREMENT OF NON- ELECTRICAL PARAMETERS Classification of transducers – Measurement of pressure, temperature, displacement, flow, angular velocity – Digital transducers – Smart Sensors.	[9]
DIGITAL INSTRUMENTATION* Comparison of analog and digital techniques – digital voltmeter – multi meter - A/D converters: types and characteristics – Sampling, Errors- Measurement of voltage, Current, frequency and phase - D/A converters: types and characteristics- DSO- Data Loggers – Basics of PLC programming and **Introduction to Virtual Instrumentation**** - Instrument standards& Protocols. **Hands on practice:** Simulation of Linear Variable Differential Transducer using Virtual Lab	[9]
Total Hours	45

Text Book(s):

1.	SawhneyA. K , Puneet Sawhney ‘A Course in Electrical & Electronic Measurements & Instrumentation’, Dhanpat Rai and Co, New Delhi, Edition 2011.
2.	Kalsi H. S., ‘Electronic Instrumentation’, Tata McGraw-Hill, New Delhi, 2010

Reference(s):

1.	Carr J. J., ‘Elements of Electronic Instrumentation and Measurement’, Pearson Education India, New Delhi, 2011
2.	Bolton W., Programmable Logic Controllers, 6th Edition, Elseiver, 2015.
3.	Northrop R. B, ‘Introduction to Instrumentation and Measurements’, Taylor & Francis, New Delhi, 3rd Edition 2014.
4.	Doebelin E. O and Manik D. N, “Measurement Systems – Application and Design”, Tata McGraw-Hill, New Delhi, 6th Edition 2017.

* - SDG 9 – Industry Innovation and Infrastructure
** - SDG 17 – Implementation & revitalize the Global Partnership

Course Content and Lecture Schedule

S. No.	Topics	No. of Hours
1	**CONCEPTS OF MEASUREMENTS**	
1.1	Instruments: classification, applications	1
1.2	Elements of a generalized measurement system	2
1.3	Static and dynamic characteristics	2
1.4	Errors in measurement	2
1.5	Statistical evaluation of measurement data.	2
2	**MEASUREMENT OF PARAMETERS IN ELECTRICAL SYSTEMS**	
2.1	Classification of instruments	1
2.2	Moving coil and moving iron meters	2
2.3	Induction type, dynamometer type watt meters	2
2.4	Energy meter	2
2.5	Power factor meter&Instrument transformers (CT & PT).	2
3	**AC/DC BRIDGES AND INSTRUMENTATION AMPLIFIERS**	
3.1	Wheatstone bridge	1
3.2	Kelvin double bridge	1
3.3	Megger	1
3.4	Maxwell bridges	1
3.5	Haybridges	1
3.6	Wienbridges	1
3.7	Schering bridges	1
3.8	Errors and compensation in A.C. bridges	1
3.9	Instrumentation Amplifiers.	1
4	**TRANSDUCERS FOR MEASUREMENT OF NON- ELECTRICAL PARAMETERS**	
4.1	Classification of transducers	1
4.2	Measurement of pressure	1
4.3	Measurement of temperature	1
4.4	Measurement of displacement	1
4.5	Measurement of flow	1
4.6	Measurement of angular velocity	1
4.7	Digital transducers	2
4.8	Smart Sensors	1
5	**DIGITAL INSTRUMENTATION**	
5.1	Comparison of analog and digital techniques	1
5.2	Digital voltmeter - multi meter	1
5.3	A/D converters: types and characteristics	1
5.4	Sampling, Errors	1
5.5	Measurement of voltage, Current, frequency and phase	1
5.6	D/A converters: types and characteristics	1
5.7	DSO- Data Loggers	1
5.8	Basics of PLC programming and Introduction to Virtual Instrumentation	1
5.9	Instrument standards & Protocols.	1

Course Designer(s):

1. N.Kayalvizhi – kayalvizhi@ksrct.ac.in

60 EE 504	Microprocessor and Microcontrollers	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- Explore the fundamentals of microprocessors with its assembly language programming
- Understand the functionalities of different peripheral interfaces for 8085 microprocessor
- Explore the architecture and internal structure of the 8051 microcontroller and interfacing
- Introduce advanced controllers like Arduino, understanding their features and capabilities
- Understand the architecture of STM32 series microcontrollers with its applications

Pre-requisites

- Analog and Digital Electronics

Course Outcomes

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

CO1	Explain the architecture, instruction set, and addressing modes of 8085 microprocessor and develop assembly language programs for 8085	Understand
CO2	Interface memory and various I/O peripherals with microprocessor	Apply
CO3	Illustrate the architectural features and programming techniques of 8051 and Arduino microcontrollers	Understand
CO4	Design interfacing circuits for ADCs, DACs, sensors, LCDs, motors, and other peripherals	Apply
CO5	Describe the features and peripherals in STM32 Cortex-M3 controller and build embedded 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	2	2	-	-	-	-	-	-	-	-	-	1	1
CO2	3	2	3	3	3	-	-	-	-	-	-	2	1	1
CO3	2	2	2	-	3	-	-	-	-	-	-	2	2	1
CO4	2	3	2	-	3	-	-	-	-	-	-	3	3	2
CO5	3	2	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	10	20	30
Understand	30	30	40
Apply	20	10	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E Electrical and Electronics Engineering								
60 EE 504 Microprocessor 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 Introduction to 8085 – 8085 Architecture – Addressing modes - Instruction set - Assembly language programming - Timing diagram - Interrupt structure - Memory interfacing - Comparison of 8085 processor with 8086 processor.	[9]
Peripheral Interfacing 8255 Programmable Peripheral Interface – 8253 Programmable Interval Timer – 8259 Programmable Interrupt Controller – 8279 Keyboard & display controller - 8251 Interfacing serial I /O – ADC and DAC Interfacing – DMA controller.	[9]
8051 and Arduino Microcontrollers 8051 – Architecture, Special Function Registers (SFRs), I/O Pins Ports and Circuits, Instruction set, Addressing modes, Assembly language programming. **Introduction to advanced controllers – Arduino: Features – Architecture and memory organization programming arduino microcontrollers using Sketch.***	[9]
8051 Peripherals Timers - UART - Interrupts – ADC, DAC, Applications: Keyboard Interfacing -Seven segment LED, LCD interfacing & Sensor Interfacing – DC Motor & Stepper Motor interfacing.	[9]
STM32Series Microcontrollers Structure of microcontrollers- Cortex-M3 core – Peripherals - General purpose input output, clocking, timers & counters, interrupts - types of interrupts. Nested vector interrupt controller (NVIC) in Cortex-M cores. Interrupt vectors. Priorities. Interrupt flags in STM microcontrollers -DAC and ADC - UART- **Applications- BLDC Motor Control***	[9]
Total Hours:	**45**

Text Book(s):

1.	Gaonkar R. S, ‘Microprocessor Architecture Programming and Application with 8085’, 6th Edition, Penram International Publishing India Pvt Ltd., 2013.
2.	Soumitra Kumar Mandal, —Microprocessors and Microcontrollers Architecture, Programming and System Design 8085,8086 and 8051, 8th Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2013

Reference(s):

1.	Trevor Martin “STMicroelectronics Microcontrollers on Cortex-M3 core” STM32 Series,2018
2.	“Arduino Book for Beginners” by Mike Cheich, Open Hardware Design Group LLC, 29 Jun 2021
3.	https://docs.arduino.cc/built-in-examples/
4.	https://deepbluembedded.com/stm32-arm-programming-tutorials/

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule

S. No	Topics	No. of Hours
1	**8085 Microprocessor**	
1.1	Introduction to µp, Pin Details of 8085	1
1.2	Architecture of 8085, Registers ALU, Timing and control signals	1
1.3	Machine cycles – Functional block diagram – Memory R/W, I/O R/W with ALE operation	1
1.4	Addressing modes with example instructions	1
1.5	Instruction set – Instruction format, classification based on word size and operation, data transfer group	1
1.6	Instruction cycle, T state, Execution time – Timing diagram	1
1.7	Simple programs	1
1.8	Interrupts – Maskable, Non maskable, vectored, non vectored, priority of interrupts and interrupt structure.	1
1.9	Memory Interfacing with 8085, Comparison of 8085 processor with 8086 processor	1
2	**Peripheral Interfacing**	
2.1	Pin details and architecture of 8255 – Programmable Peripheral Interface	1
2.2	Modes and control word format of 8255, 8255 Interfacing with mode 0 function	1
2.3	Pin details, architecture of 8253 Timer	1
2.4	Modes of 8253, control word and suitable timing waveform - Program examples	1
2.5	Pin details and architecture of 8279 Keyboard controller	1
2.6	Modes and control word format of 8279 with their Interfacing	1
2.7	Pin details and architecture of 8251 serial data communication	1
2.8	Pin details, architecture and control word of 8257 and their interfacing with 8085 processor	1
2.9	D/A and A/D Interfacing with 8085, DMA Interfacing.	1
3	**8051 and Arduino Microcontrollers**	
3.1	Comparison of µp with µc – Features of 8051 micro controller	1
3.2	Pin details and architecture of 8051 micro controller	1
3.3	Special Function Registers (SFRs) and Formats	1
3.4	Addressing modes – Immediate, register direct, memory direct, memory Indirect, and Index addressing modes	1
3.5	Instruction set of 8051 – Data transfer, Arithmetic, Logical, Branching and Bit manipulation Instructions	1
3.6	8051 Programming – Arithmetic operations, complement operation – code conversions	1
3.7	Introduction to advanced controllers	1
3.8	Arduino Features, Architecture and memory organization	1
3.9	Programming arduino microcontrollers using Sketch	1
4	**8051 Peripherals**	
4.1	8051 Timer – Timer operating modes, Timer control and operation	1
4.2	8051 Serial communication UART– structure of ports – operating modes	1
4.3	Interrupts – Interrupt sources, vector addressing, enabling and disabling of interrupt and priorities	1
4.4	Interfacing of ADC and DAC and sensor with 8051 micro controller	2
4.5	Keyboard, seven segment LED and LCD interfacing	2
4.6	Interfacing of stepper motor control – speed control and control of direction of rotation	1
4.7	Interfacing of DC motor control – speed control and control of direction of rotation	1
5	**STM32Series Microcontrollers**	
5.1	Overview, architecture, and core features	1
5.2	Cortex-M3 Core and Peripherals	1
5.3	Clocking, Timers & Counters	1
5.4	Interrupts	1
5.5	NVIC in Cortex-M Cores	1
5.6	Interrupt Flags	1
5.7	DAC and ADC	1
5.8	UART	1
5.9	BLDC Motor Control	1

Course Designer(s)

Dr.G.Vijayagowri - hodeee@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 & Viva 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	

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

Common to ALL Branches

60 MY 003 – Startups and Entrepreneurship

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	2	0	0	30	2*	100	-	100

Introduction to Entrepreneurship & Entrepreneur 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 scenario	[6]
Problem-Opportunity Identification, Customers Discovery and competitive advantage 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 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 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 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

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? Art of pitching and storytelling	1

Course Designer(s)

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

61 EE 5P1	Control and Virtual Instrumentation Laboratory	Category	L	T	P	Credit
		PC	0	0	3	1.5

Objectives

- To obtain the transfer function of DC and AC servomotor experimentally
- To obtain the frequency response plots using MATLAB program and analyse the stability
- To design the compensators using MATLAB program
- To determine the unknown parameters using various bridge circuits
- To learn the different types of transducers

Pre-requisites

- Electric Circuit Analysis, Control systems and Measurement and instrumentation

Course Outcomes

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

CO1	Determine the transfer function parameters of DC and AC servomotors.	Analyze
CO2	Plot the frequency response of various compensators and design of compensators using MATLAB	Analyze
CO3	Obtain the stability analysis using Root Locus Technique and frequency response plots in MATLAB.	Analyze
CO4	Perform basic arithmetic operations using Labview	Analyze
CO5	DAB Interfacing	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	2	-	3	-	-	-	2	-	-	2	3	3
CO2	3	3	2	3	3	-	-	-	3	-	-	2	3	3
CO3	3	3	2	2	3	2	-	-	3	2	-	2	3	3
CO4	3	3	2	3	3	-	-	3	2	2	-	2	3	3
CO5	3	3	2	-	3	2	2	3	3	2	-	2	3	3

3 - Strong; 2 - Medium; 1 - Low

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. - Electrical and Electronics Engineering								
61 EE 5P1- Control and Virtual Instrumentation 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. Determination of transfer function parameters of DC servomotor.
2. Determination of transfer function parameters of AC servomotor.
3. Time response characteristics of a second order system.
4. Frequency response characteristics of a second order system.
5. Constant gain compensation in time and frequency domain.
6. **Design of compensation networks - Lead, Lag, Lead-lag***
7. Design of state feedback controller.
8. Perform basic arithmetic operations using Labview
9. Implementation of Array functions using Labview
10. Mini Project

Note: MATLAB and Labview are used for simulation.

*SDG 9 – Industry Innovation and Infrastructure

Course Designer(s)

Dr.T.Venkatesan venkatesan@ksrct.ac.in

60 EE 5P2	Special Applications Laboratory	Category	L	T	P	Credit
		PC	0	0	3	1.5

Objectives

- Understand the basic programs on 8085 microprocessor and 8051 microcontroller
- Explore different interfacing techniques and protocols to ensure compatibility and seamless data exchange between the microprocessor and microcontroller-based system and connected peripherals
- Learn to utilize KEIL IDE features for writing, compiling, debugging, and testing firmware/software code for microcontrollers
- Explore programming methodologies and best practices for developing applications targeting STM32F4 microcontrollers using popular development tools and programming languages
- Design and conduct open-ended experiments aimed at implementing real-time applications using microprocessors and microcontrollers

Pre-requisites

- Analog and Digital Electronics

Course Outcomes

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

CO1	Design and implement basic assembly language programs to perform arithmetic, logical, and control operations on the 8085 microprocessor	Apply
CO2	Design interfacing circuits with 8085 processors.	Apply
CO3	Develop and implement 8051 microcontroller based systems.	Apply
CO4	Develop the program for microcontrollers using KEIL IDE.	Apply
CO5	Develop the program for STM32F4 microcontroller and perform real time 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	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 - Low														

Assessment Pattern

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

K.S.Rangasamy College of Technology – Autonomous R2022

B.E - Electrical and Electronics Engineering

60 EE 5P2 - Special Applications 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. Programs for arithmetic, logical operations using 8085 and 8051.
2. Interfacing and programming of keyboard & display controller with 8085.
3. Interfacing and programming of Traffic Light controller with 8085.
4. Interfacing and programming of stepper motor controller with 8051.
5. Develop a program for STM32 microcontroller using KEIL IDE to perform the following tasks
   - Blinking LED for 15 milliseconds
   - Read the data from serial port
6. Interfacing and Programming of Temperature Sensor and Ultrasonic Sensor using STM32 controller.
7. **Mini Project – Application using Arduino***

Open Ended Experiments*

1. Develop an application using ADC/DAC.
2. Develop an application using UART.

*SDG 9 – Industry Innovation and Infrastructure

Course Designer(s)

1. Dr.G.Vijayagowri vijayagowri@ksrct.ac.in
2. Mr.T.Prabhu prabhut@ksrct.ac.in

60 EE 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.	Understand
CO2	Identify and articulate real-world engineering problems through brainstorming and mind map techniques.	Analyse
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.	Analyse
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	3
CO3	3	-	-	-	-	-	-	3	3	3	-	-	3	3
CO4	3	-	-	-	-	-	-	3	3	3	-	-	3	3
CO5	3	3	-	-	-	-	-	3	3	3	-	-	3	3
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

Rev.No. 00 / w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

Syllabus

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R2022</th></tr>
<tr><th colspan="9">B.E – Electrical and Electronics Engineering</th></tr>
<tr><th colspan="9">60 EE 5P3 - Design Thinking and Innovation Laboratory</th></tr>
<tr><th rowspan="2">Semester</th><th colspan="3">Hours/Week</th><th rowspan="2">Total Hours</th><th>Credit</th><th colspan="3">Maximum Marks</th></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>0</td><td>0</td><td>2</td><td>30</td><td>1</td><td>60</td><td>40</td><td>100</td></tr>
<tr><td colspan="8">Design Thinking and Innovation Process
Introduction to Design Thinking and Innovation - Design, Design Thinking, Innovation - Stages of Design Thinking Process – Case Study: Analysis of Existing Problems and Solutions.</td><td>[8]</td></tr>
<tr><td colspan="8">Selection of Problem
Identification and Selection of Problem to Solve, Tools - Brain-storming- Sorting & affinity- Links, Mind-mapping- affinity-Links.</td><td>[4]</td></tr>
<tr><td colspan="8">Secondary research on Problem Space
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.</td><td>[6]</td></tr>
<tr><td colspan="8">Primary research on Problem Space
Understanding your Users environment - Primary research - Observation, Conversations, Questionnaires, Documentation - Conducting Contextual Inquiry.</td><td>[6]</td></tr>
<tr><td colspan="8">Analysis of Problem Space
Identify, Classify, Compare, Prioritize, Cross-relate information - Personas Observations, Inference, Opportunities, Recommendations (OIOR) - Redefining the Problem Statement.</td><td>[6]</td></tr>
<tr><td colspan="8" align="right">Total Hours:</td><td>30</td></tr>
<tr><td colspan="8">Text Book(s):</td><td></td></tr>
<tr><td>1.</td><td colspan="8">• 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
• NPTEL: Design, Technology and Innovation by Prof. B. K. Chakravarthy, IDC School of Design, IIT Bombay. https://onlinecourses.nptel.ac.in/noc20_de03/preview
• NPTEL: Innovation by Design by Prof. B. K. Chakravarthy, IDC School of Design, IIT Bombay, https://onlinecourses.swayam2.ac.in/aic19_de02/preview.,
www.dsource.in , The Resource for Design by e-Kalpa Design Team, IDC, IIT Bombay,DoD, IIT Guwahati & NID, Bengaluru.</td></tr>
<tr><td colspan="9">Reference(s):</td></tr>
<tr><td>1.</td><td colspan="8">1. Zero to One: Note on Start-Ups, or How to Build the Future</td></tr>
<tr><td>2.</td><td colspan="8">2. The Lean Startup: How Constant Innovation Creates Radically Successful Businesses</td></tr>
<tr><td>3.</td><td colspan="8">3. Start With Why: How Great Leaders Inspire Everyone To Take Actions.</td></tr>
</table>

*SDG:9 - Industry Innovation and Infrastructure

Course Designer(s)

Dr.K.Raja – raja@ksrct.ac.in

Design Thinking and Innovation Laboratory - Assessment

1,2 Hours: **Introduction to Design Thinking**

Duration	Activity	Materials	
		Faculty	**Students**
10 Minutes	**Individual:** Students have to write their thoughts to the following questions in the worksheet. 1) What is Design? 2) Who is a Designer? 3) What is Design Thinking? 4) What are the steps of Design Thinking Process? 5) Who is a Design Thinker?	Worksheet: Space for writing Answer	Pen & File
20 Minutes	**Individual:** Students have to watch the video 1 and reflection the thought to the following questions in the work sheet. Video 1: Toilet Bed - https://www.youtube.com/watch?v=KJ5TRHE7omU&ab_channel=sjkinnovations 1) What are the problems faced by the elderly/injured people? 2) How did Saravana Muthu solve the problem? 3) Where Saravana Muthu want updating/changes in the product? Why? 4) Saravana Muthu is a Designer? Justify the Statement. 5) Toilet Bed is a Design. Justify the Statement.	Worksheet: QR Code contain Video Link Space for writing Answer	Cellphone , Headphone, Pen & File
20 Minutes	**Individual:** Students have to watch the video 2 and reflection the thought to the following questions in the work sheet. Video 2 : Jaipur Foot, India https://youtu.be/7W6ckXZbL4o 1) What are the problem faced by the handicapped in India? 2) How did Ramachandra Sharma solve the problem? 3) Why Ramachandra Sharma used rubber material for foot? Where he got idea? 4) Dr.Mathur is a Designer? Justify the Statement 5) Jaipur is a Design? Justify the statement.	Worksheet: QR Code contain Video Link Space for writing Answer	Cellphone , Headphone, Pen & File
10 Minutes	**Individual:** Students have to share the thought written in the worksheet	Randomly Call any two or three student and ask him to share the thoughts with other students.	Communicate the thoughts with clarity.
30 Minutes	**Individual:** Students have to watch the video 3 and reflection the thought to the following questions in the work sheet. Video 3: What you **understand** from the video? What are the **rules to be followed** by policeman on bandobast? How does the policeman **doing bandobast**? What the policeman **feel** while on the bandobast? What the policeman **like to have** on the bandobast? As a designer, what will you **do to the policeman** easy to do their	Worksheet: QR Code contain Video Link Space for writing Answer	Cellphone , Headphone, Pen & File

	bandobast duty?		
30 Minutes	**Individual:** Students have to watch the video 4 and reflection the thought to the following questions in the work sheet. Video 4: What you **understand** from the video? How the **Parkinson's disease affect** the Ali? Why Ali is not drinking coffee when surrounding by many people? What Ali **feel** while walking on the Staircase? What Ali **like** to do daily? As a designer, what **will you do** to Ali easy to do their daily activity?	Worksheet: QR Code contain Video Link Space for writing Answer	Cellphone , Headphone, Pen & File
10 Minutes	**Individual:** Students have to share the thought written in the worksheet	Randomly Call any two or three student and ask him to share the thoughts with other students.	Communicate the thoughts with clarity.

After the class

Outcome: Students understand the design thinking process.

Students have to watch the videos in the playlist: It will enhance the understand ability of design thinking process

Design Thinking Series Playlist : Tamil. https://www.youtube.com/playlist?list=PLf_-l5JEujRhJmOGcj8YOLZQI15cG7x7Z

3,4 Hours: **Mind-sets of Design Thinking**

Duration	Activity	Materials	
		Faculty	Students
10 Minutes	Individual: Recap of Last Class Students have to share what they learned on last class	Randomly Call any two or three student and ask him to share the thoughts of design thinking process with other students.	Communicate the thoughts with clarity.

70 Minutes	Team: Maximum 3 Students Design Challenge : Build a tower of spaghetti/straw noodles that will hold one marshmallow/rubber. Make the tallest tower possible from the materials supplied. The marshmallow/rubber must be able to sit on top without falling off. Time : 10 Minutes for Define the design challenge + 05 Minutes (Team Discussion) + 20 Minutes (Build) + 10 Minutes (Measurement and Compare) + 15 Minutes (Reflection of Thought) + 10 Minutes of watch Video 20 sticks of (uncooked) spaghetti or straws per team ● One yard (36 inches) of masking tape per team ● One yard (36 inches) of string/thread per team (the string must be easily breakable by hand. If the string is thick, include scissors in your kit.) ● One marshmallow/ eraser per team: around 1.5 inches in size across. ● Measuring tape to measure the height of the structures. ● Countdown Timer/ stopwatch to keep track of the time. Personal reflection: • What was my role in the team? • What worked well on Ideation/Prototype/ test? What failed on Ideation/Prototype/ test? • What would I improve next time in my team's work? • What learning would you take away from this challenge? • Are you a design thinker? Justify the Answer. Team reflection: • What was the team's strategy to solve the challenge? • What worked well on team/Collaboration? Please refer to the Faculty Guide: https://www.sessionlab.com/methods/marshmallow-challenge-with-debriefing https://static1.squarespace.com/static/57c6b79629687fde090a0fdd/t/58ab5a6046c3c4e069a2842d/148762 4802348/SpaghettiMarshmallow.pdf **Students watch** **VIDEO | Tom Wujec - Build a Tower, Build a Team:** https://www.ted.com/talks/tom_wujec_build_a_tow	Define the design challenge. Facilitate the students to do design challenge	Discuss the design ideas, discuss structures and strengths, and even sketch ideas before you begin. Build your design Measure Reflection the thought to the questions in the work sheet
20 Minutes	Individual: Students have to write their thoughts to the following questions in the worksheet Do you make it something and what it? Where you do iterate? Why? Do you learn anything from failure? What?	Worksheet: Space for writing Answer	Pen & File

	Are you an optimistic on your design? How? Do you have a confidence on your creative? How it help it? **Design Kit: Mindset Videos:** https://www.youtube.com/watch?v=_yWAllNl7E4&list=PLIeYpC-T18cbnZcjli2x9ScBABYL76n12&index=2&ab_channel=IDEO.org		
Additional	Team: Maximum 3 Students Design Challenge: Build a Strong Paper Structures that will hold many books. Time : 05 Minutes for Define the design challenge + 05 Minutes (Team Discussion) + 20 Minutes (Build) + 10 Minutes (Count and Compare) + 15 Minutes (Reflection of Thought) Materials: •Tape •Books •Paper (regular copy paper will do) Please refer to the Faculty Guide: https://littlebinsforlittlehands.com/strong-paper-structures/ Personal reflection: • What was my role in the team? • What worked well on Ideation/Prototype/ test? What failed on Ideation/Prototype/ test? • What would I improve next time in my team's work? • What learning would you take away from this challenge? • Are you a design thinker? Justify the Answer. Team reflection: • What was the team's strategy to solve the challenge? • What worked well on team/Collaboration?	Define the design challenge. Facilitate the students to do design challenge	Discuss the design ideas, discuss structures and strengths, and even sketch ideas before you begin. Build your design Reflection the thought to the questions in the work sheet

After the class

Outcome: Students can ideate and make a thing and test it.
Student understand the mind-set of design thinking

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	2	2	3	-	3	-	-	-	2	3	3	2	2
CO2	3	3	3	3	-	2	-	-	-	2	3	3	3	3
CO3	2	2	2	2	-	3	-	-	-	2	3	3	-	3
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 – AutonomousR2022

Common to all Branches

Career Skill Development – IV

Semester	Hours/Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	0	0	2	30	1*	100	--	100

Verbal & Analytical Reasoning* Seating Arrangements – Analytical Reasoning (PUZZELS) – Machin input and output – Coded Inequality – Eligibility Test	[6]
Quantitative Aptitude – Part – 4* Permutation and Combination – Probability – Quadratic equation – Geometry – Clock – Calendar – Logarithmic	[6]
Non-Verbal Reasoning* 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* 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* 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 and SDG 9 – Industry, innovation and Infrastructure

Course Contents and Lecture Schedule

	Topics	No. of Hours
1	**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	**Quantitative Aptitude – Part – 4**	
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	**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	**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	**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 2025-2026)
SIXTH SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weight age of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1.	60 EE 601	Power System Analysis and Stability	2	40	60	100	45	100
2.	60 EE 602	Digital Signal Processing	2	40	60	100	45	100
3.	60 EE 603	Power System Protection and Switchgear	2	40	60	100	45	100
4.	60 EE 604	Power Electronics and Industrial Drives	2	40	60	100	45	100
5.	60 MY 004	Disaster Management	2	100	-	100	-	100
6.	60 EE E2*	Professional Elective – II	2	40	60	100	45	100
7.	60 EE L3*	Open Elective – III	2	40	60	100	45	100
PRACTICAL								
8.	60 EE 6P1	Power Electronics and Drives Laboratory	3	60	40	100	45	100
9.	60 EE 6P2	Electrical Appliances Analysis Laboratory	3	60	40	100	45	100
10.	60 EE 6P3	Design Thinking and Product Development Laboratory	3	60	40	100	45	100
11.	60 CG 0P5	Comprehension Test	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 the theory end semester examination and 40 marks for practical end semester examination.

BoS Chairman Signature

60 EE 601	Power System Analysis and Stability	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To impart knowledge on the need for "power system analysis" and model various power system components
- To solve the power flow problems by using standard methods
- To study the impact of the balanced fault on the system
- To study the impact of the unbalanced fault on the system
- To examine the need of steady state and transient analysis and emerging techniques in power system

Pre-requisites

- Knowledge on Electrical Circuit Analysis, Generation, Transmission and Distribution

Course Outcomes

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

CO1	Model the various power system components for steady-state analysis.	Analyze
CO2	Carry out the power flow analysis by Gauss-Seidel and Newton-Raphson methods.	Analyze
CO3	Conduct the fault analysis of power system for balanced faults.	Analyze
CO4	Apply symmetrical components to resolve unbalanced networks into balanced networks and develop the sequence networks for unsymmetrical fault analysis.	Analyze
CO5	Compute the stability of the system with the help of equal area criteria and Modified-Euler methods.	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	2	2	-	-	-	-	-	-	-	3	3
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	2	-	-	-	-	-	-	-	3	2
CO4	3	3	3	3	2	-	-	-	-	-	-	-	3	3
CO5	2	3	3	3	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	10
Understand	10	10	30
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 – Electrical and Electronics Engineering

60 EE 601 - Power System Analysis and Stability

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
Introduction Power scenario in India – Need for system analysis in planning and operation of modern power system – Modeling: Generator model, power transformer, transmission line and load, shunt capacitor and shunt reactor – one line diagram–Per phase and per unit Analysis–impedance diagram – reactance diagram. **Hands on Practice:** Single line diagram of power system using Simulation model	[9]
Power Flow Analysis* Primitive network and its matrices – construction of Y-bus using inspection and singular Transformation methods –. Importance of power flow analysis in planning and operation of power systems – Classification of bus – need and selection of slack bus – power flow equation – computation of slack bus power, line flow and losses – representation of off nominal tap changing transformer. Power Flow Solution Methods**:** Gauss Seidel and Newton – Raphson methods (Rectangular and polar coordinates form) – algorithm and flowchart **Hands on Practice:** Formulation of Y bus and Z bus matrices using Simulation	[9]
Symmetrical Fault Analysis* Need and types of faults analysis – Assumption in short circuit analysis - Z bus building algorithm – Fault MVA – short circuit of an unloaded synchronous machine – calculation of symmetrical fault current using Thevenin's theorem and Z-bus – post fault bus voltages – Current limiting reactors.	[9]
Unsymmetrical Fault Analysis* Introduction to Symmetrical components – sequence impedance – sequence circuits of synchronous machine, transformer and transmission line. Concept of shunt and series fault - Fault analysis: single line to ground fault, line to line fault and double line to ground faults using Thevenin`s theorem.	[9]
Power System Stability* Importance of stability analysis in power system planning and operation – Classification of power system stability – Rotor angle stability –power angle equation – swing equation – solution of swing equation by step by step method –small signal stability – transient stability: equal area criterion – critical clearing angle and clearing time – application of critical clearing angle to transient stability of synchronous machine –Multi-machine stability analysis - solution of swing equation by modified Euler's method.	[9]
Total Hours (Lect 45 + Tut 15)	60

Text book(s):

1	Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw-Hill Education, 3rd edition 2019.
2	John J. Grainger, William D. Stevenson, Jr, 'Power System Analysis', Mc Graw Hill Education (India) Private Limited, New Delhi, 2017.

Reference(s):

1.	Venkatesh P, Manikandan B. V, Srinivasan A, Charles Raja S, "Electrical Power Systems: Analysis, Security and Deregulation" Prentice Hall India (PHI), second edition – 2017
2.	Prabha Kundur, "Power System stability and control", Tata McGraw Hill publishing company Ltd., New Delhi, Third Edition 2012.
3.	HadiSaadat, "Power System Analysis", Tata McGraw Hill Publishing Co. Ltd, 21st reprint 2010.
4.	http://nptel.ac.in/courses/108105067/.

* SDG9 Industry, Innovation, and Infrastructure (SDG 9)

Course Contents and Lecture Schedule

S. No	Topics	No. of Hours
1	**Introduction**	
1.1	Power scenario in India, Need for system analysis in planning and operation of modern power system	1
1.2	Modeling: Generator model, power transformer, transmission line and load, shunt capacitor and shunt reactor	1
1.3	one line diagram	1
1.4	Per phase and per unit Analysis	2
1.5	impedance diagram	2
1.6	reactance diagram	2
2	**Power Flow Analysis**	
2.1	construction of Y-bus using inspection and singular Transformation methods	1
2.2	Importance of power flow analysis in planning and operation of power systems	1
2.3	Classification of bus – need and selection of slack bus	1
2.4	power flow equation	1
2.5	computation of slack bus power, line flow and losses	1
2.6	representation of off nominal tap changing transformer	1
2.7	Power Flow Solution Methods**:** Gauss Seidel and Newton – Raphson methods (Rectangular and polar coordinates form) – algorithm and flowchart	3
3	**Symmetrical Fault Analysis**	
3.1	Need and types of faults analysis	1
3.2	Assumption in short circuit analysis	1
3.3	Z bus building algorithm	1
3.4	Fault MVA	1
3.5	Short circuit of an unloaded synchronous machine	1
3.6	Calculation of symmetrical fault current using Thevenin's theorem and Z-bus – post fault bus voltages – Current limiting reactors.	1
3.7	Calculation of symmetrical fault current using Z-bus – post fault bus voltages – Current limiting reactors.	2
3.8	Post fault bus voltages – Current limiting reactors.	1
4	**Unsymmetrical Fault Analysis**	
4.1	Introduction to Symmetrical components	1
4.2	Sequence impedance	1
4.3	Sequence circuits of synchronous machine, transformer and transmission line.	1
4.4	Concept of shunt and series fault	1
4.5	Fault analysis: Single line to ground fault using Thevenin`s theorem.	2
4.6	Fault analysis: Line to line fault using Thevenin`s theorem.	2
4.7	Fault analysis: Double line to ground faults using Thevenin`s theorem.	1
5	**Power System Stability**	
5.1	Importance of stability analysis in power system planning and operation and Classification of power system stability	1
5.2	Rotor angle stability,power angle equation and swing equation	1
5.3	Solution of swing equation by step by step method –small signal stability	2
5.4	Transient stability: equal area criterion – critical clearing angle and clearing time	2
5.5	Application of critical clearing angle to transient stability of synchronous machine	1
5.6	Multi-machine stability analysis	1
5.7	Solution of swing equation by modified Euler's method	1

Course Designer(s)

T.Venkatesan – Professor/EEE – venkatesan@ksrct.ac.in

60 EE 602	Digital Signal Processing	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To introduce the concept of analyzing discrete time signals & systems
- To study the various time to frequency domain transformation techniques
- To understand the computation algorithmic steps for Fourier Transform
- To study about filters and their design for digital implementation
- To introduce the programmable digital signal processor & its application

Pre-requisites

- Knowledge on Z Transform, Fourier Series, Fourier Transform, Laplace Transform, Microprocessor and Microcontroller

Course Outcomes

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

CO1	Comprehend, classify and analyze the signals and systems	Analyze
CO2	Illustrate the system representation using transforms	Apply
CO3	Design suitable digital FIR algorithm for the given specification	Analyze
CO4	Design suitable digital IIR algorithm for the given specification	Analyze
CO5	Use digital signal processor for application development	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	2	2	-	-	-	-	-	-	-	3	3
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	2	-	-	-	-	-	-	-	3	2
CO4	3	3	3	3	2	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	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	10
Understand	10	10	30
Apply	20	20	30
Analyse	20	20	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Rev.No. 00 / w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E – Electrical and Electronics Engineering								
60 EE 602 – Digital Signal Processing								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
VI	3	1	0	60	4	40	60	100

Signals and System Overview of Typical Digital Signal Processing in Real-World Applications- Representation of Discrete-time Signals - **Elementary Discrete-time Signals***- Classification of Discrete-time Signals - Classification of Discrete-time Systems - sampling techniques. Z-transform and its properties - Inverse Z-transform - Convolution - Discrete Correlation. **Hands on Practice:** Write a program to generation of discrete time sequences To compute cross correlation and circular correlation of two finite length sequence. To compute convolution of two sequences	[9]
Discrete-time Transform Relation between Z-transform and Fourier Transform - **Discrete-time Fourier Transform (DTFT)***- Properties - Transform - Transfer Function - Frequency Response of Discrete-time Systems - Fast Fourier Transform - Decimation in Time (DIT) Radix-2 FFT - The 8-point DFT Using Radix-2 DIT FFT - Butterfly Diagram - Decimation in Frequency (DIF) Radix-2 FFT - The 8-point DFT Using Radix-2 DIF FFT - Computation of IDFT through FFT. **Hands on Practice:** To find poles and Zeros of a Transfer function. To find DFT / IDFT of a discrete time signal. Implementation of FFT of a given sequence.	[9]
IIR filter design Design of IIR filters from analog filters - Design an Analog butterworth low pass filter - Design an Analog chebyshev low pass filter - **Frequency Transformation in analog domain***- Design of High pass, Band pass and Band stop filter - Realization of Digital filters.	[9]
FIR Filter Design Linear phase FIR filter - - Design of FIR Filters Using Windows - Rectangular Window, Triangular or Bartlett Window, Hanning Window, Hamming Window, Blackman Window, Kaiser Window. - Design of FIR Filters by Frequency Sampling Technique. Realization of FIR filters - Introduction to optimal filters.	[9]
Digital Signal Processors VLIW Architecture - Pipelining - Special Addressing Modes in P-DSPs - On-chip Peripherals - P-DSPs with RISC and CISC - Architecture of TMS320C54 - Internal memory organization, Overflow handling, the carry bit, Dual 16 bit mode -TMS320C67XX DSP Architecture features - DSP Building Blocks - memory space organization - external bus interfacing signal - Memory Interface - Parallel I/O interface Programmed I/O interrupts and I/O Direct Memory Access (DMA).Introduction to Commercial Processors.	[9]
Total Hours (Lect 45 + Tut 15)	60

Text Book(s):

1	Anand Kumar A , Digital Signal Processing", PHI Learning Private Limited, 2015	
2	Mitra S. K. "Digital Signal Processing", Fourth Edition, Mc Graw Hill Education, 2013.	

Reference(s):

1.	Proakis J. G and Manolakis D. G, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, 4th Edition 2007.
2.	Robert J.Schilling& Sandra L.Harris ,' Introduction to Digital Signal Processing using MATLAB', Cengage Learning, 2nd Edition 2013.
3.	Emmanuel C Ifeachor and Barrie W Jervis ,"Digital Signal Processing – A Practical approach" Pearson Education, Second edition, 2002.
4.	Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, 'Discrete – Time Signal Processing', Pearson Education, New Delhi, 2nd Edition 2012

* SDG9 Industry, Innovation, and Infrastructure (SDG 9)

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1	**Introduction to Digital Signal Processing**	
1.7	Basic Concepts of Digital Signal Processing with block diagram	1
1.8	Overview of Typical Digital Signal Processing in Real-World Applications	1
1.9	Representation of Discrete-time Signals	1
1.10	Elementary Discrete-time Signals	1
1.11	Basic Operations on Sequences	1
1.12	Classification of Discrete-time Signals	1
1.13	Classification of Discrete-time Systems	2
1.14	sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect	1
2	**Discrete Time System Analysis**	
2.8	Z-transform and its properties	1
2.9	Inverse *Z*-transform - methods	2
2.10	Stability and Causality	1
2.11	Solution of Difference Equations Using Z-transforms	1
2.12	Impulse Response and Convolution Sum	1
2.13	Circular convolution – Linear convolution of two finite length sequences through circular convolution	2
2.14	Discrete Correlation - Cross Correlation, Autocorrelation	1
3	**Discrete-time Fourier Transform**	
3.9	Relation between Z-transform and Fourier Transform	1
3.10	Discrete-time Fourier Transform (DTFT)	
3.11	Properties of Discrete-time Fourier Transform	2
3.12	Transfer Function	1
3.13	Frequency Response of Discrete-time Systems	1
3.14	Fast Fourier Transform	
3.15	Decimation in Time (DIT) Radix-2 FFT - The 8-point DFT Using Radix-2 DIT FFT - Butterfly Diagram	2
3.16	Decimation in Frequency (DIF) Radix-2 FFT - The 8-point DFT Using Radix-2 DIF FFT - Computation of IDFT through FFT	2
4	**Digital filter design**	
4.8	Infinite-duration Impulse Response (IIR) Filters	1
4.9	Design of IIR Filter by Impulse Invariant Transformation	1
4.10	Design of IIR Filter by the Bilinear Transformation Method	1
4.11	Design of Low-pass Digital Butterworth Filter	1
4.12	Design of Low-pass Chebyshev Filter	1
4.13	FIR Filters	
4.14	Design Techniques for FIR Filters	1
4.15	Design of FIR Filters Using Windows - Rectangular Window, Triangular or Bartlett Window, Hanning Window, Hamming Window, Blackman Window, Kaiser Window.	2
4.16	Design of FIR Filters by Frequency Sampling Technique	1
4.10	Introduction to optimal filters.	1
5	**Digital Signal Processors**	
5.8	Van Neumann architecture	1
5.9	Harvard Architecture	
5.10	VLIW Architecture - Pipelining - Special Addressing Modes in P-DSPs - On-chip Peripherals - P-DSPs with RISC and CISC	2
5.11	Architecture of TMS320C50 - Bus Structure - Central Processing Unit - on chip memory - on chip peripherals - User Maskable Interrupts	2
5.12	Addressing modes	1
5.13	Architecture of TMS320C5	2
5.14	Introduction to Commercial Processors	1

Course Designer(s)

1. N. Rajasekaran – AP/EEE – rajasekaran.n@ksrct.ac.in

60 EE 603	Power System Protection and Switchgear	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To teach the principles and need for protection schemes by different fault current calculations
- To teach different aspects of static relays and numerical protection schemes
- To learn to protect different power equipments like transformer, generator etc.,
- To learn the principles, construction and problems associated with different types of circuit breaker
- To analyze the causes of external faults and thus suitably protect the different electrical apparatus against them

Pre-requisites

- Knowledge on Electrical Machines, Generation, Transmission and Distribution

Course Outcomes

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

CO1	Analyse different types of faults and their effects on the power system and understand the practical significance of protection zones	Analyze
CO2	Understanding the different aspects of static relays and numerical protection schemes	Apply
CO3	Determine the abnormal conditions and apply the various protection schemes to protect the different components of power system.	Apply
CO4	Compare the various types of circuit breakers	Understand
CO5	Identify the causes and explain the usage of protective devices against over voltages.	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	2	2	3	2
CO2	3	3	2	2	2	2	2	2	2	2	2	2	3	2
CO3	3	3	2	2	2	2	2	2	2	2	2	2	3	2
CO4	3	3	2	2	2	2	2	2	2	2	2	2	3	2
CO5	3	3	2	2	2	2	2	2	2	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	10	10	10
Understand	20	20	30
Apply	10	30	30
Analyse	20	-	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S. Rangasamy College of Technology – Autonomous R2022

B.E – Electrical and Electronics Engineering

60 EE 603 – Power System Protection and Switchgear

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

Protective Relays** Principles and need for protective schemes – nature and causes of faults– types of faults - Zones of protection and essential qualities of protection – Protection scheme–electromagnetic relays: over current relays – directional, distance and differential relays: current balance, voltage balance.	[9]
Static and Digital Protection* Static Relays - Block Diagram, Phase and amplitude comparators and their duality, static over current relays: directional, non directional – microprocessor based over current relays: Directional and non directional – Numeric relays: Block Diagram and general working, Comparison between electromechanical and numeric relays – Introduction to Phasor Measurement units - Role of PMU for protection. **Hands on Practice:** Simulation of Over current relay using MATLAB Simulink.	[9]
Apparatus Protection** Review of CT's & PT's - Apparatus protection: Protection of alternator - abnormal conditions – differential protection of Alternator stator winding - balanced earth fault protection by differential system - stator inter turn protection – Transformer protection – Buchcholz relay - earth fault protection - circulating current scheme for transformer protection- Protection of bus bars - transmission lines: time graded over current protection- differential protection, Translay scheme. **Hands on Practice:** Simulation of Bus bar protection using MATLAB Simulink. Simulation of Alternator protection using MATLAB Simulink. Simulation of Transmission line using MATLAB Simulink.	[9]
Theory of Arc Interruption and Circuit Breakers* Physics of arc phenomena: arc initiation, maintenance and interruption - Restriking voltage & Recovery voltage - rate of rise of recovery voltage, current chopping - interruption of capacitive current, resistance switching- Fuses: important terms, HRC fuses, High voltage fuses. Selection of Circuit Breakers - Types of Circuit Breakers – Air blast, oil: Bulk oil and minimum oil, SF6, Vacuum and HVDC circuit breakers – Circuit breaker ratings – Testing of Circuit Breakers – Circuit breaker selection based on applications.	[9]
Protection Against Over Voltages** Causes of Over Voltages- Internal and External – methods of protection against over voltages – ground wires, surge absorbers, surge diverters - neutral grounding: solid grounding, resistance grounding, resonant grounding - insulation coordination.	[9]
Total Hours	45

Text Book(s):

1.	Ravindra P. Singh, "Switch Gear and Power System Protection", PHI learning Private Ltd, New
2.	Bhuvanesh A oza, Nirmal kumar C Nair, Rashesh P Meha, Vijay H Makwana, "Power System Protection and Switch gear", Tata McGraw Hill Private Ltd., 2010.

Reference(s):

1.	Badri Ram, Vishwakarma, "Power System Protection and Switchgear", Tata McGraw Hill Private Ltd, Second Edition, 2017.
2.	Paithankar Y.G and Bhide S.R, "Fundamental of Power System Protection", PHI publisher Pvt Ltd., Second Edition, New Delhi, 2013.
3.	B.Ravindranath, and N. Chander, "Power System Protection & Switchgear", New Age Publishers,
4.	C.L.Wadhwa, Electrical Power Systems, 6th Edition, New Age International (P) Ltd., 2010.

*SDG9 - Industry, Innovation and Infrastructure

** SDG9- Industry, Innovation and Infrastructure & SDG11- Sustainable Cities and Communities

Course Contents and Lecture Schedule

S. No	Topics	No. of Hours
1	**PROTECTIVE RELAYS**	
1.1	Need for protective schemes	1
1.2	Nature and causes of faults	2
1.3	Types of faults	1
1.4	Zones of protection and essential qualities of protection	1
1.5	Protection schemes	1
1.6	Electromagnetic relay	2
1.7	Over current relays	1
2	**STATIC AND DIGITAL PROTECTION**	
2.1	Static relays – Block Diagram	2
2.2	Phase and amplitude comparators and their duality	2
2.3	Static over current relays - Directional, non-directional	1
2.4	Microprocessor based protective relays - Directional, non-directional	2
2.5	Numeric relays –Block Diagram and general working, Comparison between electromechanical and numerical relays	1
2.6	Introduction to phasor measurement units Role of PMU for protection	1
3	**APPARATUS PROTECTION**	
3.1	Protection of alternators & abnormal conditions, stator winding faults and rotor circuit faults	1
	Working principle, merits and demerits of Differential protection	2
3.2	Transformer protection:	2
3.3	Bus bar protection:	1
3.4	Transmission line protection:	2
3.5	Current and potential transformers	1
4	**THEORY OF CIRCUIT INTERRUPTION AND CIRCUIT BREAKERS**	
4.1	Physics of arc phenomena	1
4.2	Arc interruption	1
4.3	Methods of arc extinction	1
4.4	Different voltage conditions associated with circuit breaking:	1
4.5	Current chopping	1
4.6	Resistance switching	1
4.7	Introduction to switch gear	1
4.8	Basic working principle of Circuit breaker	1
	Types of circuit breakers:	
4.9	Testing of circuit breakers Circuit breaker selection based on applications	1
5	**PROTECTION AGAINST OVER VOLTAGES**	
5.1	Causes of over voltages	1
5.2	Lightning - Different types of lightning strokes and effects.	2
5.3	Protection against over voltages: Design & application of Earthing screens	1
5.4	Surge absorbers, Equivalent circuit of Ferranti surge absorber	1
5.5	Surge diverters	2
5.6	Grounding, Definition, significance of grounding and types	2

Course Designer(s)

1. M. Dhanapal – AP/EEE – dhanapalm@ksrct.ac.in

60 EE 604	Power Electronics and Industrial Drives	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To understand the working of various types of power semiconductor devices and its dynamic characteristics
- To comprehend the operation, characteristics of controlled rectifiers and AC voltage controllers
- To learn the different types of inverters and the harmonic reduction methods
- To illustrate the working of different types of DC choppers and its drives
- To study about the Induction motor drives and its control.

Pre-requisites

- Basic knowledge on semiconductors and analog electronics

Course Outcomes

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

CO1	Classify the types of semiconductor devices	Understand
CO2	Analyzethe performance of controlled convertersand AC voltage controllers for various loads	Analyze
CO3	Exemplify the various types of PWM inverters and its harmonic control	Apply
CO4	Discuss the various types of DC Choppers and its control strategies.	Understand
CO5	Delineate the speed control methods for induction motor drives.	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	2	3	-	-	-	-	-	-	2	2	3
CO2	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO3	3	3	3	2	3	-	-	-	-	-	-	2	2	3
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO5	3	3	3	2	3	-	-	-	-	-	-	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	20	30
Understand	20	20	30
Apply	20	20	30
Analyse	10	-	10
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R 2022								
B.E –Electrical and Electronics Engineering								
60 EE 604 - Power Electronics and Industrial Drives								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
VI	3	0	0	45	3	40	60	100

POWER SEMI-CONDUCTOR DEVICES Study of switching devices, Power Diode, SCR, GTO, BJT, MOSFET, IGBT and IGCT- Static characteristics: SCR, MOSFET and IGBT - Triggering and commutation circuit for SCR- Introduction to Driver and snubber circuits.	[9]
CONTROLLED RECTIFIERS AND AC VOLTAGE CONTROLLERS Single phase – Three phase – Half controlled – Fully controlled rectifiers – Dual converters -Effect of source and load inductance - **AC voltage controllers*** –Introduction to Cyclo converters, Matrix converters.	[9]
INVERTERS Single phase and three phase voltage source inverters (both120 mode and 180º mode)– Voltage& harmonic control-PWM techniques: Multiple PWM, Sinusoidal PWM, modified sinusoidal PWM – Introduction to space vector modulation	[9]
DC CHOPPER AND DRIVES Step-down and step-up chopper-control strategy– Introduction to types of choppers-A, B, C, D and E– 4 quadrant operation of chopper fed drive – Switched mode regulators- Buck, Boost, Buck- Boost regulator. **Hands on practice: (MATLAB / Open source)** 1.Controlled converters(Single/ Three phase) 2.Inverters(Single/ Three phase) 3.Multilevel Inverter	[9]
INDUCTION MOTOR DRIVES Review of speed control of 3 phase Induction Motors: Stator voltage / frequency control–-voltage source inverter control- current source inverter control- variable frequency control from voltage source/current source.Introduction to multilevel inverters - Multilevel converter-fed induction motor drive- rotor resistance control-Slip power recovery scheme-static Scherbius drive-static Kramer drive, Introduction of vector or field oriented control.	[9]
Total Hours:	**45**

Text book(s):

1.	Rashid M . H, ‘Power Electronics: Circuits, Devices and Applications’, Pearson Education, Fourth Edition, New Delhi, 2014.
2.	Gopal K.Dubey, “Fundamentals of Electrical Drives”, Narosa Publishing House, New Delhi, 2015

Reference(s):

1.	Bimbra P. S. “Power Electronics” Khanna Publishers, fifth Edition, 2012.
2.	Bimal K. Bose, “Modern Power Electronics and AC Drives”, Pearson Education. (Singapore), Fifth Indian reprint, 2005.
3.	Krishnan R, ‘Electric Motor Drives: “Modeling, Analysis and Control”, Prentice Hall of India Pvt. Ltd, 2002.
4.	Singh M. D., " Power Electronics, Tata McGraw-Hill Education, 2008

* - SDG -7 (Affordable and Clean Energy)

Rev.No. 00 / w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

Course Contents and Lecture Schedule

S. No.	Topics	No. of Hours
1. POWER SEMI-CONDUCTOR DEVICES		
1.9.	Study of switching devices, Power Diode	1
1.10.	SCR-Static characteristics:	1
1.11.	GTO its Static characteristics	1
1.12.	BJT	1
1.13.	MOSFET	1
1.14.	IGBT- Static characteristics:	1
1.15.	IGCT- Static characteristics:	1
1.16.	Triggering and commutation circuit for SCR-	1
1.17.	Introduction to Driver and snubber circuits.	1
2. CONTROLLED RECTIFIERS AND AC VOLTAGE CONTROLLERS		
2.8.	Single phase controlled rectifiers - Half and Fully controlled rectifiers	1
2.9.	Three phase controlled rectifiers - Half and Fully controlled rectifiers	2
2.10.	Dual converters	1
2.11.	Effect of source and load inductance -Single phase	1
2.12.	Effect of source and load inductance-Three phase	1
2.13.	AC voltage controllers	1
2.14.	Introduction to Cyclo converters	1
2.15.	Matrix converters.	1
3.INVERTERS		
3.10.	Single phase voltage source inverters	1
3.11.	Three phase voltage source inverters	1
3.12.	120 º mode of operation and	1
3.13.	180º mode of operation	2
3.14.	Voltage& harmonic control	1
3.15.	PWM techniques: Multiple PWM	1
3.16.	PWM techniques: Sinusoidal PWM, modified sinusoidal PWM	1
3.17.	Introduction to space vector modulation	1
4. DC CHOPPER AND DRIVES		
4.9.	Step-down and step-up chopper	1
4.10.	Control strategy	1
4.11.	Introduction to types of choppers-A, B, C, D and E	2
4.12.	4 quadrant operation of chopper fed drive	1
4.13.	Switched mode regulators	1
4.14.	Switched mode regulators- Buck converter	1
4.15.	Switched mode regulators- Boost converter	1
4.16.	Buck- Boost Buck regulator	1
5. INDUCTION MOTOR DRIVES		
5.8.	Review of speed control of 3 phase Induction Motors: Stator voltage / frequency control	1
5.9.	Voltage source inverter control	1
5.10.	Current source inverter control	1
5.11.	Variable frequency control from voltage source/current source	1
5.12.	Introduction to multilevel inverters	1
5.13.	Multilevel converter-fed induction motor drive	1
5.14.	Rotor resistance control	1
5.15.	Slip power recovery scheme-static Scherbius drive	1
5.16.	Static Kramer drive, Introduction of vector or field oriented control	1

Course Designer(s)

1. Dr.R.Balamurugan – balamurugan@ksrct.ac.in

60 EE 6P1	Power Electronics and Drives Laboratory	Category	L	T	P	Credit
		PC	0	0	3	1.5

Objectives

- To study the VI characteristics of semiconductor switches.
- To observe the waveforms of controlled power converters for various loads
- To acquire knowledge on the design of controlled converter fed DC drives.
- To facilitate the students about speed control of Induction motor using V/F method.
- To design and analyze the three phase induction motor drives

Pre-requisites

- Basic knowledge on semiconductors and analog electronics

Course Outcomes

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

CO1	Illustrate the characteristics of power electronic switches	Apply
CO2	Analyze the performance of the controlled converters for different loads	Apply
CO3	Simulate and analyze the control of DC drives	Apply
CO4	Develop a speed control for Induction motor drives using V/F method	Apply
CO5	Design and simulate the speed control of 3 phase 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	3	3	3	3	3	-	-	-	2	2	2	2	3	3
CO2	3	3	3	3	3	2	1	1	2	2	2	2	3	3
CO3	3	3	3	3	3	2	1	1	2	2	2	2	3	3
CO4	3	3	3	3	3	2	1	1	2	2	2	2	3	3
CO5	3	3	3	3	3	2	1	1	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	-	-	-	-
Apply	50	25	100	100
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E – Electrical and Electronics Engineering								
60 EE 6P1 - Power Electronics and Drives Laboratory								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	0	0	3	45	1.5	60	40	100

List of Experiments:

1. VI characteristics of SCR
2. VI characteristics of MOSFET and IGBT
3. Firing angle control of single phase half and fully controlled converter with R Load.
4. Control of inverter using Single, Multiple and Sinusoidal PWM Techniques.
5. **AC phase control using SCR***
6. Speed control of DC motor using three phase fully controlled converter.
7. Speed control of Induction Motor Drive using V/F Control
8. Simulation of controlled converter fed DC motor drive
9. Simulation of Chopper fed DC motor drive.
10. Simulation of speed control of 3phase Induction motor drive.

Tool: MATLAB

*SDG 7 – Affordable and Clean Energy

Course Designer(s)

1. Dr.R.Balamurugan – balamurugan@ksrct.ac.in

60 EE 6P2	Electrical Appliances Analysis Laboratory	Category	L	T	P	Credit
		PC	0	0	3	1.5

Objectives

- To identify faults in a circuit and check its working status
- To teardown a product and reassemble again
- To understand the design from the disassembled circuit
- To learn about the components and their functionality in a circuit
- To study the component configurations and the connections

Pre-requisites

- Basic Physics, Analog, Digital and Power Electronics

Course Outcomes

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

CO1	Test and service any electrical/electronic circuit	Analyze
CO2	Efficiently disassemble and reassemble a product	Apply
CO3	Develop a model for a new product with advanced features	Apply
CO4	Convert the developed design into a product	Apply
CO5	Enhance the efficiency of the existing product using current technologies	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	3	-	-	1	2	2	-	2	1	-
CO2	3	2	-	3	3	-	-	1	2	-	-	2	-	-
CO3	3	3	2	3	3	3	3	2	2	-	3	3	-	3
CO4	3	3	3	3	3	3	3	2	2	3	3	3	3	3
CO5	3	3	3	3	3	2	3	2	2	3	3	3	3	1
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	75	75
Analyse	25	13	25	25
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	25	100	100

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Electrical and Electronics Engineering								
60 EE 6P2 – Electrical Appliances Analysis Laboratory								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VI	0	0	3	45	1.5	60	40	100

List of Experiments:

1. Test and identify the faults in a given inverter module
2. Service the inverter module.
3. Disassemble a product.*
   i. Extract the design information.
   ii. Draw the circuit.
   iii. Find the connections and power requirements.
   iv. Discuss on the advanced features to be added to the product based on the components and their configurations at optimized cost.

The product for experiment 3 can be chosen from the below list or the student can bring his own product

- Firing Circuit module
- UPS board
- Iron Box
- Water Heater
- Testing boards

*SDG 9 – Industry Innovation and Infrastructure

Course Designer(s)

1. Dr.G.Vijayagowrivijayagowri@ksrct.ac.in

60 EE 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	2
3 - Strong; 2 - Medium; 1 - Some														

Review I (CO1)			Review II (CO2,CO3)			Review III (CO4 and CO5)				(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	Report	**Total**	
10	10	10	10	20	10	10	10	05	**05**	**100**	**60**

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

K.S.Rangasamy College of Technology – Autonomous R 2022								
B.E – Electrical and Electronics Engineering								
60 EE 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 Generating Creative ideas - Idea Sketching, Brainstorming for Ideas, SCAMPER, Creativity and Lateral thinking- Concept Maps and Evaluation	[8]
Soft Prototyping Soft Prototyping - Paper Prototype (low-fidelity), Scenarios and Storyboarding, MVP (minimum Viable product).	[4]
Final Prototyping Medium Prototyping - Proof of Concept (PoC), Info Architecture, Experience Design-Human Factors / Ergonomics - Systems Mapping – high prototyping - 3D Modelling & Printing.	[6]
Usability Studies User Studies – Observation – Conversations - Think-aloud protocol – Feedback – Iterate - Finalise solution.	[8]
Publish the solution 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
Semester VI		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.

Pre-requisites

- 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	-	-	1	2	2	3
CO2	3	3	2	2	-	-	-	-	1	2	2	3
CO3	3	3	2	2	-	-	-	-	1	2	2	3
CO4	3	3	2	2	-	-	-	-	1	2	2	3
CO5	3	3	2	2	-	-	-	-	1	2	2	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

60 MY 004	Disaster Management	Category	L	T	P	Credit
		MC	2	0	0	0

Objectives

- To understand the fundamental concepts of disasters, including hazard, vulnerability, risk, and capacity
- To recognise the different types of natural, biological, technological, and man-made disasters
- To explain the disaster management cycle and apply appropriate strategies for prevention, mitigation, preparedness, response, recovery, and rehabilitation.
- To know the disaster management frameworks and practices in India
- To recognise science, technology, and engineering approaches for disaster risk reduction

Pre-requisites

- Nil

Course Outcomes

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

CO1	Understand basic terms related to disasters, hazards, vulnerability, risk, and disaster management.	Understand
CO2	Recognize different types of natural, biological, technological, and man-made disasters.	Understand
CO3	Know the main stages of the disaster management cycle and the roles of people and authorities during disasters.	Understand
CO4	Summarize the disaster management systems, laws, and institutions in India.	Understand
CO5	Recognize the role of safety practices, science, and technology in reducing disaster risks.	Understand

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-
CO2	1	1	-	-	-	1	1	-	-	-	-	-	-	-	-
CO3	1	1	-	-	-	2	1	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-
CO5	-	-	-	-	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	20	20	-
Understand	40	40	-
Apply	-	-	-
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	-

Rev.No. 00 / w.e.f. 04/01/2026
Passed in BoS Meeting held on 15/12/2025
Approved in Academic Council Meeting held on 03/01/2026

BoS Chairman Signature

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E –Electrical and Electronics Engineering								
60 MY 004 - Disaster Management								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V/VI	3	0	0	30	0	100	-	-

Understanding Disasters Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity – Disaster and Development, and disaster management	[6]
Types, Trends, Causes, Consequences and Control of Disasters Geological Disasters (earthquakes, landslides, tsunami, mining) Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire) Technological Disasters (chemical, industrial, radiological, nuclear) and Man- made Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters	[6]
Disaster Management Cycle and Framework Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development Awareness During Disaster – Evacuation – Disaster Communication – Search and Rescue - Emergency Operation Centre – Incident Command System – Relief and Rehabilitation – Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action	[6]
Disaster Management in India Disaster Profile of India – Mega Disasters of India and Lessons Learnt Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter- Governmental Agencies	[6]
Applications of Science and Technology for Disaster Management Geo-informatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination) Land Use Planning and Development Regulations Disaster Safe Designs and Constructions Structural and Non Structural Mitigation of Disasters S&T Institutions for Disaster Management in India.	[6]
Total Hours:	**30**

Text Book(s):

1.	Coppola D P, 2007. Introduction to International Disaster Management, Elsevier Science (B/H), London.
2.	Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi

Reference(s):

1.	An overview on natural & man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi
2.	World Disasters Report, 2009. International Federation of Red Cross and Red Crescent, Switzerland
3.	Encyclopaedia of disaster management, Vol I, II and IIIL Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006
4.	Disasters in India Studies of grim reality, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur

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 2025-2026)
SEVENTH SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weight age of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1.	60 HS 002	Engineering Economics and Financial Accounting	2	40	60	100	45	100
2.	60 EE 701	Power System Operation and Control	2	40	60	100	45	100
3.	60 EE 702	Electric Mobility	2	40	60	100	45	100
4.	60 EE 703	Embedded Systems	2	50	50	100	45	100
5.	60 EE E3*	Professional Elective – III	2	40	60	100	45	100
6.	60 EE E4*	Professional Elective – IV	2	40	60	100	45	100
7.	60 AB 00*	NCC/NSS/NSO/YRC/ RRC/Fine Arts*	2	100	-	100	45	100
8.	60 AC 001	Research Skill Development	2	100	-	100	-	100
PRACTICAL								
9.	60 EE 7P1	Electrical System Design Laboratory	3	60	40	100	45	100
10.	60 EE 7P2	Project Work Phase – I	3	100	-	100	-	100
11.	60 CG 0P6	Internship	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 the theory end semester examination, 50 marks for theory cum practical end semester examination and 40 marks for practical end semester examination.

Rev.No. 00 / w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025
Signature

BoS Chairman

60 HS 002	Engineering Economics and Financial Accounting	Category	L	T	P	Credit
		HS	3	0	0	3

Objectives

- To know about the economic principles underlying demand, supply, and market structure
- To understand the concept related to types of business organization and types of banking
- To know about concepts in financial accounting and capital budgeting
- To understand the different methods of pricing and appraisal of projects
- To know the application of break-even analysis in engineering projects

Pre-requisites

- NIL

Course Outcomes

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

CO1	Summarize the basic concepts of economics, demand, supply, and market structure	Understand
CO2	Interpret the forms of business organization and functions of commercial and central bank	Understand
CO3	Examine the basis of financial accounting and capital budgeting techniques	Apply
CO4	Demonstrate the different types of pricing strategies and comprehensive project feasibility in diverse business	Apply
CO5	Demonstrate the break even analysis in engineering projects and business	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	2	3	3
CO2	-	-	-	-	-	2	2	-	-	-	3	3	-	3
CO3	-	-	2	3	-	-	-	-	-	-	3	-	2	2
CO4	2	-	-	3	-	2	-	-	-	-	-	3	3	3
CO5	3	3	3	3	-	-	2	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	25	25	35
Understand	35	25	45
Apply	-	10	20
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
Common to Civil, EEE, ECE, CSE, IT, AI&DS, AIML, CSBS, EE (VLSI D&T), BT, FT								
60 HS 002 - Engineering Economics and Financial Accounting								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Basic Economics Definition of Economics – Nature and Scope of Economics, Basic Concepts of Economics, Factors of Production - Definition of Demand – Law of Demand, Exception to Law of Demand, Factors Affecting Demand, Elasticity of Demand, Demand Forecasting – Definition of Supply – Factors Affecting Supply, Elasticity of Supply – Market Structure – Perfect Competition, Imperfect Competition – Monopoly, Duopoly, Oligopoly, and Bilateral Monopoly.	[9]
Organization and Business Financing* Forms of Business – Sole Proprietorship, Partnership, Joint Stock Company, Cooperative Organization, State Enterprise - Mixed Economy - Money and Banking – Kinds of Banking, Functions of Commercial Banks and Central Bank – Definition of Monetary Policy and its Types – Types of financing - Short Term Borrowing, Long Term Borrowing - Internal Generation of Funds – External Commercial Borrowings.	[9]
Financial Accounting and Capital Budgeting The Balance Sheet and Related Concepts – The Profit and Loss Statement and Related Concepts – Financial Ratio Analysis – Definition of Working Capital – Types, Factors – Definition of Capital Budgeting - Techniques – Average Rate of Return, Payback Period, Net Present Value, Profitability Index Method and Internal Rate of Return.	[9]
Cost Analysis Types of Costing – Traditional Costing Approach - Activity Based Costing - Fixed Cost – Variable Cost – Marginal Cost – Cost Output Relationship in the Short Run and in Long Run – Pricing Practice – Full Cost Pricing – Marginal Cost Pricing – Going Rate Pricing – Bid Pricing – Pricing for a Rate of Return – Project Appraisal - Appraisal process, - Cost Benefit Analysis – Feasibility Reports — Technical Feasibility, Economic Feasibility, Financial Feasibility, Managerial Feasibility, Operational Feasibility.	[9]
Break Even Analysis Basic Assumptions –Break-Even Chart – Profit Zone in Break-Even Chart, Loss Zone in Break-Even Chart, Angle of Incidence – Managerial Uses of Break-Even Analysis, Applications of Break-Even Analysis in Engineering Projects.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Khan M.Y., Jain P.K., “Financial Management”, 8rd Edition, McGraw Hill Education, 2018.
2.	Maheshwari K.L., Varshney R.L., “Managerial economics”, 22nd Edition, S Chand and Co., New Delhi, 2018.
Reference(s):	
1.	Samuelson P.A., “ Economics - An Introductory”, 16th Edition, New Age Publications, New Delhi, 2019.
2.	Barthwal R.R., “Industrial Economics - An Introductory”, 4th Edition, New Age Publications, New Delhi, 2021.
3.	Bhattacharyya S. K., John Deardon, “Accounting for Management Text and Cases”, 3rd Edition, S Chand Publication, 2018.

*SDG 9 – Increase Industry Innovation and Infrastructure

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1	**Basic Economics**	
1.1	Definition of economics – nature and scope of economics	1
1.2	Basic concepts of economics, factors of production	1
1.3	Definition of demand – law of demand	1
1.4	Exception to law of demand	1
1.5	Factors affecting demand, elasticity of demand	1
1.6	Demand forecasting	1
1.7	Definition of supply – factors affecting supply,	1
1.8	Elasticity of supply	1
1.9	Market structure – perfect competition, imperfect competition	1
2	**Organization and Business Financing**	
2.1	Forms of business – sole proprietorship, partnership	1
2.2	Joint stock company, cooperative organization, state enterprise	1
2.3	Mixed economy - Money and banking	1
2.4	Kinds of banking	1
2.5	Functions of commercial banks and central bank	1
2.6	Definition of monetary policy and its types	1
2.7	Types of financing	1
2.8	Short term borrowing, long term borrowing	1
2.9	Internal generation of funds	1
3	**Financial Accounting and Capital Budgeting**	
3.1	The balance Sheet and related concepts	1
3.2	The profit and loss statement and related concepts	1
3.3	Financial ratio analysis	1
3.4	Definition of Working capital – types,	1
3.5	Factors	1
3.6	Definition of Capital budgeting - Techniques	1
3.7	Average rate of return, Payback period	1
3.8	Net present value, Profitability index method	1
3.9	Internal rate of return	1
4	**Cost Analysis**	
4.1	Types of costing - Traditional costing approach - activity based costing	1
4.2	Fixed Cost – variable cost – marginal cost	1
4.3	Cost output relationship in the short run and in long run	1
4.4	Pricing practice – full cost pricing	1
4.5	Marginal cost pricing, going rate pricing	1
4.6	Bid pricing – pricing for a rate of return	1
4.7	Project appraisal - appraisal process - Cost benefit analysis –	1
4.8	Feasibility reports -–– technical feasibility, economic feasibility	1
4.9	Financial feasibility, managerial feasibility, operational feasibility.	1
5	**Break Even Analysis**	
5.1	Basic assumptions – break-even chart	2
5.2	Profit zone in break-even chart, Loss zone in break-even chart	2
5.3	Angle of incidence	2
5.4	Managerial uses of break-even analysis	2
5.5	Applications of break-even analysis in engineering projects	1

Course Designer(s)

1. Mr.V.S.Vijayachander - vijayachander@ksrct.ac.in
2. Dr.E.kalaivani - kalaivanie@ksrct.ac.in

60 EE 701	Power System Operation and Control	Category	L	T	P	Credit
		PC	2	1	0	3

Objectives

- To study the system load characteristics and to operate and control the power system.
- To compute the schedule of generating units in an economic way during power system operation.
- To model the power-frequency dynamics and to design the power-frequency controllers.
- To model reactive power-voltage interaction and to maintain voltage profile against varying system load.
- To illustrate the use of SCADA and EMS for monitoring and controlling the power system.

Pre-requisites

- Transmission and Distribution

Course Outcomes

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

CO1	Describe the concept of power system operation based on load characteristics.	Understand
CO2	Determine the economic dispatch and unit commitment problems of generating units.	Apply
CO3	Develop automatic load frequency control and develop mathematical model of two area load frequency control.	Apply
CO4	Apply different voltage control methods for compensating the reactive power and develop mathematical model of excitation systems.	Apply
CO5	Enhance the knowledge in energy control centre for computer control of power system and the various operating states of power system using state estimation and security 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	-	-	3	-	-	2	3	2	2	3	3	2
CO2	3	3	-	-	3	-	2	2	2	2	2	3	3	2
CO3	3	3	-	-	3	-	2	2	2	2	2	3	3	2
CO4	3	3	-	-	3	-	2	2	2	2	2	3	3	2
CO5	3	3	-	-	3	-	2	1	2	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	20	10	30
Understand	20	20	30
Apply	20	30	40
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Rev.No. 00/ w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E – Electrical and Electronics Engineering

60 EE 701 – Power System Operation and Control

Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	2	1	0	45	3	40	60	100

Preliminaries on Power System Operation and Control Power scenario in Indian grid — National and Regional load dispatching centers — requirements of good power system - real power vs frequency and reactive power vs voltage control loops - **system load variation, load curves and forecasting*** — load factor, demand factor, diversity factor, capacity factor, utilization factor - speed load characteristics - regulation of two generators in parallel.	[6]
System Operation Statement of economic dispatch problem –Incremental cost curve – optimal operation of thermal units without and with transmission losses (no derivation of transmission loss coefficients) – base point and participation factors method – statement of unit commitment (UC) problem – constraints on UC problem – solution of UC problem using priority list.	[6]
System Control: Real Power – Frequency Control Load Frequency Control (LFC) of single area system — static and dynamic analysis of uncontrolled and controlled cases - LFC of two area system - tie line modeling – block diagram representation of two area system - static and dynamic analysis - tie line with frequency bias control. **Hands on Training - Simulation of Frequency Control**	[6]
System Control: Reactive Power – Voltage Control Generation and absorption of reactive power - basics of reactive power control — Automatic Voltage Regulator (AVR) – brushless AC excitation system – block diagram representation of AVR loop - static and dynamic analysis – stability compensation. **Hands on Training - Simulation of Voltage Control and Reactive Power Management**	[6]
Computer Control of Power Systems Need of computer control of power systems, concept of energy control center and its functions, system monitoring, data acquisition and control, system hardware configuration, **SCADA and EMS functions****, state estimation problem — measurements and errors.	[6]
Total Hours(30+15)	**45**

Text Book(s):

1.	Allen J. Wood and Bruce F. Wollen berg, —"Power Generation Operation and Control", Wiley India Pvt. Ltd., 3rd Edition, 2013.
2.	Abhijit Chakrabarti & Sunita Halder, "Power System Analysis- Operation & Control", PHI New Delhi, 3rd Edition, 2010.

Reference(s):

1.	B.R.Gupta, and Vandana singhal, —"Power System Operation and Control", S.Chand and company Ltd., New Delhi,
2.	S.Sivanagaraju and G.Sreenivasan, —"Power System Operation and Control", Pearson education, New Delhi, 2010.
3.	Prabha Kundur, —"Power System stability and control", Tata McGraw Hill publishing company Ltd., New Delhi, Third Edition 2012.
4.	D.P.Kothari and I.J.Nagrath," Modern *Power System* Analysis", 4th Edn,. Tata McGraw Hill Education Private Limited2011.

*SDG 12 – Responsible Consumption and Production
**SDG 11 – Sustainable Cities and Communities

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Preliminaries on Power System Operation and Control**	
1.1	Power scenario in Indian grid — National and Regional load dispatching centers — requirements of good power system	1
1.2	Real power vs frequency and reactive power vs voltage control loops	2
1.3	System load variation, load curves and forecasting(Problems)	2
1.4	Load factor, demand factor, diversity factor, capacity factor, utilization factor(Problems)	2
1.5	Speed load characteristics - regulation of two generators in parallel.	2
2.0	**System Operation**	
2.1	Statement of economic dispatch problem –Incremental cost curve (Problems)	2
2.2	Optimal operation of thermal units without and with transmission losses(Problems)	2
2.3	Base point and participation factors method(Problems)	2
2.4	Statement of unit commitment (UC) problem – constraints on UC problem	1
2.5	Solution of UC problem using priority list(Problems)	2
3.0	**System Control: Real Power – Frequency Control**	
3.1	Load Frequency Control (LFC) of single area system	1
3.2	Static and dynamic analysis of uncontrolled and controlled cases	2
3.3	LFC of two area system - tie line modelling	2
3.4	Block diagram representation of two area system	1
3.5	Static and dynamic analysis – tie line with frequency bias control.	1
3.6	**Hands on Training – Simulation of Frequency Control**	2
4.0	**System Control: Reactive Power – Voltage Control**	
4.1	Generation and absorption of reactive power – basics of reactive power control	2
4.2	Brushless AC excitation system	1
4.3	Automatic Voltage Regulator (AVR)	2
4.4	Block diagram representation of AVR loop	1
4.5	Static and dynamic analysis – stability compensation.	1
4.6	**Hands on Training - Simulation of Voltage Control and Reactive Power Management**	2
5.0	**Computer Control of Power Systems**	
5.1	Need of computer control of power systems, concept of energy control center and its functions	2
5.2	System monitoring, data acquisition and control	2
5.3	System hardware configuration	1
5.4	SCADA and EMS functions	2
5.5	State estimation problem — measurements and errors	2

Course Designer(s)

1. S.Jaividhya - jaividhya@ksrct.ac.in

60 EE 702	Electric Mobility	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To appraise the history, challenges types and benefits of Electric vehicle
- To acquire knowledge in energy storage systems and its packing methodology
- To comprehend the concept of BMS/EMS
- To recognize the significance of charging system
- To learn the INDIA N and GLOBAL Scenario

Pre-requisites

- Basic Knowledge on Electrical Machines, Batteries and fuel cell for commercial applications

Course Outcomes

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

CO1	Interpret the types, performance and challenges of existing Electric vehicle	Understand
CO2	Identify the appropriate energy storage system for different electric vehicles	Understand
CO3	Design the novel controller for battery management in electric vehicle	Apply
CO4	Select the appropriate charging station for new launching vehicles	Understand
CO5	Demonstrate the electric vehicle scenario and its business strategy in India and around the globe	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
CO2	3	3	-	-	-	3	3	-	-	-	-	3	3	2
CO3	3	3	-	-	3	3	3	-	-	-	-	3	3	2
CO4	3	3	-	-	3	2	3	-	-	-	-	3	3	2
CO5	-	-	-	-	-	3	3	-	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	20
Understand	40	30	50
Apply	-	10	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022									
B.E – Electrical and Electronics Engineering									
60 EE 702 – Electric Mobility									
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**			
	L	T	P		C	CA	ES	Total	
VII	3	0	0	45	3	40	60	100	

Electric Vehicle Architecture Design* Introduction – Electric drive train - History of Electric Vehicles, Need, Comparison with conventional Technology, Benefits, Performance and EV Challenges in implementation, Electrical design, protection and system requirement, Types of Electric Vehicle and components, Photovoltaic solar based EV design, Battery Electric Vehicle (BEV), Hybrid Electric Vehicle (HEV), Plug-in hybrid vehicle (PHEV), Electrification Level of EV, Calculating the Acceleration Force ,Finding the Total Tractive Effort. Types of drives and their ratings.	[9]
Energy Storage Solutions** Introduction to Energy Storage for Hybrid and Electric Vehicles - Battery, Fuel cell, Types and operation of Fuel cell, Super/Ultra capacitor, Battery Cell Types (Lead Acid/Li/NiMH) and their comparison. Hybridization of different energy storage device, Battery charging and discharging calculation, Cell Selection and sizing, Battery layout design, Battery Pack Configuration, Battery Pack Construction, Battery selection criteria.	[9]
Battery Management System* 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. **Hands-on:** Simulation of Battery Management System	[9]
Electric Vehicles Charging Station**** Type of Charging station, Selection of charging station, Components of charging station, Single line diagram of charging station, Fast charging technologies. **Hands-on:** Simulation of DC Fast Charger for Electric Vehicle	[9]
INDIAN and GLOBAL Scenario*** Technology Scenario, Market Scenario, Policies and Regulations, Payback and commercial model. INTERNATIONAL STANDARD: IEC 61851-1- Electric vehicle conductive charging system – Part 1: General requirements. E-mobility business, E mobility companies in India, Connected, Shared, Autonomous Mobility, Indian Roadmap on EV (FAME), EVs infrastructure in India and Global, Role of e-vehicle in smart grid.	[9]
Total Hours:	**45**

Text Book(s):	
1.	John G. Hayes, G. Abas Goodarzi, Electric Power train: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles, Wiley Publication, 2017.
2.	Chris Mi, M. Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles Principles and Applications with Practical Perspectives, Wiley Publication, 2011.
Reference(s):	
1.	Ehsani M, Gao Y Gay S and Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, CRC Press, 2017.
2.	Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2016.
3.	James Larminie, John Lowry, Electric Vehicle Technology Explained, 2nd Edition, ISBN: 978-1-119-94273- 3 Wiley Publication, September 2012.
4.	https://nptel.ac.in/courses/108103009/

*SDG 7 – Affordable and Clean Energy
**SDG 8 – Decent Work and Economic Growth
***SDG 9 – Industry Innovation and Infrastructure
****SDG11 – Sustainable Cities and Communities

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Electric Vehicle Architecture Design**	
1.1	Introduction – Electric drive train - History of Electric Vehicles, Need	1
1.2	Comparison with conventional Technology, Benefits	1
1.3	Performance and EV Challenges in implementation	1
1.4	Electrical design, protection and system requirement	1
1.5	Types of Electric Vehicle and components	1
1.6	Photovoltaic solar based EV design, Battery Electric Vehicle (BEV)	1
1.7	Hybrid Electric Vehicle (HEV), Plug-in hybrid vehicle (PHEV)	1
1.8	Electrification Level of EV, Calculating the Acceleration Force Finding the Total Tractive Effort	1
1.9	Types of drives and their ratings	1
2.0	**Energy Storage Solutions**	
2.1	Introduction to Energy Storage for Hybrid and Electric Vehicles	1
2.2	Battery, Fuel cell, Types and operation of Fuel cell	1
2.3	Super/Ultra capacitor	1
2.4	Battery Cell Types (Lead Acid/Li/NiMH) and their comparison	2
2.5	Hybridization of different energy storage device, Battery charging and discharging calculation	1
2.6	Cell Selection and sizing, Battery layout design	1
2.7	Battery Pack Configuration, Battery Pack Construction, Battery selection criteria	2
3.0	**Battery Management System**	
3.1	Need of BMS, BMS Topology	1
3.2	BMS Controller, 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	1
3.6	Software-based high-level supervisory control	1
3.7	**Hands-on:** Simulation of Battery Management System	2
4.0	**Electric Vehicles charging station**	
4.1	Type of Charging station	2
4.2	Selection of charging station	2
4.3	Components of charging station	1
4.4	Single line diagram of charging station	1
4.5	Fast Charging technologies.	1
4.6	**Hands-on:** Simulation on DC Fast Charger for Electric Vehicle	2
5.0	**INDIAN and GLOBAL Scenario**	
5.1	Technology Scenario, Market Scenario	1
5.2	Policies and Regulations, Payback and commercial model	2
5.3	INTERNATIONAL STANDARD: IEC 61851-1- Electric vehicle conductive charging system Part 1: General requirements	1
5.4	E-mobility business, E mobility companies in India, Connected, Shared, Autonomous E-mobility	2
5.5	Indian Roadmap on EV (FAME)	1
5.6	EVs infrastructure in India and Global	1
5.7	Role of e-vehicle in smart grid	1

Course Designer(s)

Mr.M.Dhanapal - dhanapalm@ksrct.ac.in

60 EE 703	Embedded Systems	Category	L	T	P	Credit
		PC	3	0	2	4

Objectives

- To analyze the historical evolution of embedded systems, delineating pivotal milestones and their influence on contemporary applications.
- To scrutinize the core components of typical embedded systems, assessing their functionality and interdependencies for optimal configurations.
- To synthesize embedded firmware design principles, integrating hardware components seamlessly to optimize system performance.
- To evaluate the efficacy of Real-Time Operating Systems (RTOS) in managing tasks, processes, and resources within embedded systems.
- To design and implement task communication and synchronization techniques in embedded systems, fostering seamless collaboration between system components.

Pre-requisites

- Microprocessor and Microcontroller
- Electron Devices and Circuits

Course Outcomes

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

CO1	Recognize the historical evolution of Embedded Systems, discerning key advancements and their transformative impact on modern technologies.	Remember
CO2	Identify and differentiate between various hardware components and communication interfaces in typical embedded systems.	Understand
CO3	Design and develop embedded firmware solutions for common components, incorporating essential features.	Apply
CO4	Implement Real-Time Operating Systems (RTOS) for effective task and resource management in embedded system designs.	Apply
CO5	Apply appropriate task communication and synchronization techniques to meet specific embedded system requirements.	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	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	3
CO4	3	-	3	-	-	-	-	-	-	-	-	-	3	-
CO5	-	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	40	-	20	-	-	40	-
Understand	20	-	20	-	-	60	-
Apply	-	50	20	50	50	-	50
Analyse	-	50	-	50	50	-	50
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

Syllabus

<table>
<tr><td colspan="9">K.S.Rangasamy College of Technology – Autonomous R2022</td></tr>
<tr><td colspan="9">B.E – Electrical and Electronics Engineering</td></tr>
<tr><td colspan="9">60 EE 703 - Embedded Systems</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>VII</td><td>3</td><td>0</td><td>2</td><td>75</td><td>4</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="8">Introduction to Embedded Systems*: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.</td><td>[9]</td></tr>
<tr><td colspan="8">Typical Embedded System**: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.</td><td>[9]</td></tr>
<tr><td colspan="8">Embedded Firmware*: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.</td><td>[9]</td></tr>
<tr><td colspan="8">RTOS Based Embedded System Design***: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.</td><td>[9]</td></tr>
<tr><td colspan="8">Task Communication*: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication / Synchronization Issues, Task Synchronization Techniques, Device Drivers, Boot loader, How to Choose an RTOS.</td><td>[9]</td></tr>
<tr><td colspan="8">Practical:
1. Firmware Development with Arduino IDE- blink an LED connected to an Arduino board.
2. FreeRTOS Integration with Arduino- two tasks to blink two LEDs at different rates.
3. Network Simulation with OMNeT++- reate a basic network with nodes and links using OMNeT++.
4. Programming with STM32CubeIDE- simple program to blink an LED connected to an STM32 microcontroller.
5. Task Communication and Synchronization with Arduino- Coordinate access to shared resources between tasks.
6. RTOS Task Scheduling Optimization- Assign priorities to tasks based on their importance and urgency.
Tools used: Arduino IDE / OMNeT++ simulation framework / STM32CubeIDE.</td><td>[30]</td></tr>
<tr><td colspan="8">Total Hours: (Lecture - 45; Practical - 30)</td><td>75</td></tr>
<tr><td colspan="8">Text Book(s):</td><td></td></tr>
<tr><td>1.</td><td colspan="8">Shibu K.V., "Introduction to Embedded Systems", McGraw Hill Education, 2nd Edition, 2019.</td></tr>
<tr><td>2.</td><td colspan="8">Frank Vahid, Tony D. Givargis “Embedded System Design: A Unified Hardware / Software Introduction”, John Wiley & Sons Canada, Limited,2007.</td></tr>
<tr><td colspan="9">Reference(s):</td></tr>
<tr><td>1.</td><td colspan="8">Lyla B. Das “Embedded Systems: An Integrated Approach”, Pearson Education India, 2013, 8131787664, 9788131787663</td></tr>
<tr><td>2.</td><td colspan="8">David E. Simon, “An Embedded Software Primer” –Pearson Education,2009</td></tr>
<tr><td>3.</td><td colspan="8">https://onlinecourses.nptel.ac.in/noc24_cs25/preview</td></tr>
<tr><td>4.</td><td colspan="8">https://www.coursera.org/specializations/real-time-embedded-systems</td></tr>
</table>

*SDG 9 – Industry Innovation and Infrastructure, **SDG 7 – Affordable and Clean Energy ***SDG 11 - Sustainable Cities and Communities

Course Contents and Lecture Schedule

S. No.	Topics	No. of Hours
1	**Introduction to Embedded Systems**	
1.1	Definition of Embedded System	1
1.2	Embedded Systems Vs General Computing Systems	1
1.3	History of Embedded Systems	1
1.4	Classification	1
1.5	Major Application Areas	2
1.6	Purpose of Embedded Systems	2
1.7	Characteristics and Quality Attributes of Embedded Systems	1
2	**Typical Embedded System**	
2.1	Core of the Embedded System	1
2.2	General Purpose and Domain Specific Processors	1
2.3	ASICs, PLDs	1
2.4	Commercial Off-The-Shelf Components (COTS)	1
2.5	Memory: ROM, RAM, Memory according to the type of Interface	1
2.6	Memory Shadowing	1
2.7	Memory selection for Embedded Systems	1
2.8	Sensors and Actuators	1
2.9	Communication Interface: Onboard and External Communication Interfaces	1
3	**Embedded Firmware**	
3.1	Reset Circuit, Brown-out Protection Circuit	2
3.2	Oscillator Unit, Real Time Clock	2
3.3	Watchdog Timer	2
3.4	Embedded Firmware Design Approaches and Development Languages	3
4	**RTOS Based Embedded System Design**	
4.1	Operating System Basics	1
4.2	Types of Operating Systems	2
4.3	Tasks, Process and Threads	2
4.4	Multiprocessing and Multitasking	2
4.5	Task Scheduling	2
5	**Task Communication**	
5.1	Shared Memory, Message Passing	2
5.2	Remote Procedure Call and Sockets	1
5.3	Task Synchronization: Task Communication Synchronization Issues	2
5.4	Task Synchronization Techniques	2
5.5	Device Drivers, Boot loader	1
5.6	How to Choose an RTOS	1
Practical:		
1.	Firmware Development with Arduino IDE blink an LED connected to an Arduino board.	5
2.	Free RTOS Integration with Arduino- two tasks to blink two LEDs at different rates.	5
3.	Network Simulation with OMNeT++- create a basic network with nodes and links using OMNeT++.	5
4.	Programming with STM32CubeIDE- simple program to blink an LED connected to an STM32 microcontroller.	5
5.	Task Communication and Synchronization with Arduino-- Coordinate access to shared resources between tasks.	5
6.	RTOS Task Scheduling Optimization- Assign priorities to tasks based on their importance and urgency.	5

Course Designer(s)

1. Dr.D. Sri Vidhya - srividhya@ksrct.ac.in
2. Mr. A.Thangadurai – thangaduraia@ksrct.ac.in

60 AB 001	National Cadet Corps - AIR WING	Category	L	T	P	Credit
		HS	2	0	2	3*

Objectives

- To designed especially for NCC Cadets
- To develop character, camaraderie, discipline, secular outlook
- To inculcate spiri to adventure, sports manspirit
- 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-requisites

- 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	Knowledge
CO2	Demonstrate the sense of discipline with smartness and have basic knowledge of weapons and their use and handling	Knowledge
CO3	Illustrate various forces and moments acting on aircraft	Apply
CO4	Outline the concepts of aircraft engine and rocket propulsion	Apply
CO5	Design, build and fly chuck gliders/model airplanes and display static models	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	-	-	-	-
CO2	-	-	-	-	3	-	-	-	-	-	-	-	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	1	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	1	-	-	-	-	-	-	-	-	-	-
3 - Strong; 2 - Medium; 1 - Some														

K.S.Rangasamy College of Technology – Autonomous R2022								
Common to ALL Branches								
60 AB 001 - NCC AIR WING								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
VII	**2**	**0**	**2**	**60**	**3***	**100**	**-**	**100**

NCC Organisation and National Integration 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-PakWar-1971- Operation Safed Sagar .National Integration-Unity in diversity- Contribution of you thin nationbuilding-Nationalintegrationcouncil-ImagesandSlogansonNationalIntegration.	[9]
Drill and Weapon Training 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-Sidepace, Pace forwardandtotherear-Markingtime-Drillwitharms-Ceremonialdrill-Guardmounting.(WITHDEMONSTRATION)	[9]
Principles of Flight Laws of motion-Forces acting on aircraft- Bernoulli‟s theorem-Stalling-Primary control surfaces-Secondary control surfaces-Aircraft recognition.	[9]
Aero Engines Introduction of Aero engine-Types of engine- Piston engine- Jet engines-Turboprop engines-Basic Flight Instruments-Modern trends.	[9]
Aero Modeling 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.	[9]
Total Hours	45

Text Books:

1.	“National Cadet Corps- A Concise handbook of NCC Cadets”, Ramesh Publishing House,NewDelhi,2014.

Reference(s):

1.	“Cadets Handbook–Common Subjects SD/SW”,published b yDGNCC,New Delhi.
2.	“Cadets Handbook-Specialized Subjects SD/SW”,published by DGNCC, New Delhi.
3.	“NCCOTA Precise”, published by DGNCC, New Delhi.

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 to100 marks.

Course Designer

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

Rev.No. 00/ w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

60 AB 002	National Cadet Corps – ARMY WING	Category	L	T	P	Credit
		HS	2	0	2	3*

Objectives

- 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.

Pre-requisites

- 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, turnout, 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	Apply
CO5	Acquaint, expose & provide knowledge about Army/Navy/ Air force and to acquire information about expansion of Armed Forces, service subjects and important battles	Understand

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														

K.S. Rangasamy College of Technology – Autonomous R2022								
Common to all Branches								
60 AB 002 – National Cadet Corps (Army Wing)								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VII	2	0	2	45	3*	100	-	100

Content	Hours
NCC Organization & National Integration 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 - Unity in diversity- contribution of youth in nation building- national integration council- Images and Slogans on National Integration	[09]
Basic Physical Training & Drill 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).	[09]
Weapon Training Main Parts of a Rifle- Characteristics of .303 rifle- Characteristics of .22 rifle- loading and unloading – position and holdingsafety 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.	[09]
Social Awareness and Community Development 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 programmes - 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	[09]
Specialized Subject (ARMY) 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.	[09]
Total Hours	**45**

Text Book(s):	
1.	National Cadet Corps- A Concise handbook of NCC Cadets by Ramesh Publishing House, New Delhi, 2014
2.	Cadets Handbook- Specialized Subjects SD/SW published by DG NCC, New Delhi ,2014
Reference(s):	
1.	"Cadets Handbook – Common Subjects SD/SW" by DG NCC, New Delhi,2019
2.	"Cadets Handbook – Specialised Subjects SD/SW" by DG NCC, New Delhi,2017

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	Comply with 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**

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* Types of Research - Identification and Clarification of the problem – Formulating hypothesis, Selection of sample and tools of data collection - Testing the hypothesis - Conclusion	[3]
Manuscript Preparation* Structure of a manuscript - Types of manuscript - Graphical abstract - Highlights - Literature Review - Citation - Reference style - Plagiarism – Journal selection - Peer review process	[3]
Research Toolkit* Software Tools for Writing enhancement - Literature review - Reference management - Data analysis and visualization - Drawing - Plagiarism	[3]
Research Publication Metrics* 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* 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 - 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 Score	1
4.3	Quality 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

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

60 EE 7P1	Electrical System Design laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

Objectives

- Understand the modeling and computation of transmission line parameters for analyzing steady-state power system behavior.
- Gain knowledge of load flow and fault analysis techniques using computational tools for system planning and protection.
- Learn the principles of protective relay design for safeguarding power system components during abnormal conditions.
- Understand the concepts of economic dispatch and unit commitment for achieving optimal generation scheduling.
- Familiarize with load frequency control and transient stability analysis to appreciate the importance of system reliability and dynamic performance.

Pre-requisites

- Power system analysis, Transmission and Distribution

Course Outcomes

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

CO1	Calculate and model transmission line parameters for different types of power lines.	Apply
CO2	Perform load flow and fault analysis using computational tools and interpret system behavior.	Analyse
CO3	Design and evaluate protective relay settings for various fault scenarios.	Analyse
CO4	Solve economic load dispatch and unit commitment problems to optimize generation cost and scheduling.	Apply
CO5	Analyze frequency control and transient stability for ensuring reliable and stable power system operation.	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	3	-	-	-	-	-	-	2	3	3
CO2	3	3	3	2	3	-	-	-	-	-	-	2	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	2	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	2	3	3
CO5	2	3	3	3	3	-	-	-	-	-	-	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

Rev.No. 00/ w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Electrical and Electronics Engineering								
60 EE 7P1 - Electrical System Design laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	0	0	4	60	2	60	40	100

List of Experiments:

1. Computation of transmission line parameters
2. Modelling of Transmission line
3. Power flow analysis of IEEE 5 Bus system
4. Load flow analysis using computational method
5. Short circuit analysis for Symmetrical and Asymmetrical fault
6. Economic load dispatch
7. Unit commitment solution
8. Load frequency control of a single area Power System
9. Transient Stability analysis of single machine connected to an infinite bus
10. Design and analysis of protective relays

Lab Manual

1.	"Electrical System Design", Department of Electrical and Electronics Engineering, KSRCT.

*SDG 9 – Industry Innovation and Infrastructure

Course Designer(s)

1. Mr.N.Rajasekaran – rajasekaran.n@ksrct.ac.in

Rev.No. 00/ w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

60 EE 7P2	Project Work Phase I	Category	L	T	P	Credit
		PC	0	0	4	2

Objectives

- To apply the knowledge/concepts acquired in the lower semesters to create/design/implement project relevant to the field of Electrical and Electronics Engineering
- To acquire collaborative skills through working in a team to achieve common goals
- To search for related area in which the members are going to do their project
- To identify right project work, acquiring knowledge on that area, making preliminary works towards phase II of the project work
- 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

Pre-requisites

Nil

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.	Apply
CO4	Carryout partial design of the system	Apply
CO5	Prepare and present the project report	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	3	3	2	2	2	3	3	3	3	3	3
CO2	2	3	3	3	3	2	2	2	3	3	3	3	3	3
CO3	2	3	3	3	3	2	2	2	3	3	3	3	3	3
CO4	3	3	3	3	3	2	2	1	3	3	3	3	3	2
CO5	3	3	3	3	3	2	2	2	3	3	3	3	3	3

3 - Strong; 2 - Medium; 1 - Some

Methodology	• Three reviews have to be conducted by the committee of minimum of three members one of which should be the guide. • Problem should be selected. • Students have to collect about 20 papers related to their work. • Report has to be prepared by the students as per the format. • Preliminary implementation can be done if possible • Internal evaluation has to be done for 100 marks.

(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

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R2022</th></tr>
<tr><th colspan="9">B.E - Electrical and Electronics Engineering</th></tr>
<tr><th colspan="9">60 EE 7P2 – Project Work Phase I</th></tr>
<tr><th rowspan="2">Semester</th><th colspan="3">Hours/Week</th><th rowspan="2">Total Hrs</th><th>Credit</th><th colspan="3">Maximum Marks</th></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>0</td><td>0</td><td>4</td><td>60</td><td>2</td><td>100</td><td>-</td><td>100</td></tr>
<tr><td colspan="9">Assessment Methodology:
1. Project work Phase I shall be evaluated by the project review committee (Project Coordinator, Project Guide and HoD / Subject expert in the department)
2. 3 Reviews shall be conducted with subject expert and student(s) shall make a presentation on the progress made by him / her / them during the reviews
3. Student(s) shall submit a project technical report comprising of title, problem statement, importance of work, modifications, proof of concept, methodology and review of literature during the third review
4. The total marks obtained in the 3 reviews shall be reduced to 100 marks and rounded to the nearest integer
5. The schedule will be announced by the project coordinator and head of the department</td></tr>
</table>

Course Designer(s)

1. Ms.S. Jaividhya – jaividhya@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 2025-2026)
EIGHTH SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weight age of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY CUM PRACTICAL								
1.	60 EE E5*	Professional Elective – V	2	50	50	100	45	100
PRACTICAL								
2.	60 EE 8P1	Project Work Phase – II	3	60	40	100	45	100
3.	60 CG 0P6	Internship	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 the theory end semester examination, 50 marks for theory cum practical end semester examination and 40 marks for project end semester examination.

60 EE 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 4 members on a project involving theoretical and experimental studies related to the branch of study.
- To have guidance for an every project team, by the faculty member of the concerned department.
- To receive the directions from the guide, on library reading, laboratory work, computer analysis 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

Pre-requisites

Nil

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 evaluate ideas and information	Analyse
CO2	Apply these skills to the project	Analyse
CO3	Design the project work	Apply
CO4	Model and fabricate the project work	Evaluate
CO5	Prepare and present the project work along with report	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	3	3	2	2	2	3	3	3	3	3	3
CO2	2	3	3	3	3	2	2	2	3	3	3	3	3	3
CO3	2	3	3	3	3	2	2	2	3	3	3	3	3	3
CO4		3	3	3	3	2	2	1	3	3	3	3	3	2
CO5	3	3	3	3	3	2	2	2	3	3	3	3	3	3

3 - Strong; 2 - Medium; 1 - Some

Methodology	• Three reviews have to be conducted by the committee of minimum of three members one of 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 external expert examiner within the college). • The project report should be submitted by the students around at the first week of April

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E - Electrical and Electronics Engineering								
60 EE 8P1 – Project Work Phase II								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VIII	0	0	16	240	8	60	40	100

Assessment Methodology:

The objective of project work and dissertation is to enable the students to extend further investigative a study on the project.

1. 3 Reviews conducted by project review committee (Project Coordinator, Project Guide and HoD / Subject expert in the department)
2. Student(s) shall make a presentation on the progress made by him / her / them during the reviews
3. Student(s) shall submit a project technical report comprising of title, problem statement, importance of work, methodology, experimental work and outcome of the work carried out during the third review
4. The work carried out may be either under the guidance of the supervisor from the department or jointly with a supervisor drawn from other department / academic institutions / R&D laboratory / Industry
5. The project reviews (R1 + R2+R3+R4) shall carry a maximum of 60 marks
6. The project report shall be submitted as per the approved guidelines given by the college, the viva-voce examination shall carry 40 marks
7. Marks are awarded to each student of the project group based on the individual performance in the viva-voce examination

Course Designer(s)

1. Ms.S. Jaividhya – jaividhya@ksrct.ac.in

Project Work Phase II UG:
(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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PROFESSIONAL ELECTIVES (PE)

SEMESTER V, Professional Elective I

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 EE E11	Renewable Energy Sources	PE	3	3	0	0	3
2.	60 EE E12	Sensor Technology and Applications	PE	3	3	0	0	3
3.	60 EE E13	Utilization and Conservation of Electrical Energy	PE	3	3	0	0	3
4.	60 EE E14	Design of Electrical Apparatus	PE	3	3	0	0	3
5.	60 EE E15	Embedded System Design	PE	3	3	0	0	3
6.	60 EE E16	Network Analysis and Synthesis	PE	3	3	0	0	3
7.	60 EE E17	Electric Vehicle Architecture	PE	3	3	0	0	3

60 EE E11	Renewable Energy Sources	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To gain the knowledge of fundamentals and main characteristics of renewable energy sources.
- To illustrate the performance of solar, wind and Bio energy
- To Enrich the knowledge of ocean and geothermal energy sources
- To Motive the concept of battery charging Techniques and grid connected system
- To identify the recent technologies in renewable energy systems.

Pre-requisites

- Nil

Course Outcomes

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

CO1	Estimate the solar energy, Utilization of it, Principles involved in solar energy collection and conversion of it to electricity generation.	Apply
CO2	Explore the concepts involved in wind energy conversion system by studying its components, types and performance.	Understand
CO3	Acquire the knowledge of Bio energy and various other renewable energy sources	Understand
CO4	Illustrate the concept of grid connected and battery charging Techniques	Understand
CO5	Recollect the knowledge of recent renewable sources of fuel cell and hydrogen energy and Energy Economics	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	-	-	-	-	-	-	3	3	3
CO2	3	3	2	2	3	-	-	-	-	-	-	3	3	3
CO3	3	3	2	2	3	-	-	-	-	-	-	3	3	3
CO4	3	3	2	2	3	-	-	-	-	-	-	3	3	3
CO5	3	3	2	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	20	20	30
Understand	20	40	30
Apply	20	-	40
Analyse	-	-	
Evaluate	-	-	-
Create	-	-	-
Total	**60**	**60**	**100**

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Passed in BoS Meeting held on 11/06/2025
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BoS Chairman Signature

K.S.Rangasamy College of Technology – Autonomous R2022								
60 EE E11- Renewable Energy Sources								
Electrical and Electronics Engineering								
Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100

Content	Hours
Solar Energy Introduction - Solar radiation at the earth's surface-Solar Radiation measurements -Estimation of average solar Radiation. **Solar energy collectors- Classifications-Flat plate collectors-Concentrating collectors -Comparison. Solar greenhouse- Solar thermal Electric power plant. Principles of photovoltaic conversion – PV system components – types of solar cells– PV cell – module and array –array design***- equivalent circuit – I-V and P-V characteristics. Solar Photo Voltaic applications. **Hands on Practice:** Simulation of Solar PV System using SIMULINK	[9]
Wind Energy Introduction - **Basic principles of wind energy conversion***: Nature of the wind, power in the wind, forces on the blades - wind data and energy estimation-site selection-**classification of wind energy conversion systems Advantages and Disadvantages-Types of wind machines-Horizontal axis machine-Vertical axis machine Generating System-Energy Storage***– Application of wind energy-Safety and environmental aspects.	[9]
Other Renewable Energy Sources* Bio energy - Introduction Biomass conversion technologies – types of bio gas plants - applications –Biomass energy programme in India. Tidal energy – Basic principle of tidal power – components and operations of tidal power plant- Geothermal energy - Geothermal Sources – Prospects of geothermal energy in India - Ocean energy resources – principles of ocean thermal energy conversion (OTEC) – Methods of Ocean thermal electric power generation- Impact of renewable energy generation on environment, Kyoto protocol, Carbon Credit, CDM.	[9]
Stand Alone and Grid Connected Systems **Basics of stand-alone and grid-connected systems (for Solar PV and wind) – hybrid systems***– Need for Hybrid Systems - Range and type of Hybrid systems - synchronization with grid – system sizing - **Battery – types - Battery charging and charge regulator*** **Hands on Practice:** Simulation of grid connected wind energy conversion system using SIMULINK	[9]
Storage Systems & Energy economics **Fuel cells-Hydrogen energy- Small hydro resources - Super capacitors – Ultra Flywheel mechanism for storage - basic operation and schematic only***. Fundamentals and methodology of evaluation of energy economics	[9]
Total Hours	45

Text Book(s):

1.	Rai G. D , “ Non-Conventional Energy Sources”, Khanna Publishers,2002
2.	Khan B. H, "Non-Conventional Energy Resources”, Tata Mc Graw Hill, Third Edition, 2017.

Reference(s):

1.	Shobh Nath Singh “Non-Conventional Energy Resources” Pearson India, 2015
2.	Thipse S S “Non Conventional and Renewable Energy Sources” Alpha Science International Limited, 2014
3.	Alpha Science International Limited “Renewable Energy Resources” Taylor & Francis 2015.
4.	Dr. Navani J P, “Non-Conventional Energy Resources” S CHAND & Company Limited, 2015
5.	https://onlinecourses.nptel.ac.in/noc23_ge47

* SDG 7 – (Affordable and Clean Energy)

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Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

Course Contents and Lecture Schedule

S.No	Topics	No. of Hours
1	**Solar Energy**	
1.1	Introduction - Solar radiation at the earth's surface	1
1.2	Solar Radiation measurements	1
1.3	Estimation of average solar Radiation	1
1.4	Solar energy collectors- Classifications-Flat plate collectors-Concentrating collectors -Comparison.	2
1.5	Solar greenhouse- Solar thermal Electric power plant.	1
1.6	Principles of photovoltaic conversion – PV system components	1
1.7	Types of solar cells– PV cell – module and array –array design -	1
1.8	Equivalent circuit – I-V and P-V characteristics. Solar Photo Voltaic applications.	1
2	**Wind Energy**	
2.1	Introduction	1
2.2	Basic principles of wind energy conversion: Nature of the wind, power in the wind, forces on the blades	1
2.3	Wind data and energy estimation	1
2.4	Site selection	1
2.5	classification of wind energy conversion systems -Advantages and Disadvantages	1
2.6	Types of wind machines- Horizontal axis machine	1
2.7	Vertical axis machine Generating System	1
2.8	Energy Storage	1
2.9	Application of wind energy-Safety and environmental aspects.	1
3	**Other Renewable Energy Sources**	
3.1	Bio energy - Introduction Biomass conversion technologies	1
3.2	types of bio gas plants - applications	1
3.3	Biomass energy programme in India	1
3.4	Tidal energy	1
3.5	Basic principle of tidal power – components and operations of tidal power plant	1
3.6	Geothermal energy - Geothermal Sources – Prospects of geothermal energy in India	1
3.7	Ocean energy resources – principles of ocean thermal energy conversion (OTEC) – Methods of Ocean thermal electric power generation-	1
3.8	Impact of renewable energy generation on environment,	1
3.9	Kyoto protocol, Carbon Credit, CDM.	1
4	**Stand Alone and Grid Connected Systems**	
4.1	Basics of stand-alone and grid-connected systems (for Solar PV).	1
4.2	Basics of stand-alone and grid-connected systems (for wind)	1
4.3	Hybrid systems – Need for Hybrid Systems - Range	1
4.4	Type of Hybrid systems	1
4.5	synchronization with grid	1
4.6	System sizing	1
4.7	Battery – types	2
4.8	Battery charging and charge regulator	1
5	**Storage Systems & Energy economics**	
5.1	Fuel cells	1
5.2	Hydrogen energy	2
5.3	Small hydro resources	1
5.4	Super capacitors	2
5.5	Ultra Flywheel mechanism for storage - basic operation and schematic only	2
5.6	Fundamentals and methodology of evaluation of energy economics	1

Course Designers

1. R.Radhamani - radhamani@ksrct.ac.in

60 EE E12	Sensor Technology and Applications	Category	L	T	P	Credit
		OE	3	0	0	3

Objectives

- To impart the knowledge on the functional aspects of various sensor
- To educate about the working of various types of sensors.
- To define the various electronic circuit interfaces with sensors for different applications.
- To infer about the fundamental working of digital and semiconductor sensors
- To transmit knowledge about latest sensors.

Pre-requisites

- Physics for Electrical Engineering and Analog Electronics

Course Outcomes

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

CO1	Recall the fundamentals about sensors and its characteristics	Remember
CO2	Illustrate the working of various sensors	Understand
CO3	Interface the various Electronic Circuits for different sensors	Apply
CO4	Propose about necessity for digital and semiconductor sensors.	Understand
CO5	Acquire knowledge on the latest sensors.	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	-	-	-	2	2	2	2	2	2
CO2	3	3	3	-	3	-	-	-	-	-	2	2	2	2
CO3	3	3	3	-	3	2	-	2	2	-	2	2	2	2
CO4	3	3	3	-	3	-	-	-	-	-	2	2	2	2
CO5	2	2	2	-	2	-	2	-	2	-	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	20	20	34
Understand	40	30	60
Apply	-	10	06
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E – Electrical and Electronics Engineering

60 EE E12 – Sensor Technology and Applications

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

Sensors Fundamentals and Characteristics Sensor, actuator and transducer, Signals and Systems- Sensor Classification: passive and active Sensor, absolute and relative Sensor, Units of Measurements - Sensor Characteristics: Transfer Function, Calibration, Nonlinearity, Saturation Repeatability, Dead Band, Resolution.	[9]
Principle of Sensing & Transduction Mechanical and Electromechanical sensor, Resistive(potentiometric type), Strain gauge -Inductive sensor: common types- Reluctance change type, Capacitive Sensors, Thermal Sensors, Magnetic Sensors, Proximity Sensor and its smart phone applications, Piezoelectric Effect.	[9]
Interface Electronic Circuits Input Characteristics of Interface Circuits, Amplifiers, Excitation Circuits, Analog to Digital Converters, Direct Digitization and Processing, Bridge Circuits, Data Transmission, Batteries for Low Power Sensors.	[9]
Digital and Semiconductor Sensors Position Encoders and application in conveyor systems, Resonant Sensors, SAW Sensors, Sensors Based on Semiconductor Junctions, Sensors Based on MOSFET Transistors, Charge-Coupled and CMOS Image Sensors, Fiber-Optic Sensors, Ultrasonic based Sensors and its liquid level measurement applications, Biosensors. **Hands - on:** 1. Ultrasonic Distance Sensor in Arduino with Tinkercad	[9]
Latest Sensors * IoT sensors, green- IoT Sensors, prospects and challenges for smart sensors, Pollution sensors, RFID sensors, Wearable sensors and its biomedical applications, Optical Image sensors, Biometric sensors and its usage in authentication applications, Printed sensors and MEMS. **Hands - on:** 1. IoT Sensor(LED) Circuit with Tinkercad	[9]
Total Hours:	**45**

Text Book(s):

1.	Patranabis D, “Sensors and Transducers”, 2nd Edition, PHI, New Delhi, 2022.
2.	Sawney A K, Puneet Sawney, “A Course in Mechanical Measurements and Instrumentation and Control”, 12th Edition, Dhanpat Rai and Co, New Delhi, 2017.

Reference(s):

1.	Sinha G R, “Advances in Modern Sensors, Physics, design, simulation and Applications” , IOP science, 2020
2.	Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs and Applications", 5th Edition, Springer, 2016.
3.	Ernest O Doebelin, “Measurement Systems – Applications and Design”, Tata McGraw-Hill, 2009.
4.	Walter Lang, “Sensors and Measurement Systems”, 2nd Edition, River Publishers, 2021.
5.	https://nptel.ac.in/courses/108106193 https://onlinecourses.nptel.ac.in/noc21_ee32/preview https://archive.nptel.ac.in/courses/106/105/106105166/ https://www.coursera.org/learn/sensor-manufacturing-process-control/home/welcome

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule

S. No.	Topics	No. of Hours
1	**Sensors Fundamentals and Characteristics**	
1.1	Sensor, actuator and transducer	2
1.2	Signals and Systems; Sensor Classification: passive and active Sensor	2
1.3	Absolute and relative Sensor, Units of Measurements	2
1.4	Sensor Characteristics: Transfer Function, Calibration, Nonlinearity	2
1.5	Saturation Repeatability, Dead Band, Resolution.	1
2	**Principle of Sensing & Transduction**	
2.1	Mechanical and Electromechanical sensor	2
2.2	Resistive(potentiometric type), Strain gauge	1
2.3	Inductive sensor: common types	2
2.4	Reluctance change type ,Capacitive Sensors, Thermal Sensors	2
2.5	Magnetic Sensors, Proximity Sensor and its smart phone applications, Piezoelectric Effect	2
3	**Interface Electronic Circuits**	
3.1	Input Characteristics of Interface Circuits, Amplifiers	2
3.2	Excitation Circuits	1
3.3	Analog to Digital Converters, Direct Digitization and Processing	2
3.4	Bridge Circuits, Data Transmission	2
3.5	Batteries for Low Power Sensors	2
4	**Digital and Semiconductor Sensors**	
4.1	Position Encoders and application in conveyor systems, Resonant Sensors, SAW Sensors	2
4.2	Sensors Based on Semiconductor Junctions	1
4.3	Sensors Based on MOSFET Transistors	1
4.4	Charge-Coupled and CMOS Image Sensors	2
4.5	Fiber-Optic Sensors, Ultrasonic based Sensors and its liquid level measurement applications, Biosensors	2
4.6	Hands - on: Ultrasonic Distance Sensor in Arduino with Tinkercad	1
5	**Latest Sensors**	
5.1	IoT sensors	1
5.2	Green- IoT Sensors, prospects and challenges for smart sensors	2
5.3	Pollution sensors, RFID sensors	2
5.4	Wearable sensors and its biomedical applications, Optical Image sensors,	2
5.5	Biometric sensors and its usage in authentication applications, Printed sensors and MEMS	1
5.6	Hands - on: IoT Sensor(LED) Circuit with Tinkercad	1

Course Designer(s)

1. Dr.R.Balamurugan – balamurugan@ksrct.ac.in

60 EE E13	Utilization and Conservation of Electrical Energy	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To acquire knowledge about utilization of electrical energy for various illuminations.
- To calculate the energy efficiency in thermal utilities
- To Estimate the energy efficiency in Electrical utilities
- To import the knowledge of energy audit and management
- To distinguish the various energy audit instruments

Pre-requisites

- Nil

Course Outcomes

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

CO1	Evaluate the illumination system and design the lighting schemes	Apply
CO2	Determine the energy conservation in thermal utilities	Apply
CO3	Identify and analyze the energy conservation/saving opportunities in different electric utilities	Apply
CO4	Interpret the procedure for energy audit	Understand
CO5	Identify the instruments used in energy audit 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	2	1	-	-	-	-	-	-	-	3	1
CO2	3	3	3	2	1	-	-	-	-	-	-	-	3	1
CO3	3	3	3	2	1	-	-	-	-	-	-	-	3	1
CO4	3	3	3	3	1	-	-	-	-	-	-	-	3	1
CO5	3	3	3	2	1	-	-	-	-	-	-	-	3	1
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	20	40
Apply	30	20	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	**60**	**60**	**100**

K. S. Rangasamy College of Technology – Autonomous 2018									
60 EE E13 - Utilization and Conservation of Electrical Energy									
Electrical and Electronics Engineering									
Professional Elective - I									
Semester	**Hours/Week**			**Total hrs**	**Credit**	**Maximum Marks**			
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**	
V	3	0	0	45	3	40	60	100	

Illumination* Nature of radiation –Definitions – Cosine law of illumination – Polar curves – Lighting calculations- Design of simple illumination systems- Outdoor lighting schemes: Street Lighting, Flood lighting- Indoor lighting schemes: Factory hall lighting - Types of lamps: Arc, Incandescent and Discharge - Energy efficient lamps. **Hands on Practice:** Design of illumination system for outdoor lighting schemes using MATLAB	9
Energy Efficiency in Thermal Utilities* Fuels and combustion -Boilers-Steam systems- Furnaces - HVAC, Refrigeration and Air Conditioning, Co-generation, Tri-generation & Waste Energy Recovery – Gas based generation systems.	9
Energy Efficiency in Electrical Utilities* Electrical system - Electrical motors - Fans and Blowers and Variable speed drives - Pumps - Compressors - Lighting system Case study: Motor efficiency testing, Monitoring of power and energy usage of electrical machines by power quality analyser - Access the condition of electrical motor by thermal imager – Power quality issues in industries – Power quality standards of ZED	9
General Aspects of Energy Management and Energy Audit* Definition and Objective of Energy Management - Tips for Energy Conservation - Energy Audit: Need, Types, Methodology and Approach - Procedures and Techniques - Energy Policy Planning and Implementation - Instruments for Energy Audit - Energy auditing in lighting - Energy monitoring and targeting.	9
Energy Audit Instruments* Basic measurements – Electrical measurements, Light, Pressure, Temperature and heat flux, Velocity and Flow rate, Vibrations-Instruments Used in Energy systems: Load and power factor measuring equipment's, Wattmeter, flue gas analysis, Temperature and thermal loss measurements, air quality analysis **Hands on Practice:** Energy Monitoring and targeting using MATLAB	9
Total Hours	**45**

Text book(s):

1.	Wadhwa C L, "Generation, Distribution and Utilization of electric energy", New age International Publications 2015.
2.	BEE, "General aspect of energy management and energy audit, Energy efficiency in electrical utilities energy performance assessment for equipment & utility systems" - Bureau of Energy Efficiency, New Delhi, India, fourth edition, 2015.

Reference(s):

1.	Sivaganaraju, S, "Electric Energy Generation, Utilisation and Conservation" Pearson, New Delhi, 2012.
2.	Albert Thumann, Terry Niehus and William J. Younger, "Handbook of Energy Audits", Fairmont Press.
3.	Abbi Y P, "Handbook on Energy Audit and Environment Management", Teri Press. 2014.
4.	http://www.cercind.gov.in/Act-with-amendment.pdf

* SDG 12 - Responsible Production and Consumption

Course Contents and Lecture Schedule

S. No.	Topics	No. of Hours
1.Illumination		
1	Nature of radiation –Definitions	1
2	Cosine law of illumination	1
3	Polar curves – Lighting calculations	1
4	Design of simple illumination systems	1
5	Outdoor lighting schemes: Street Lighting	1
6	Flood lighting- Indoor lighting schemes:	1
7	Factory hall lighting	1
8	Types of lamps: Arc, Incandescent and Discharge	1
9	Energy efficient lamps	1
2. Energy Efficiency in Thermal Utilities		
1	Fuels and combustion	1
2	Boilers	1
3	Steam systems	1
4	Furnaces	1
5	HVAC, Refrigeration and Air Conditioning	1
6	Co-generation, Tri-generation	1
7	Waste Energy Recovery	1
8	Gas based generation systems	2
3. Energy Efficiency in Electrical Utilities		
1	Electrical system	1
2	Electrical motors	1
3	Fans and Blowers - Variable speed drives	1
4	Pumps - Compressors	1
5	Lighting system Case study	1
6	Motor efficiency testing, Monitoring of power and energy usage of electrical machines by power quality analyser	1
7	Access the condition of electrical motor by thermal imager	1
8	Power quality issues in industries	1
9	Power quality standards of ZED	1
4. General Aspects of Energy Management and Energy Audit		
1	Definition and Objective of Energy Management - - - - - -	1
2	Tips for Energy Conservation	1
3	Energy Audit: Need, Types, Methodology and Approach	1
4	Procedures and Techniques	2
5	Energy Policy Planning and Implementation	1
6	Instruments for Energy Audit	1
7	Energy auditing in lighting	1
8	Energy monitoring and targeting	1
1. Energy Audit Instruments*		
1	Basic measurements – Electrical measurements	1
2	Light, Pressure & Temperature measurement	2
3	Heat flux, Velocity and Flow rate	1
4	Vibrations-Instruments Used in Energy systems	1
5	Load and power factor measuring equipment’s	1
6	Wattmeter, flue gas analysis	1
7	Temperature and thermal loss measurements	1
8	air quality analysis	1

Course Designer(s)

1. Dr. M. K. Elango elango@ksrct.ac.in

60 EE E14	Design of Electrical Apparatus	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To impart the knowledge on the complete design of DC machines
- To introduce the basic design concepts and cooling arrangement of transformers
- To transfer the knowledge on the design of Induction machines
- To impart the design concepts of Synchronous machines
- To apply the open source tools for the design of all kinds of electrical machines

Pre-requisites

- Knowledge on DC and AC Electrical Machines, Transformers

Course Outcomes

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

CO1	Discuss the factors influencing the designing of electrical machines.	Understand
CO2	Determine the main dimensions and various parameters of DC machines.	Apply
CO3	Determine the main dimensions and various parameters of transformers.	Apply
CO4	Design the main dimensions and various parameters of Induction machine.	Analyse
CO5	Design the dimensions of synchronous machines based on given Parameters.	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	2	2	2	2	2	2	2	2	2	2	3	-
CO2	3	3	2	2	2	2	2	2	2	2	2	2	3	-
CO3	3	3	2	2	2	2	2	2	2	2	2	2	3	-
CO4	3	3	2	2	2	2	2	2	2	2	2	2	3	-
CO5	3	3	2	2	2	2	2	2	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	10
Understand	20	20	30
Apply	10	10	30
Analyse	20	20	30
Evaluate	-	-	-
Create	-	-	-
Total	**60**	**60**	**100**

BoS Chairman Signature

K.S.Rangasamy College of Technology – Autonomous R2022								
60 EE E14 - Design of Electrical Apparatus								
B.E – Electrical and Electronics Engineering								
Semester	**Hours/Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
V	3	0	0	45	3	40	60	100

INTRODUCTION Major considerations in Electrical Machine Design - Electrical Engineering Materials – Space factor – Choice of Specific Electrical and Magnetic loadings – Thermal considerations - Heat flow – Temperature rise - Rating of machines – Standard specifications.	[9]
DC MACHINES* Output Equations – Main Dimensions -Magnetic circuit calculations – Carter's Coefficient - Net length of Iron –Real & Apparent flux densities – Unbalanced Magnetic Pull- Selection of number of poles – Design of Armature – Design of Field winding - Design of commutator and brushes – performance prediction using design values. **Hands on Practice:** Performance prediction of DC Machines using design values	[9]
TRANSFORMERS* Output Equations – Main Dimensions - KVA output for single and three phase transformers – Window space factor - Overall dimensions – Operating characteristics – Regulation – No load current – Temperature rise in Transformers – Design of Tank - Methods of cooling of Transformers. **Hands on Practice:** Design and simulation of Transformer tank with cooling tubes	[9]
INDUCTION MOTORS* Output equation of Induction motor – Main dimensions –Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor -– Magnetic leakage calculations – Leakage reactance of polyphase machines- Magnetizing current - Short circuit current –Operating characteristics. **Hands on Practice:** Design of start and rotor of induction motors	[9]
SYNCHRONOUS MACHINES* Output equations – choice of loadings – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length – Design of rotor – Design of damper winding – Determination of full load field mmf – Design of field winding – Design of turbo alternators – Rotor design. **Hands on Practice:** Design and simulation of Turbo alternator rotor	[9]
Total Hours	45

Text Books:

1.	Sawhney A.K, "A Course in Electrical Machine Design ", Dhanpat Rai& Sons, Sixth edition 2018.
2.	Sen S.K., " Principles of Electrical Machine Designs with Computer Programmers ", Oxford and IBH Publishing Co. Pvt. Ltd, 2016.

Reference(s):

1.	Shanmugasundaram A., Gangadharan and Palani R, "Electrical Machine Design Data Book ", New Age International Pvt. Ltd., 2007.
2.	Upadhyay K.G., " Design of Electrical Machines", New Age International Pvt. Ltd., 2018
3.	Agarwal R.K., "Principles of Electrical Machine Design ", S.K.Kayaria& Sons , 2017
4.	Eclayton A. and NNHancock, , "The performance and Design of Direct current Machines ", CBS & Distributors Pvt.Ltd, 2016

* - SDG 9 - Industry, Innovation and Infrastructure

Course Contents and Lecture Schedule

S. No	Topics	No. of Hours
1.1	Major considerations in Electrical Machine Design	1
1.2	Electrical Engineering Materials	1
1.3	Space factor	1
1.4	Choice of Specific Electrical and Magnetic loadings	1
1.5	Thermal considerations	1
1.6	Heat flow	4
	Temperature rise	
	Rating of machines	
	Standard specifications	
2.1	Output Equations	1
2.2	Magnetic circuit calculations	1
2.3	Net length of Iron	1
2.4	Real & Apparent flux densities	1
2.5	Unbalanced Magnetic Pull	1
2.6	Selection of number of poles	1
2.7	Design of Armature	1
2.8	Design of Field winding	1
2.9	Design of commutator and brushes	1
3.1	Output Equations	2
	Main Dimensions	
3.2	KVA output for single and three phase transformers	1
3.3	Window space factor	1
3.4	Overall dimensions	1
3.5	Operating characteristics	1
3.6	Temperature rise in Transformers	1
3.7	Design of Tank	1
3.8	Methods of cooling of Transformers	1
4.1	Output equation of Induction motor	1
4.2	Rules for selecting rotor slots of squirrel cage machines	1
4.3	Design of rotor bars & slots	1
4.4	Design of end rings	1
4.5	Design of wound rotor	1
4.6	Magnetic leakage calculations	1
4.7	Leakage reactance of polyphase machines	1
4.8	Magnetizing current	1
4.9	Short circuit current	1
	Operating characteristics	
5.1	Output equations	1
5.2	Design of salient pole machines	1
	Short circuit ratio	
	shape of pole face	
5.3	Armature design	2
	Armature parameters	
	Estimation of air gap length	
5.4	Design of rotor	1
5.5	Design of damper winding	1
5.6	Design of field winding	1
5.7	Design of turbo alternators	1
5.8	Rotor design	1
	Total	45

Course Designer(s)

1. S. SRINIVASAN – srinivasan@ksrct.ac.in

60 EE E15	Embedded System Design	Category	L	T	P	Credit
		PE	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

- Digital Electronics and 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	Disseminate the students with the RTOS and its software tools.	Understand
CO4	To bring out the various networks and buses, interfacing protocols with embedded system.	Analyse
CO5	To model hardware/software design approaches for real-time 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	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	20	30
Understand	40	20	30
Apply	-	10	30
Analyse	-	10	10
Evaluate	-	-	-
Create	-	-	-
Total	**60**	**60**	**100**

K.S.Rangasamy College of Technology – Autonomous R2022

60 EE E15 Embedded System Design

B.E - Electrical and Electronics Engineering

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

Typical Embedded System [9]

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.

ARM Architecture [9]

ARM Design Philosophy, ARM Architecture, Registers, ARM Instruction set, Thumb Instruction set, Instruction Pipeline, Interrupts and Vector Table,ARM Processor Families, ARM simple programs.

Hands on Practices:

MATLAB EXERCISE

1. Implement basic ARM assembly programs using ARM instruction set and Thumb instruction set.
2. Integrate MATLAB with ARM development tools (e.g., Keil µVision) for code generation.

Real Time Operating Systems [9]

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: FreeRTOS or MicriumuC/OS

Network Protocols [9]

Sockets, ports, UDP, TCP/IP, HTTP, Telnet, Gopher, client server model, socket programming, 802.11, Bluetooth, Zigbee, firewalls, network security, I^{2}C, CAN, LIN and flexray communication protocols. Wireless sensor networks – Introduction – Applications – Network Topology – Localization –Time Synchronization - Energy efficient MAC protocols

Modelling with Hardware/Software Design Approaches [9]

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.***

Hands on Practices:

Model and simulate embedded systems for control-dominated and data-dominated applications

1. Digital camera
2. Adaptive cruise control in a car

Total Hours 45

Text Book(s):

1.	Rajkamal P, 'Embedded System – Architecture, Programming, Design', Tata McGraw Hill, 4^{th} 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,
2.	Lyla B Das," Embedded Systems-An Integrated Approach", Pearson Education 2013
3.	ARMSystemsDeveloper'sGuides-Designing&OptimizingSystemSoftware–AndrewN. 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	**Typical Embedded System**	
1.1	Introduction To Embedded System	1
1.2	Core of the Embedded System	1
1.3	Core of the Embedded System	1
1.4	Memory	1
1.5	Memory Shadowing	1
1.6	Memory Shadowing	1
1.7	Memory selection for embedded systems	1
1.8	Sensors and Actuators	1
1.9	Communication Interfaces	1
2	**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	**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	1
3.5	Functions of RTOS	2
3.6	Semaphores	1
3.7	Message Queue	1
3.8	Popular RTOS	1
4	**Network Protocols**	
4.1	Network Protocols	1
4.2	Network Protocols	1
4.3	Network Protocols	1
4.4	Network Protocols	1
4.5	Network Protocols	1
4.6	Network Protocols	1
4.7	Communication Protocols for Automotive	1
4.8	Wireless Sensor Networks	1
4.9	Network Topology	1
5	**Modelling with Hardware/Software Design Approaches**	
5.1	EDLC	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
	Total	45

Course Designer(s)

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

60 EE E16	Network Analysis and Synthesis	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To relate pole and zero locations to characteristics of time-domain functions and frequency domain functions
- To Learn the concepts of Two-port Network parameters.
- To know the concept and design of frequency selective filters.
- To explore more advanced concepts in the analysis of attenuators.
- To synthesize a network in different forms from the transfer function.

Pre-requisites

- Electric Circuit Analysis

Course Outcomes

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

CO1	Develop Laplace Transformed analysis of network function	Apply
CO2	Gain the knowledge in characteristics of two port network parameters.	Apply
CO3	Apply two-port network analysis in the design and analysis of various filters.	Apply
CO4	Compute the parameters for the design of various attenuators	Apply
CO5	Synthesize passive one-port networks using standard Foster and Cauer forms.	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	2	2	3	3
CO2	3	3	3	3	3	-	-	-	3	2	2	2	3	3
CO3	3	3	3	3	3	-	-	-	3	2	2	2	3	3
CO4	3	3	3	3	3	-	-	-	3	2	2	2	3	3
CO5	3	3	3	3	3	-	-	-	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	20	20	30
Understand	20	20	30
Apply	20	20	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	**60**	**60**	**100**

K.S. Rangasamy College of Technology – Autonomous R2022								
60 EE E16 - Network Analysis and Synthesis								
B.E- Electrical and Electronics Engineering								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100

NETWORK FUNCTIONS Review of Network functions for one port and two port networks: – pole zero location for driving point and transfer functions-Impulse response of Network functions from pole-zero plots-Sinusoidal steady-state frequency response from pole-zero plots - stability by Routh-Harwitz criterion	[9]
TWO PORT NETWORKS Review of network parameter sets for two-port networks (z, y, h, g, T, T' parameters, equivalent circuits and inter-relationship between parameters). Image parameter description of a reciprocal two-port network - Image impedance - Characteristic impedance - propagation constant— derivation of characteristic impedance and propagation constant for T and Pi networks under sinusoidal steady state.	[9]
FILTERS* Introduction – Types of Filters – Equation of Filter Network – Classification of Pass band & Stop Band – Constant K Filters – "m" derived Filters – Impedance Matching – Advantages of 'm' derived Filters – Composite Filter – Butter Worth Approximation – Chebyshev Approximation.	[9]
ATTENUATORS Introduction – Nepers, Decibels –Lattice Attenuator – T-Type Attenuator –π Type Attenuator – L-Type Attenuator – Bridged T-Type - Attenuator Ladder type Attenuator – balanced Attenuators – Insertion Loss.	[9]
NETWORK SYNTHESIS Identification of network synthesis, Brune's positive and real function (PRF), properties of PRF, testing of driving point functions, even and odd function, one terminal pair network driving point synthesis with LC elements, RC elements, Foster and Cauer form- Brune's synthesis, Bottduffin cycle. **Hands on training:** Determination of 2-port network parameters using Virtual Lab Simulation of frequency response of second order active filter using Virtual Lab	[9]
Total Hours	45

Text Book(s):

1.	Singh R R, 'Network Analysis and Synthesis', 2nd Edition, McGraw Hill Education Pvt Limited, 2021.
2.	Van Valkenburg M E, "Network Analysis", Prentice-Hall of India Pvt Ltd, New Delhi, 2015.

Reference(s):

1.	Sudhakar A and Shyammohan S, 'Circuits & Network Analysis and Synthesis', 4th Edition, McGraw Hill, 2021
2.	Pandey S K, Network Analysis Synthesis S. Chand Publishing, 2012
3.	Ravish R Singh, 'Network Analysis and Synthesis', 2nd Edition, McGraw Hill Education Pvt Limited, 2019.
4.	Wadhwa C L, Network Analysis & Synthesis 2nd Revised Edition, New Age International, 2006.
5.	Franklin F. Kuo, 'Network Analysis and Synthesis', 5th Edition, Wiley International, 2012. 4 John D

* - SDG 9 – Industry Innovation and Infrastructure

Course Content and Lecture Schedule

S.No.	Topic	No. of Hours
1	**NETWORK FUNCTIONS**	
1.1	Review of Network functions for one port and two port networks	1
1.2	Pole zero location for driving point and transfer functions	2
1.3	Impulse response of Network functions from pole-zero plots	2
1.4	Sinusoidal steady-state frequency response from pole-zero plots	2
1.5	Stability by Routh-Harwitz criterion	2
2	**TWO PORT NETWORKS**	
2.1	Review of network parameter sets for two-port networks	2
2.2	Image parameter description of a reciprocal two-port network	2
2.3	Image impedance - Characteristic impedance - propagation constant	1
2.4	Derivation of characteristic impedance and propagation constant for T networks under sinusoidal steady state.	2
2.5	Derivation of characteristic impedance and propagation constant for Pi networks under sinusoidal steady state.	2
3	**FILTERS**	
3.1	Introduction – Types of Filters	1
3.2	Equation of Filter Network	1
3.3	Classification of Pass band & Stop Band	1
3.4	Constant K Filters	1
3.5	“m” derived Filters - Impedance Matching	1
3.6	Advantages of ‘m’ derived Filters	1
3.7	Composite Filter	1
3.8	Butter Worth Approximation	1
3.9	Chebyshev Approximation	1
4	**ATTENUATORS**	
4.1	Introduction – Nepers, Decibels	1
4.2	Lattice Attenuator	1
4.3	T-Type Attenuator	1
4.4	□Type Attenuator	1
4.5	L-Type Attenuator	1
4.6	Bridged T-Type Attenuator	1
4.7	Ladder type Attenuator	1
4.8	Balanced Attenuators	1
4.9	Insertion Loss.	1
5	**NETWORK SYNTHESIS**	
5.1	Identification of network synthesis,	1
5.2	Brune’s positive and real function (PRF), properties of PRF	2
5.3	Testing of driving point functions, even and odd function	1
5.4	One terminal pair network driving point synthesis Foster I form	1
5.5	One terminal pair network driving point synthesis Foster II form	1
5.6	One terminal pair network driving point synthesis CauerI form	1
5.7	One terminal pair network driving point synthesis CauerII form	1
5.8	Brune’s synthesis, Bottduffin cycle.	1

Course Designer(s)

1. N.Kayalvizhi – kayalvizhi@ksrct.ac.in

60 EE E17	Electric Vehicle Architecture	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To Mastering vehicle dynamics and propulsion principles for enhanced motion efficiency.
- To Analyzing diverse vehicle architectures, including EV evolution, across various vehicle types.
- To Optimizing powertrain components, focusing on efficiency and performance in EVs and hybrids.
- To Designing effective control strategies for hybrid vehicles to improve fuel economy and emissions.
- To Implementing and assessing the advantages of Plug-In Hybrid Electric Vehicles (PHEVs) for energy efficiency and environmental impact.

Pre-requisites

- Nil

Course Outcomes

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

CO1	Demonstrate a comprehensive understanding of vehicle dynamics, propulsion systems, and their application in vehicle motion efficiency	Understand
CO2	Evaluate and compare various vehicle architectures, including electric vehicle evolution, across diverse transportation modes.	Analyze
CO3	Analyze, size, and optimize powertrain components, emphasizing efficiency and performance in electric and hybrid vehicles	Understand
CO4	Design and implement effective control strategies for hybrid vehicles to enhance fuel economy and reduce emissions in practical scenarios	Apply
CO5	Apply their knowledge to comprehend, implement, and assess the advantages of Plug-In Hybrid Electric Vehicles (PHEVs) concerning energy efficiency and environmental sustainability	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	2	2	2	3	3	3	2	1
CO2	3	3	3	2	-	-	-	-	-	2	-		2	2
CO3	3	3	3	3	3	-	-	-	2	3	-	2	2	1
CO4	3	2	3	2	-	-	-	-	-	3	-		3	1
CO5	3	3	3	2	3	3	2	2	3	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	10	10	10
Understand	20	20	30
Apply	20	30	30
Analyse	10	-	30
Evaluate	-	-	-
Create	-	-	-
Total	**60**	**60**	**100**

K.S.Rangasamy College of Technology – Autonomous R2022

60 EE E17 - Electric Vehicle Architecture

B.E – Electrical and Electronics Engineering

Semester	Hours/Week			Total	Credit	Maximum		
	L	T	P		C	CA	ES	Total
V	3	0	0	45	3	40	60	100

VEHICLE MECHANICS Vehicle mechanics*- Roadway fundamentals, Laws of motion, Vehicle Kinetics, Dynamics of vehicle motion, propulsion power, velocity and acceleration, Tire –Road mechanics, Propulsion System Design.	[9]
VEHICLE ARCHITECTURE and SIZING&***** Electric Vehicle History, and Evolution of Electric Vehicles. Series, Parallel and Series parallel Architecture, Micro and Mild architectures. Mountain Bike - Motorcycle- Electric Cars and Heavy Duty EVs. -Details and Specifications	[9]
POWER COMPONENTS AND BRAKES**** Power train Component sizing- Gears, Clutches, Differential, Transmission and Vehicle Brakes. EV power train sizing, HEV Powertrain sizing, Example.	[9]
HYBRID VEHICLE CONTROL STRATEGY**** Vehicle supervisory controller, Mode selection strategy, Modal Control strategies. **Hands on practice: (MATLAB / Open source)** Battery Sizing and Design for Electric Vehicles Modeling and Simulation of EV using MATLAB	[9]
PLUG-IN HYBRID ELECTRIC VEHICLE** Introduction-History-Comparison with electrical and hybrid electrical vehicle-Construction and working of PHEV-Block diagram and components-Charging mechanisms-Advantages of PHEV	[9]
Total Hours	45

Text Book(s):	
1.	Ali Emadi, “Advanced Electric Drive Vehicles”, CRC Press, First edition 2017.
2.	Nil Patel, Akash Kumar Bhoi, Sanjeevikumar Padmanaban, “Electric Vehicles Modern Technologies and Trends”, Jens Bo Holm-Nielsen Springer, 2020
Reference(s):	
1.	Seth Leitman and Bob Brant, “Build Your Own Electric Vehicle”, , McGraw Hill, Third Edition
2.	Mark Warner, “The Electric Vehicle Conversion Handbook: How to Convert Cars, Trucks, Motorcycles, and Bicycles -- Includes EV Components, Kits, and Project Vehicles”, HP Books, 2011
3.	Rogelio León , Christian Montaleza , José Luis Maldonado , MarCOs Tostado-Véliz and Francisco Jurado, Thermo, “Hybrid Electric Vehicles: A Review of Existing Configurations and Thermodynamic Cycles”, 2021, 1, 134–150. https://doi.org/10.3390/thermo1020010.

*SDG-9(Industry, Innovation, and Infrastructure)
**SDG 7(Affordable and Clean Energy)
***SDG 11 (Sustainable Cities and Communities)
****SDG 13(Climate Action)

Course Contents and Lecture Schedule

S.No	Topics	No. of Hours
1	**VEHICLE MECHANICS**	
1.1	Vehicle mechanics	1
1.2	Roadway fundamental	1
1.3	Laws of motion	1
1.4	Vehicle Kinetics	1
1.5	Dynamics of vehicle motion	1
1.6	propulsion power	1
1.7	velocity and acceleration	1
1.8	Tire –Road mechanics	1
1.9	Propulsion System Design.	1
2	**VEHICLE ARCHITECTURE and SIZING**	
2.1	Electric Vehicle History	1
2.2	Evolution of Electric Vehicles	1
2.3	Series, Parallel and Series parallel Architecture	1
2.4	Micro and Mild architectures	1
2.5	Mountain Bike	1
2.6	Motorcycle- Electric Cars and Heavy Duty EVs	2
2.7	Details and Specifications	2
3	**POWER COMPONENTS AND BRAKES**	
3.1	Power train Component sizing	1
3.2	Gears, Clutches	2
3.3	Differential, Transmission and Vehicle Brakes	2
3.4	EV power train sizing	2
3.5	HEV Powertrain sizing, Example.	2
4	**HYBRID VEHICLE CONTROL STRATEGY**	
4.1	Vehicle supervisory controller	3
4.2	Mode selection strategy	3
4.3	Modal Control strategies	3
5	**PLUG-IN HYBRID ELECTRIC VEHICLE**	
5.1	Introduction	1
5.2	History-Comparison with electrical and hybrid electrical vehicle	2
5.3	Construction and working of PHEV	1
5.4	Block diagram and components	2
5.5	Charging mechanisms	2
5.6	Advantages of PHEVs.	1
	Total	45

Course Designer(s)

1. Dr. D. Srividhya - srividhyad@ksrct.ac.in

PROFESSIONAL ELECTIVES (PE)

SEMESTER VI, Professional Elective II

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 EE E21	Solar Energy Systems	PE	3	3	0	0	3
2.	60 EE E22	Principles of IoT and its Applications	PE	3	3	0	0	3
3.	60 EE E23	HVDC and FACTS	PE	3	3	0	0	3
4.	60 EE E24	Analysis of Electrical Machines	PE	3	3	0	0	3
5.	60 EE E25	Embedded C Programming	PE	3	3	0	0	3
6.	60 EE E26	VLSI Design	PE	3	3	0	0	3
7.	60 EE E27	Design of Motor and Power Converters for Electric Vehicles	PE	3	3	0	0	3

60 EE E21	Solar Energy Systems	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To gain the knowledge of fundamentals of Solar energy.
- To illustrate the performance of solar thermal energy conversion and its applications
- To Enrich the knowledge of Solar Photovoltaic Systems and applications
- To understand the concepts and various components of stand-alone system
- To gain the sound knowledge about grid connected PV system

Pre-requisites

- NIL

Course Outcomes

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

CO1	Explore the basic concepts of solar energy and estimate the solar energy.	Understand
CO2	Illustrate the Principles involved in solar energy collection and conversion of it into thermal energy.	Understand
CO3	Describe the knowledge of solar energy into electricity generation and Applications.	Apply
CO4	Select and design the standalone PV system for specific application	Apply
CO5	Reconnoiter the knowledge of Grid connected PV system and design a system for specific 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	-	-	3	2	3
CO2	3	3	3	3	-	-	3	-	-	-	-	-	2	3
CO3	3	3	3	-	-	-	3	-	-	-	-	-	2	3
CO4	3	3	3	3	-	-	3	-	2	-	3	3	2	3
CO5	3	3	3	3	-	-	3	-	2	-	3	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	20	20	30
Understand	40	20	30
Apply	-	20	40
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

K.S.Rangasamy College of Technology – Autonomous R2022								
B. E. Electrical and Electronics Engineering								
60 EE E21- Solar Energy Systems								
Semester	**Hours/Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
VI	3	0	0	45	3	40	60	100

Content	Hours
Introduction Characteristics of sunlight: the sun and its radiation, Solar radiation, Direct and diffusion radiation, greenhouse effect, solar isolation data and estimation- Solar energy measuring instruments Estimation of solar radiation under different climatic conditions, Estimation of total radiation	[9]
Solar Thermal Systems* Principle of conversion of solar radiation into heat, Collectors used for solar thermal, conversion: Flat plate collectors and Concentrating collectors, Solar Thermal Power Plant, Solar cookers, Solar hot water systems, Solar dryers, Solar Distillation, Solar greenhouses	[9]
Solar Photovoltaic Systems* Conversion of Solar energy into Electricity - Photovoltaic Effect, Solar photovoltaic cell and its working principle, Different types of Solar cells, Series and parallel connections, Photovoltaic applications: Battery chargers, domestic lighting, street lighting and water pumping	[9]
Stand-alone PV System **Solar modules – storage systems***: Types, applications, requirements, efficiency, **Lead acid batteries*** – power conditioning and regulation: Diodes, Regulators, Inverters- Balance of system components - protection – **standalone PV systems design*** – sizing: Reliability maps, sizing for high reliability, existing methods. Design of Solar cell	[9]
Integration of PV Systems **PV systems in buildings – Utility applications for photo voltaic*** – design issues for central power stations – safety – Economic aspect – Efficiency and performance - International PV programs – **Integration of PV and Wind*** – Indian Specific Standard for Integration. **Hands on Practice:** Simulation of Standalone PV system using SIMULINK Simulation of Grid connected PV system using SIMULINK	[9]
Total Hours	45

Text Book(s):

1.	Rai G D, “ Non-Conventional Energy Sources”, Khanna Publishers,2002
2.	Sukhatme S P,”Solar Energy”, Tata McGraw Hill, 2017.

Reference(s):

1.	Stuart R.Wenham, Martin A.Green, Muriel E. Watt and Richard Corkish, “Applied Photovoltaics”, 2011.
2.	Frank S. Barnes & Jonah G. Levine, “Large Energy storage Systems Handbook”, CRC Press, 2017.
3.	Sumathi S, “Solar PV and Wind Energy Conversion Systems (Green Energy and Technology)”, L. Ashok Kumar , P. Surekha, 2015.
4.	https://onlinecourses.nptel.ac.in/noc23_ge41

* - SDG 7 – (Affordable and Clean Energy)

Course Contents and Lecture Schedule

S. No	Topics	No. of Hours
1	**Introduction**	
1.1	Characteristics of sunlight: the sun and its radiation,	1
1.2	Solar radiation - Direct and diffusion radiation	1
1.3	Greenhouse effect	1
1.4	Solar isolation data and estimation	2
1.5	Solar energy measuring instruments	1
1.6	Estimation of solar radiation under different climatic conditions	2
1.7	Estimation of total radiation	1
2	**Solar Thermal Systems**	
2.1	Principle of conversion of solar radiation into heat	1
2.2	Collectors used for solar thermal conversion: Flat plate collectors	1
2.3	Concentrating collectors	1
2.4	Solar Thermal Power Plant	1
2.5	Solar cookers	1
2.6	Solar hot water systems	1
2.7	Solar dryers	1
2.8	Solar Distillation	1
2.9	Solar greenhouses	1
3	**Solar Photovoltaic Systems**	
3.1	Conversion of Solar energy into Electricity - Photovoltaic Effect	2
3.2	Solar photovoltaic cell,	1
3.3	Solar photovoltaic cell working principle	1
3.4	Different types of Solar cells	1
3.5	Series and parallel connections	1
3.6	Photovoltaic applications: Battery chargers	1
3.7	domestic lighting	1
3.8	street lighting and water pumping	1
4	**Stand-alone PV System**	
4.1	Solar modules	1
4.2	Storage systems: Types, applications, requirements, efficiency	1
4.3	Lead acid batteries	1
4.4	power conditioning and regulation: Diodes, Regulators, Inverters	1
4.5	Balance of system components - protection	1
4.6	Standalone PV systems design – sizing	1
4.7	Reliability maps, sizing for high reliability, existing methods.	2
4.8	Design of Solar cell	1
5	**Integration of PV Systems**	
5.1	PV systems in buildings	1
5.2	Utility applications for photo voltaic	2
5.3	Design issues for central power stations	1
5.4	Safety	2
5.5	Economic aspect	2
5.6	Efficiency and performance	1
5.7	International PV programs	1
5.8	Integration of PV and Wind	1
5.9	Indian Specific Standard for Integration	1
	Total	45

Course Designer(s)

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Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

60 EE E22	Principles of IoT and its Applications	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To study the basic concepts and principles of the Internet of Things (IoT).
- To explore the architecture and components of IoT systems.
- To learn about various IoT communication protocols and standards.
- To gain practical experience in designing and developing IoT applications.
- To examine the societal and ethical implications of IoT technologies

Pre-requisites

- Electronic Circuits
- Electron Devices and Circuits

Course Outcomes

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

CO1	Illustrate the basic concepts and principles of the Internet of Things (IoT).	Understand
CO2	Mimic the architecture and components of IoT systems.	Understand
CO3	Identify various IoT communication protocols and standards.	Understand
CO4	Develop IoT applications through practical experience.	Apply
CO5	Analyze societal and ethical implications of IoT technologies	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	2	2	-	-	-	-	3	-	-	3	2
CO2	3	3	3	2	2	-	-	-	-	3	-	-	3	2
CO3	3	3	3	2	2	-	-	-	-	3	-	-	3	2
CO4	-	3	3	3	-	-	-	-	-	-	3	-	3	2
CO5	-	3	3	-	3	-	-	-	-	-	-	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	30	20	10
Understand	30	20	30
Apply	-	20	30
Analyse	-	-	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E – Electrical and Electronics Engineering								
60 EE E22– Principles of IoT and its Applications								
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 Internet of Things and Architecture Definition and overview of IoT,Evolution and growth of IoT, Applications and use cases of IoT, IoT Architecture: IoT architecture layers: Perception layer, Network layer, Application layer, Device connectivity and communication protocols,Cloud computing and edge computing in IoT. **Hands - on:** 1. Temperature Monitoring System using Arduino and IoT Platform	[9]
IoT Devices,Sensors and Communication Protocols* Types of IoT devices: Sensors, actuators, gateways, Sensor technologies and selection criteria. Interfacing sensors with microcontrollers and IoT platforms, IoT ,Wireless communication protocols: Wi-Fi, Bluetooth, Zigbee, LoRaWAN, IoT networking standards: MQTT, CoAP, HTTP, WebSocket **Hands - on:** 1. IoT Data Transmission using MQTT Protocol	[9]
IoT Platforms and Tools* Introduction to IoT development platforms: Arduino, Raspberry Pi, ESP8266,Cloud-based IoT platforms: AWS IoT, Google Cloud IoT Core, Azure IoT Hub,IoT development tools and frameworks	[9]
IoT Security and Privacy* Threats and vulnerabilities in IoT systems, Security mechanisms: Authentication, encryption, access control, Privacy issues and regulatory compliance in IoT **Hands - on:** 1. IoT Security Assessment using Penetration Testing	[9]
IoT Application Case Studies and IoT Project Development* Smart home automation, Industrial IoT (IIoT) applications, arduino uno Healthcare IoT solutions, Smart agriculture and environmental monitoring, Ideation and project planning, Hardware and software implementation Testing, deployment, and evaluation of IoT projects	[9]
Total Hours:	**45**

Text Book(s):

1.	Maciej Kranz "Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry" Wiley ,2016
2.	Martin Charlier, Ann Light "Designing Connected Products: UX for the Consumer Internet of Things" by Claire Rowland, Elizabeth Goodman, O'Reilly Media,2015

Reference(s):

1.	Arshdeep Bahga, Vijay Madisetti "Internet of Things: A Hands-On Approach" , Arshdeep Bahga & Vijay Madisetti,2014.
2.	Klaus Schwab "The Fourth Industrial Revolution" Penguin Books Limited,2017
3.	Bruce Sinclair "IoT Inc: How Your Company Can Use the Internet of Things to Win in the Outcome Economy" McGraw Hill LLC,2017
4.	https://onlinecourses.nptel.ac.in/noc24_cs35/preview

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Introduction to Internet of Things and Architecture**	
1.1	Definition and overview of IoT	1
1.2	Evolution and growth of IoT	1
1.3	Applications and use cases of IoT	1
1.4	IoT Architecture: IoT architecture layers	1
1.5	Perception layer	1
1.6	Network layer	1
1.7	Application layer	1
1.8	Device connectivity and communication protocols	1
1.9	Cloud computing and edge computing in IoT	1
2.0	**IoT Devices, Sensors and Communication Protocols**	
2.1	Types of IoT devices	1
2.2	Sensors, actuators, gateways	1
2.3	Sensor technologies and selection criteria	1
2.4	Interfacing sensors with microcontrollers and IoT platforms	1
2.5	Wireless communication protocols	1
2.6	Wi-Fi, Bluetooth	1
2.7	Zigbee ,LoRaWAN	1
2.8	IoT networking standards ,MQTT ,CoAP	1
2.9	HTTP ,WebSocket	1
3.0	**IoT Platforms and Tools**	
3.1	Introduction to IoT development platforms	1
3.2	Arduino	1
3.3	Raspberry Pi	1
3.4	ESP8266	1
3.5	Cloud-based IoT platforms	1
3.6	AWS IoT	1
3.7	Google Cloud IoT Core	1
3.8	Azure IoT Hub	1
3.9	IoT development tools and frameworks	1
4.0	**IoT Security and Privacy**	
4.1	Threats and vulnerabilities in IoT systems	2
4.2	Security mechanisms	2
4.3	Authentication	1
4.4	Encryption	1
4.5	Access control	1
4.6	Privacy issues and regulatory compliance in IoT	2
5.0	**IoT Application Case Studies and IoT Project Development**	
5.1	Smart home automation	1
5.2	Industrial IoT (IIoT) applications	1
5.3	Healthcare IoT solutions	1
5.4	Smart agriculture and environmental monitoring	1
5.5	Ideation and project planning	1
5.6	Hardware and software implementation	2
5.7	Testing, deployment, and evaluation of IoT projects	2

Course Designer(s)

Dr.D. Srividhya - srividhya@ksrct.ac.in

60 EE E23	HVDC and FACTS	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To study the HVDC Transmission system
- To understand the control aspects of the HVDC System
- To understand the fundamentals of FACTS Controllers,
- To know the importance of controllable parameters
- To know the types of FACTS controllers & their benefits

Pre-requisites

- Power Electronics, Power Systems

Course Outcomes

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

CO1	Compare EHV AC and HVDC systems and describe various types of DC links.	Understand
CO2	Describe various methods for the control of HVDC systems and to perform power flow analysis in AC/DC systems.	Understand,
CO3	Identify a proper FACTS controller for the specific application based on system requirements.	Understand
CO4	Analyze the control circuits of Shunt Controllers, Series controllers, and combined controllers.	Apply
CO5	Describe the concepts of Power flow controllers.	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	1	1	2	3	2
CO2	3	2	2	2	3	-	-	-	2	1	3	2	3	2
CO3	3	2	2	2	2	-	-	-	2	1	2	2	3	2
CO4	3	2	2	2	3	-	-	-	3	3	2	2	3	2
CO5	3	2	2	2	2	-	-	-	2	3	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	10	10	20
Understand	50	40	50
Apply	-	10	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	**60**	**60**	**100**

K.S.Rangasamy College of Technology – Autonomous R2022								
60 EE E23 - HVDC and FACTS								
B.E – Electrical and Electronics Engineering								
Semester	**Hours/Week**			**Total Hours.**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
VI	3	0	0	45	3	40	60	100

HVDC Transmission System* Introduction, comparison of AC and DC systems, applications of DC transmission, types of DC links, Layout of HVDC Converter station, and various equipment. HVDC Converters, analysis of bridge converters with and without overlap, inverter operation, equivalent circuit representation of rectifier and inverter configurations. **Hands-on Practice: (MATLAB /SCILAB/ any other open source)** Study of steady-state and transient performance of a 6-pulse HVDC Transmission System using MATLAB Simulink	[9]
Control of HVDC system* Principles of control, desired features of control, converter control characteristics, power reversal, Ignition angle control, current and extinction angle control. Harmonics introduction, generation, AC filters, and DC filters. Introduction to multiterminal DC systems and applications, comparison of series and parallel MTDC systems, and Voltage Source Converter-based HVDC systems.	[9]
Facts concepts* Transmission Interconnections, Flow of Power in an AC System- Limits the Loading Capability, Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, Relative Importance of Controllable Parameters, Basic Types of FACTS Controllers, Brief Description and Definitions of FACTS Controllers, Checklist of Possible Benefits from FACTS Technology, In Perspective: HVDC or FACTS.	[9]
Static shunt compensators * Objectives of Shunt Compensation - Midpoint Voltage Regulation for Line Segmentation, End of Line Voltage Support to Prevent Voltage Instability, Improvement of Transient Stability. Methods of Controllable VAR. Generation –Thyristor controlled Reactor (TCR) and Thyristor Switched Reactor (TSR), Thyristor Switched Capacitor (TSC). Operation of Single Phase TSC – TSR. Switching Converter Type Var Generators, Basic Operating Principles, Basic Control Approaches. Static VAR Compensators: SVC and STATCOM, the Regulation Slope. Comparison between STATCOM and SVC, V –I and V –Q Characteristics, Transient stability, Response Time.	[9]
Static Series and Combined Compensators* Objectives of Series Compensation, Concept of Series Capacitive Compensation, Voltage Stability, Improvement of Transient Stability. GTO Thyristor-Controlled Series Capacitor, Thyristor-Switched Series Capacitor, Thyristor-Controlled Series Capacitor, The Static synchronous Series Compensator, Transmitted Power Versus Transmission Angle Characteristic. Introduction and operating principle of - Unified power flow controller (UPFC) -Interline power flow controller (IPFC). **Hands-on Practice: (MATLAB /SCILAB/ any other open source)** Study the steady-state and dynamic performance of a Unified Power Flow Controller (UPFC) using MATLAB Simulink	[9]
Total Hours	45

Text Book(s):

1.	Hingorani, L.Gyugyi, 'Concepts and Technology of Flexible AC Transmission System', IEEE Press New York, 2000 ISBN –078033 4588.
2.	Padiyar, K.R., 'HVDC transmission systems', Wiley Eastern Ltd., 2010.

Reference(s):

1.	Song, Y.H. and Allan T. Johns, 'Flexible AC Transmission Systems (FACTS)', Institution of Electrical Engineers Press, London, 1999.
2.	Mohan Mathur R. and Rajiv Karama, 'Thyristor-–based FACTS controllers for Electrical.
3.	Transmission systems', IEEE Press, Wiley Inter science, 2002.
4.	Padiyar K.R., 'FACTS controllers for Transmission and Distribution systems' New Age International Publishers, 1st Edition, 2007

* - SDG12– Responsible Consumption and Production

Rev.No. 00 / w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

Course Contents and Lecture Schedule

S. No.	Topics	No. of. Hours
1	**HVDC transmission:**	
1.1	HVDCT ransmission System :Introduction	1
1.2	Comparison of AC and DC systems,	1
1.3	Applications of DC transmission, types of DC links	2
1.4	Layout of HVDC Converter station and various equipment – HVDC Converters	2
1.5	Analysis of bridge converters with and without overlap, inverter operation	2
2	**Control of HVDC system:**	
2.1	Principles of control	1
2.2	Desired features of control	1
2.3	Converter control characteristics, power reversal, Ignition angle control, current and extinction angle control.	2
2.4	Harmonics introduction, generation, AC filters, and DC filters	2
2.5	Introduction to multi terminal DC systems and applications,	2
2.6	Comparison of series and parallel MTDC systems,	1
3	**Facts Concepts:**	
3.1	Reactive power control in electrical power transmission	1
3.2	Principles of Conventional Reactive Power Compensators	1
3.3	Introduction to FACTS	2
3.4	Flow of power in AC parallel paths, meshed systems	2
3.5	Basic types of FACTS controllers,	1
3.6	Definitions of FACTS controllers,	1
3.7	Brief description of FACTS controllers.	1
4	**Static Shunt Compensators**:	
4.1	Objectives of Shunt Compensation	1
4.2	Midpoint Voltage Regulation for Line Segmentation	1
4.3	End of Line Voltage Support to Prevent Voltage Instability	1
4.4	Improvement of Transient Stability	1
4.5	Methods of Controllable Var Generation	1
4.6	Thyristor-controlled Reactor (TCR) and Thyristor Switched Reactor (TSR)	1
4.7	Thyristor Switched Capacitor (TSC) & Operation of Single Phase TSC – TSR	1
4.8	Switching Converter Type Var Generators- Basic Operating Principles Static VAR Compensators	1
4.9	SVC and STATCOM, the Regulation Slope.	1
4.9	Comparison between STATCOM and SVC, V –I and V –Q Characteristics & Transient stability, Response Time.	1
5	**Static Series and Combined Compensators**	
5.1	Objectives of Series Compensation, Concept of Series Capacitive Compensation	1
5.2	Voltage Stability, Improvement of Transient Stability	1
5.3	GTO Thyristor- Controlled Series Capacitor	1
5.4	Thyristor - Switched Series Capacitor	1
5.5	Thyristor-Controlled Series Capacitor, The Static synchronous Series Compensator	
5.6	Transmitted Power Versus Transmission Angle Characteristic	1
5.7	Introduction and operating principle of - Unified power flow controller (UPFC)	2
5.8	Interline power flow controller (IPFC).	1

Course Designer(s)

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BoS Chairman Signature

60 EE E24	Analysis of Electrical Machines	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To provide knowledge about the fundamentals of magnetic circuits, energy, force and torque of multi-excited systems
- To analyze the steady state and dynamic state operation of DC machine through mathematical modeling and to provide the knowledge about digital computer simulation of permanent magnet and shunt D.C. machines.
- To provide the knowledge about theory of transformation of three phase variables to two phase variables.
- To analyze the steady state and dynamic state operation of three-phase induction machines using transformation theory based mathematical modeling.
- To analyze the steady state and dynamic state operation of three-phase synchronous machines using transformation theory based mathematical modeling.

Pre-requisites

- Knowledge on DC and AC Electrical Machines.

Course Outcomes

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

CO1	Study fundamentals of magnetic circuits, energy, force and torque of multi-excited systems.	Understand
CO2	Analyze the steady state and dynamic state operation of DC machine through mathematical modeling and to study the digital computer simulation of permanent magnet and shunt DC machines.	Analyze
CO3	Analyze the theory of transformation of three phase variables to two phase variables.	Analyze
CO4	Analyze the steady state and dynamic state operation of three-phase induction machines.	Analyze
CO5	Analyze the steady state and dynamic state operation of synchronous machines.	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	2	2	2	-	-	-	-	-	-	2	3	2
CO2	3	3	2	2	2	-	-	-	-	-	-	2	3	2
CO3	3	3	2	2	2	-	-	-	-	-	-	2	3	2
CO4	3	3	2	2	2	-	-	-	-	-	-	2	3	2
CO5	3	3	2	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	10	10	10
Understand	20	20	30
Apply	10	10	30
Analyse	20	20	30
Evaluate	-	-	-
Create	-	-	-
Total	**60**	**60**	**100**

Rev.No. 00 / w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

K.S.Rangasamy College of Technology – Autonomous R2022								
60 EE E24 –Analysis of Electrical Machines								
B.E – Electrical and Electronics Engineering								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
VI	3	0	0	45	3	40	60	100

PRINCIPLES OF ELECTROMAGNETIC ENERGY CONVERSION [9]

Magnetic circuits, permanent magnet, stored magnetic energy, co-energy - Force and torque in singly and doubly excited systems – Machine windings and air gap mmf - Winding inductances and voltage equations.

DC MACHINES MODELING* [9]

Elementary DC machine and analysis of steady state operation - Voltage and torque equations – Dynamic characteristics of permanent magnet and shunt DC motors – Time domain block diagrams - Solution of dynamic characteristic by Laplace transformation – Digital computer simulation of permanent magnet and shunt DC machines.

Hands on Practice:

Modeling and simulation of permanent magnet and DC shunt machine

REFERENCE FRAME THEORY [9]

Historical background – Phase transformation and commutator transformation – Transformation of variables from stationary to arbitrary reference frame - Variables observed from several frames of reference.

INDUCTION MACHINES MODELING* [9]

Static and rotating References: frames, transformation relationships - Stationary circuit Variables transformed to the arbitrary Reference frame treating R, L, C elements separately - Application of Reference frame theory to three phase symmetrical induction machine - Direct and quadrature axis model in arbitrarily rotating Reference frame - Voltage and torque equations.

Hands on Practice:

Modeling and simulation of Induction machines

SYNCHRONOUS MACHINES MODELING* [9]

Application of reference frame theory to three phase synchronous machine- Dynamic model analysis- Parks equation - Voltage and torque equations - Deviation of steady state phasor relationship from dynamic model -Generalized theory of rotating electrical machine and Krons primitive machine.

Hands on Practic:

Modeling and simulation of Synchronous machines

Total Hours 45

Text Books:

1.	Bimbhra P. S," Generalized Theory of Electrical Machines", Khanna Publishers, 2017.
2.	Paul C.Krause, Oleg Wasyzczuk, Scott S, Sudhoff " Analysis of Electric Machinery and Drive Systems, Second Edition", John Wiley 2016

Reference Books:

1.	Fitzgerald A. E, Charles Kingsley, Jr, and Stephan D, Umanx, " Electric Machinery ", Tata McGraw Hill, 5th Edition 2018.
2.	Bimal K Bose, "Modern Power Electronics and AC Drives", Pearson Education, 2019.
3.	Krishnan R, "Electric Motor Drives – Modeling, Analysis and Control", Prentice-Hall of India Pvt. Ltd., New Delhi, 2020.
4.	Eclayton A. and NNHancock, , "The performance and Design of Direct current Machines ", CBS & Distributors Pvt.Ltd, 2016

*- SDG 9 - Industry, Innovation and Infrastructure

Course Contents and Lecture Schedule

S.No	Topics	No. of Hours
1.1	Magnetic circuits	2
1.2	Permanent magnet	1
1.3	Stored magnetic energy	1
1.4	Co-energy	1
1.5	Force and torque in singly and doubly excited systems	2
1.6	Machine windings and air gap mmf	1
1.7	Winding inductances and voltage equations	1
2.1	Elementary DC machine and analysis of steady state operation	2
2.2	Voltage and torque equations	2
2.3	Dynamic characteristics of permanent magnet and shunt DC motors	2
2.4	Time domain block diagrams	1
2.5	Solution of dynamic characteristic by Laplace transformation	1
2.6	Digital computer simulation of permanent magnet and shunt DC machines.	1
3.1	Historical background	2
3.2	Phase transformation and commutator transformation	3
3.3	Transformation of variables from stationary to arbitrary reference frame	2
3.4	Variables observed from several frames of reference	2
4.1	Static and rotating References: frames, transformation relationships	2
4.2	Stationary circuit Variables transformed to the arbitrary Reference frame treating R, L, C elements separately	2
4.3	Application of Reference frame theory to three phase symmetrical induction machine	1
4.4	Direct and quadrature axis model in arbitrarily rotating Reference frame	2
4.5	Voltage and torque equations	2
5.1	Application of reference frame theory to three phase synchronous machine	1
5.2	Dynamic model analysis	1
5.3	Parks equation	1
5.4	Voltage and torque equations	2
5.5	Deviation of steady state phasor relationship from dynamic model	2
5.6	Generalized theory of rotating electrical machine and Krons primitive machine	2
	Total	45

Course Designer(s)

1. S. SRINIVASAN ASP/EEE – srinivasan@ksrct.ac.in

60 EE E25	Embedded C Programming	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To expose the students to the fundamentals of embedded.
- To Introduce the GNU C Programming Tool Chain.
- To study the basic concepts of embedded C.
- To teach the basics of ARM Programming.
- To involve Discussions/ Practice/Exercise in revising & familiarizing the concepts for improved employability skills.

Pre-requisites

- Digital Electronics, Microprocessors & Microcontrollers and C programming

Course Outcomes

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

CO1	Deliver insight into C programming and its salient features for embedded systems.	Understand
CO2	Illustrate the software and hardware architecture for distributed computing in embedded systems.	Understand
CO3	Develop a solution for problems by using the concept learned in programming using the embedded controllers.	Apply
CO4	Understand the basic communication by using serial port communication and interrupts.	Analyze
CO5	Develop simple applications with ARM controller by using its various features and interfacing with various external hardware.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	2	3	1	-	-	-	-	-	1	-	2	2
CO2	1	1	2	2	1	-	2	1	-	-	-	1	2	2
CO3	2	2	3	2	3	-	-	2	3	-	2	-	3	3
CO4	3	2	3	2	3	-	-	-	-	-	-	-	2	3
CO5	3	2	1	2	1	-	-	-	1	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	20	20	30
Understand	40	20	30
Apply	-	10	30
Analyse	-	10	10
Evaluate	-	-	-
Create	-	-	-
Total	**60**	**60**	**100**

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Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

K.S.Rangasamy College of Technology - Autonomous								
60 EE E25 Embedded C Programming								
B.E – Electrical and Electronics Engineering								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
VI	3	0	0	45	3	40	60	100

BASIC C PROGRAMMING Typical C Program Development Environment - Introduction to C Programming - Structured Program Development in C - Data Types and Operators - C Program Control - C Functions - Introduction to Arrays.	[9]
EMBEDDED C Adding Structure to 'C' Code: Object-oriented programming with C, Header files for Project and Port, Examples. Meeting Real-time constraints: Creating hardware delays - Need for timeout mechanism - Creating loop timeouts - Creating hardware timeouts.	[9]
ARM PROGRAMMING IN C Data types and time delay, I/O programming, Logic operations, Data conversion program and Accessing code ROM space, Data serialization using ARM.	[9]
ARM SERIAL PORT AND INTERRUPT PROGRAMMING IN C Basics of serial communication, ARM interface to RS232- serial port programming. ARM interrupts and programming, Programming for timer configuration.	[9]
ARM INTERFACING **ARM: ADC interfacing , DAC interfacing, Sensor interfacing, LCD interfacing, DC Motor and Stepper motor interfacing, Traffic Light Controller interfacing.*** **Hands on Practice:** **Programming using KEIL** 1.Data Serialization using ARM 2.ARM Serial Port and Interrupt Programming 3.DC Motor and Stepper Motor Interfacing 4.Sensor Interfacing	[9]
Total Hours:	**45**

Text book(s):

1.	Paul Deitel and Harvey Deitel, "C How to Program", 9th Edition, Pearson Education Limited, 2022, 1st edition.
2.	Gowrishankar S and Veena A, "Introduction to Python Programming", CRC Press, Taylor & Francis Group, 2019

Reference(s):

1.	Noel Kalicharan, "Learn to Program with C", Apress Inc., 2015, 1st edition.
2.	Andrew N. Sloss, Dominic Symes, Chris Wrigh :ARM Systems Developer's Guides – Designing & Optimizing System Software",Elsevier, 2008
3.	https://www.circuitstoday.com/getting-started-with-keil-uvision

* - SDG 11: Sustainable Cities and Communities

Course Contents and Lecture Schedule

S. No	Topics	No. of Hours
1	**Basic C Programming**	
1.1	Typical C Program Development Environment	1
1.2	Introduction to C Programming	1
1.3	Structured Program Development in C	2
1.4	Data Types and Operators	1
1.5	C Program Control	1
1.6	C Functions	2
1.7	Introduction to Arrays	1
2	**Embedded C**	
2.1	Object-oriented programming with C	1
2.2	Header files for Project and Port	2
2.3	Meeting Real-time constraints	2
2.4	Creating hardware delays	1
2.5	Need for timeout mechanism	1
2.6	Creating loop timeouts	1
2.7	Creating hardware timeouts	1
3	**ARM Programming In C**	
3.1	Data types	1
3.2	Time delay	1
3.3	I/O programming	2
3.4	Logic operations	1
3.5	Data conversion program	2
3.6	Accessing code ROM space	1
3.7	Data serialization using ARM	1
4	**ARM Serial Port and Interrupt Programming In C**	
4.1	Basics of serial communication	1
4.2	ARM interface to RS232	2
4.3	Serial port programming	2
4.4	ARM interrupts and programming	2
4.5	Programming for timer configuration	2
5	**ARM Interfacing**	
5.1	ADC &DAC interfacing	1
5.2	Sensor interfacing	2
5.3	LCD interfacing	2
5.4	DC Motor and Stepper motor interfacing	2
5.5	Traffic Light Controller interfacing	2
	Total	45

Course Designer(s)

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

60 EE E26	VLSI Design	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To acquire knowledge on the fundamentals of CMOS circuits and its characteristics
- To apply the realization concepts of combinational MOS Logic Circuits
- To design and analyze the sequential digital circuits
- To discuss the architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology
- To disseminate the different FPGA architectures and testability of VLSI circuits

Pre-requisites

- Basic Electrical and Electronics Engineering

Course Outcomes

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

CO1	Realize the concepts of digital building blocks using MOS transistor.	Analyze
CO2	Develop combinational MOS circuits and compare various power strategies.	Apply
CO3	Design and construct sequential circuits and timing systems with their classification.	Analyze
CO4	Construct various arithmetic building blocks including case study and memory subsystems.	Analyze
CO5	Apply and implement FPGA design flow and testing using hardware description language.	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	-	-	3	3	3
CO3	3	3	3	3	3	3	3	-	3	-	-	3	3	3
CO4	3	3	3	3	3	3	3	-	3	3	-	3	3	3
CO5	3	3	3	-	3	3	3	-	3	3	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	20	30
Apply	20	10	30
Analyse	10	10	10
Evaluate	-	-	-
Create	-	-	-
Total	**60**	**60**	**100**

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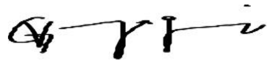
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025



BoS Chairman Signature

Syllabus:

K.S.Rangasamy College of Technology – Autonomous R2022								
60 EE E26 - VLSI Design								
B.E – Electrical and Electronics Engineering								
Semester	**Hours/Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
VI	3	0	0	45	3	40	60	100

INTRODUCTION TO MOS TRANSISTOR MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V characteristics, C-V characteristics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.	[9]
COMBINATIONAL MOS LOGIC CIRCUITS Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls. Power: Dynamic Power, Static Power, Low Power Architecture	[9]
SEQUENTIAL CIRCUIT DESIGN Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits. Timing Issues: Timing Classification of Digital System, Synchronous Design.	[9]
DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff. Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.	[9]
IMPLEMENTATION STRATEGIES AND TESTING* Electronic Design Automation, Hardware modeling with the Verilog HDL and VHDL, Logic System, Data Types and Operators for Modeling in Verilog HDL and VHDL. FPGA Building Block Architectures, FPGA Interconnect Routing Procedures. Design for Testability: Ad Hoc Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan	[9]
Total Hours	45

Text Book(s):	
1.	Neil H.E. Weste, David Money Harris — CMOS VLSI Design: A Circuits and Systems Perspective, 4th Edition, Pearson, 2017.
2.	Jan M. Rabaey, Anantha Chandrakasan, Borivoje. Nikolic, Digital Integrated Circuits:A Design perspective, Second Edition, Pearson, 2016.
Reference(s):	
1.	Sung-Mo kang, Yusuf leblebici, Chulwoo Kim — CMOS Digital Integrated Circuits:Analysis & Design,4th edition McGraw Hill Education, 2013.
2.	Wayne Wolf, — Modern VLSI Design: System on Chip, Pearson Education, 2007.
3.	R.Jacob Baker, Harry W.LI., David E.Boyee, — CMOS Circuit Design, Layout and Simulation‖, Prentice Hall
4.	M.J. Smith, — Application Specific Integrated Circuits, Addisson Wesley, 3rd Edition Pearson 2003.

*- SDG 9 - Industrial Innovation and Infrastructure

Course Contents and Lecture Schedule

S. No	Topics	No. of Hours
1	**INTRODUCTION TO MOS TRANSISTOR**	
1.1	MOS Transistor, CMOS logic, Inverter	1
1.2	Pass Transistor, Transmission gate	1
1.3	Layout Design Rules, Gate Layouts, Stick Diagrams	1
1.4	Long-Channel I-V characteristics, C-V characteristics	2
1.5	Non ideal I-V Effects, DC Transfer characteristics	1
1.6	RC Delay Model, Elmore Delay	1
1.7	Linear Delay Model, Logical effort	1
1.8	Parasitic Delay, Delay in Logic Gate, Scaling	2
2	**COMBINATIONAL MOS LOGIC CIRCUITS**	
2.1	Circuit Families: Static CMOS, Ratioed Circuits	1
2.2	Cascode Voltage Switch Logic, Dynamic Circuits	2
2.3	Pass Transistor Logic, Transmission Gates	1
2.4	Domino, Dual Rail Domino	1
2.5	CPL, DCVSPG	1
2.6	DPL, Circuit Pitfalls	1
2.7	Power: Dynamic Power, Static Power	1
2.8	Low Power Architecture	1
3	**SEQUENTIAL CIRCUIT DESIGN**	
3.1	Static latches and Registers	1
3.2	Dynamic latches and Registers	1
3.3	Pulse Registers, Sense Amplifier Based Register	1
3.4	Pipelining, Schmitt Trigger	1
3.5	Monostable Sequential Circuits,	1
3.6	Astable Sequential Circuits	1
3.7	Timing Issues: Timing Classification of Digital System	1
3.8	Synchronous Design	2
4	**DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM**	
4.1	Arithmetic Building Blocks: Data Paths, Adders	1
4.2	Multipliers, Shifters, ALUs	1
4.3	power and speed tradeoffs	1
4.4	Case Study: Design as a tradeoff	2
4.5	Designing Memory and Array structures: Memory Architectures and Building Blocks	2
4.6	Memory Core	1
4.7	Memory Peripheral Circuitry	1
5	**IMPLEMENTATION STRATEGIES AND TESTING**	
5.1	Electronic Design Automation	1
5.2	Hardware modeling with the Verilog HDL and VHDL	1
5.3	Logic System, Data Types and Operators for Modeling in Verilog HDL and VHDL	2
5.4	FPGA Building Block Architectures	1
5.5	FPGA Interconnect Routing Procedures	1
5.6	Design for Testability: Ad Hoc Testing, Scan Design	1
5.7	BIST, IDDQ Testing	1
5.8	Design for Manufacturability, Boundary Scan	1
	Total	45

Course Designer(s)

Dr.S.Gomathi -gomathi@ksrct.ac.in

60 EE E27	Design of Motor and Power Converters for Electric Vehicle	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To understand the dynamics of EVs
- To gain a comprehensive understanding of electric motors for EV applications
- To investigate emerging DC-DC converter technologies and their modeling approaches
- To impart knowledge on vehicle control for standard drive cycles of electrical vehicles (EVs)
- To develop a thorough understanding of power stage transfer functions in DC-DC converters, enabling accurate modeling and analysis for optimal control design and performance optimization.

Pre-requisites

- Knowledge on Electrical Machines, Control System, Power Electronics

Course Outcomes

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

CO1	Analyze, design, and optimize EV systems for sustainable and efficient transportation solutions.	Analyze
CO2	Analyze speed and torque control strategies for each motor type, above and below rated speed.	Analyze
CO3	Analyze and model the buck/boost converter operation and to design the same	Analyze
CO4	Design and implement efficient and robust control systems for various electric motor drives.	Apply
CO5	Understand the concept and significance of power stage transfer functions in DC-DC converters.	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	2	2	2	3
CO2	3	3	2	2	2	2	2	2	2	2	2	2	2	3
CO3	3	3	2	2	2	2	2	2	2	2	2	2	2	3
CO4	3	3	2	2	2	2	2	2	2	2	2	2	2	3
CO5	3	3	2	2	2	2	2	2	2	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	20	20	30
Understand	10	10	30
Apply	20	20	30
Analyse	10	10	10
Evaluate	-	-	-
Create	-	-	-
Total	**60**	**60**	**100**

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BoS Chairman Signature

K.S.Rangasamy College of Technology – Autonomous R2022

60 EE E27 – Design of Motor and Power Converters for Electric Vehicles

B.E – Electrical and Electronics Engineering

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

ELECTRIC VEHICLE DYNAMICS* Introduction to EVs, Types & Parts, Applications, and advantages.-Standard drive cycles-Dynamics of Electric Vehicles-Tractive force-Maximum speed, torque, power, energy requirements of EVs.	[9]
MOTORS FOR ELECTRIC VEHICLES * Introduction – Speed And Torque control of above and below rated speed-Speed control of EV in the constant power region of electric motors. DC Motors, Induction Motor, Permanent Magnet Synchronous Motors (PMSM), Brushless DC Motors, Switched Reluctance Motors (SRMs).Synchronous Reluctance Machines-Choice of electric machines for EVs.	[9]
MODELING OF DC-DC CONVERTERS* Overview of PWM Converter Modelling -Power Stage Modelling - PWM Block Modelling – Voltage Feedback Circuit and Small-Signal Model of PWM Converter - Averaging Power Stage Dynamics - Average Models for buck/boost Converter - Small-Signal Model of Converter Power Stage - Frequency Response of Converter	[9]
CONTROL OF DC AND AC MOTOR DRIVES* Speed control for constant torque, constant HP operation of all electric motors - DC/DC chopper based four quadrant operation of DC motor drives, inverter based V/f Operation (motoring and braking) of induction motor drives, vector control operation of Induction motor and PMSM, Brushless DC motor drives, Switched reluctance motor (SRM) drives.	[9]
POWER STAGE TRANSFER FUNCTIONS OF DC – DC CONVERTERS * Power Stage Transfer Functions of buck-boost Converter in CCM Operation, Input-to-Output Transfer Function, Duty Ratio-to-Output Transfer Function, Load Current-to-Output Transfer Function. **Hands-on Practice: (MATLAB / SCI LAB / Any other Open Source)** Design of buck converter Design of boost converter Simulation of buck, boost and buck boost converter-open loop (With power circuit and Transfer function).	[9]
Total Hours	45

Text Book(s):

1.	Teuvo Suntio, Tuomas Messo, Joonas “Power Electronic Converters” , 1 st Edition, Puukko, 2017
2.	Atif Iqbal, Shaikh Moinoddin, Bhimireddy Prathap Reddy, “Electrical Machine Fundamentals with Numerical Simulation using MATLAB/SIMULINK”, , Wiley,2021, 1st Edition.

Reference(s):

1.	Rabiul Islam,Md. Rakibuzzaman Shah, Mohd. Hasan Ali, “Emerging Power Converters for Renewable Energy and Electric Vehicles Modeling, Design, and Control”, CRC Press,2021, 1 st Edition
2.	Iqbal Hussain, “Electric and Hybrid Vehicles: Design Fundamentals, Second Edition” CRCPress, Taylor & Francis Group, Third Edition 2021.
3.	Randall Shaffer, “Fundamentals of Power Electronics with MATLAB”, 2nd Edition, 2013, Lakshmi
4.	Gopal.K.Dubey, “Fundamentals of Electrical Drives” Narosa Publishing House, second Edition, 2020

*SDG-7- Affordable and Clean Energy

Course Content and Lecture Schedule

S.No	Topics	No. of Hours
1	**ELECTRIC VEHICLE DYNAMICS**	
1.1	Introduction to EVs, Types & Parts	2
1.2	Applications, and advantages	1
1.3	Standard drive cycles	1
1.4	Dynamics of Electric Vehicles	2
1.5	Tractive force	1
1.6	Maximum speed, torque,	1
1.7	Power, energy requirements of EVs.	1
2	**MOTORS FOR ELECTRIC VEHICLES**	
2.1	Introduction – Speed And Torque control of above and below rated speed	1
2.2	Speed control of EV in the constant power region of electric motors.	1
2.3	DC Motors,	1
2.4	Induction Motor	1
2.5	Permanent Magnet Synchronous Motors (PMSM),	1
2.6	Brushless DC Motors,	1
2.7	Synchronous Reluctance Machines	1
2.8	Switched Reluctance Motors (SRMs)	1
2.9	Choice of electric machines for EVs	1
3	**MODELING OF DC-DC CONVERTERS**	
3.1	Overview of PWM Converter Modelling	1
3.2	Power Stage Modelling	1
3.3	PWM Block Modelling	1
3.4	Voltage Feedback Circuit	1
3.5	Small Signal Model of PWM Converter	1
3.6	Averaging Power Stage Dynamics	1
3.7	Average Models for buck/boost Converter	1
3.8	Small-Signal Model of Converter Power Stage	1
3.9	Frequency Response of Converter	1
4	**CONTROL OF DC AND AC MOTOR DRIVES**	
4.1	Speed control for constant torque, constant HP operation of all electric motors	2
4.2	DC/DC chopper based four quadrant operation of DC motor drives,	1
4.3	inverter based V/f Operation (motoring and braking) of induction motor drives,	2
4.4	vector control operation of Induction motor and PMSM,	2
4.5	Brushless DC motor drives,	1
4.6	Switched reluctance motor (SRM) drives.	1
5	**POWER STAGE TRANSFER FUNCTIONS OF DC – DC CONVERTERS**	
5.1	Power Stage Transfer Functions	2
5.2	buck-boost Converter in CCM Operation,	2
5.3	Input-to-Output Transfer Function,	2
5.4	Duty Ratio-to-Output Transfer Function,	2
5.5	Load Current-to-Output Transfer Function	1

Course Designer(s)

1. S.Shree Ram Senthil- shreeramsenthil@ksrct.ac.in

PROFESSIONAL ELECTIVES (PE)

SEMESTER VII, Professional Elective III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 EE E31	Wind Energy Conversion Systems	PE	3	3	0	0	3
2.	60 EE E32	Industrial Internet of Things	PE	3	3	0	0	3
3.	60 EE E33	Substation Engineering and Substation Automation	PE	3	3	0	0	3
4.	60 EE E34	Multilevel Power Converters	PE	3	3	0	0	3
5.	60 EE E35	Embedded Processor	PE	3	3	0	0	3
6.	60 EE E36	Neural Networks and Fuzzy Systems	PE	3	3	0	0	3
7.	60 EE E37	Electric Vehicle Design, Mechanics and Control	PE	3	3	0	0	3

60 EE E31	Wind Energy Conversion Systems	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To understand the fundamental principles of wind energy conversion.
- To analyse wind resource assessment techniques.
- To investigate different types of wind turbine and their components.
- To explore the integration of wind energy into power grids.
- To assess the applications and economics of wind energy.

Pre-requisites

- Mathematics, Physics, Control System, Power Electronics

Course Outcomes

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

CO1	Analyze wind energy fundamentals and resource assessment techniques.	Analyze
CO2	Analyze the aerodynamic principles governing wind turbine performance and power extraction.	Analyze
CO3	Classify various wind turbine technologies, components, and control strategies.	Apply
CO4	Analyze the operation of wind energy conversion systems and their integration with the power grid.	Analyze
CO5	Estimate the economic and environmental aspects of wind energy development.	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	3	3	-	2	2	2	-	-	1	3	2
CO2	3	3	3	3	3	-	2	2	2	-	-	1	3	2
CO3	3	2	2	2	3	-	2	2	2	-	-	1	3	2
CO4	3	3	3	3	3	-	2	2	2	-	-	1	3	2
CO5	3	2	2	2	3	-	2	2	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	10	10	10
Understand	20	20	30
Apply	10	10	30
Analyse	20	20	30
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. – Electrical and Electronics Engineering</td></tr>
<tr><td colspan="9">60 EE E31- Wind Energy Conversion Systems</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>VII</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>
</table>

Introduction to Wind Energy* History and development of wind energy -Wind Energy Basics, Wind Speeds and scales, Terrain, Roughness, Wind Mechanics, Power Content, Class of wind turbines- Wind energy resource assessment - wind data acquisition and analysis-Wind power potential and limitations-Environmental impacts of wind energy.	[9]
Wind Turbine Aerodynamics* Wind characteristics and wind resource assessment-Aerodynamics of air foils - lift and drag forces-Betz limit and power extraction from wind-Wind turbine rotor design principles.	[9]
Wind Turbine Technologies* Horizontal Axis Wind Turbines (HAWTs) vs. Vertical Axis Wind Turbines (VAWTs)- Components of a wind turbine: tower, nacelle, rotor, blades, gearbox, generator-Power control strategies for wind turbines- blade pitch control, yaw control, and power regulation.	[9]
Wind Energy Conversion Systems* Types of generators used in wind turbines - DC generators- Fixed vs. variable speed wind generators- induction generators, synchronous generators -Integration of wind farms into power grids- Power electronics converters for wind energy conversion. **Hands - on:** 1. Simulation of DFIG based Wind turbine. 2. Simulation of PMSG based Wind turbine.	[9]
Wind Energy Economics* Economic aspects of wind energy- Capacity Factor-Cost Calculation-Annual Energy Output-Simple Payback Period Capital Recovery Factor-Depreciation-Life Cycle Costing-cost of wind power, subsidies-Wind energy policies and future prospects.	[9]
Total Hours:	**45**

Text Book(s):

1.	Tiwari, G. N. and Somasundaram, S. “Wind Energy Handbook", Alpha Science International Ltd, 2020.
2.	Venkata Yaramasu and Bin Wu., “Model Predictive Control of Wind Energy Conversion Systems”, Wiley- IEEE Press, 2016.

Reference(s):

1.	Sathyamurthy T, "Renewable Energy Engineering and Technology”, CRC Press, 2023.
2.	Mukherji, S., and Banerjee, S.,"Wind Power Systems: Theory and Practice", CRC Press, 2022.
3.	Joshua Earnest and Tore Wizeliu., “Wind Power Plants and Project Development”, PHI Learning Pvt.Ltd, New Delhi, 2015.
4.	Freris, N.,"Wind Turbine Technology”, Academic Press, 2019.

*SDG 7 – Affordable and Clean Energy

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Introduction to Wind Energy**	
1.1	History and development of wind energy	1
1.2	Wind Energy Basics, Wind Speeds and scales, Terrain, Roughness,	2
1.3	Wind Mechanics, Power Content, Class of wind turbines	1
1.4	Wind energy resource assessment	1
1.5	Wind data acquisition and analysis	2
1.6	Wind power potential and limitations	1
1.7	Environmental impacts of wind energy	1
2.0	**Wind Turbine Aerodynamics**	
2.1	Wind characteristics	1
2.2	Wind resource assessment	1
2.3	Aerodynamics of air foils	2
2.4	Lift and drag forces	1
2.5	Betz limit and power extraction from wind	2
2.6	Wind turbine rotor design principles.	2
3.0	**Wind Turbine Technologies**	
3.1	Horizontal Axis Wind Turbines (HAWTs)	1
3.2	Vertical Axis Wind Turbines (VAWTs)	1
3.3	Components of a wind turbine: tower, nacelle, rotor, blades, gearbox, generator	2
3.4	Power control strategies for wind turbines	2
3.5	Blade pitch control,	1
3.6	Yaw control and Power regulation.	2
4.0	**Wind Energy Conversion Systems**	
4.1	Types of generators used in wind turbines	1
4.2	DC generators	1
4.3	Fixed vs. variable speed wind generators	2
4.4	Induction generators and synchronous generators	2
4.5	Integration of wind farms into power grids	2
4.6	Power electronics converters for wind energy conversion	1
5.0	**Wind Energy Economics**	
5.1	Economic aspects of wind energy	2
5.2	Capacity Factor.	1
5.3	Cost Calculation	1
5.4	Depreciation & Life Cycle Costing	1
5.5	Annual Energy Output-Simple Payback Period Capital Recovery Factor	1
5.6	Cost of wind power & subsidies	1
5.7	Wind energy policies and future prospects	2

Course Designer(s)

1. Mr.S.Shree Ram Senthil - shreeramsenthil@ksrct.ac.in

60 EE E32	Industrial Internet of Things	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- Understand the historical industrial revolutions, the role of traditional IoT and IIoT in modern industry.
- Gain knowledge of various sensors and actuators used in industrial processes and the roles of microcontrollers and embedded PCs within IIoT systems.
- Learn about communication protocols like Bluetooth, WiFi, and LoRa used in wireless sensor nodes, and explore the functionalities of IoT Hub systems.
- Understand the role of IoT gateways and edge systems, and grasp real-time data monitoring techniques.
- Explore next-gen sensors, collaboration platforms, AR/VR, AI, and Big Data in IIoT.

Pre-requisites

- Embedded system, Microprocessor and microcontroller, internet of things

Course Outcomes

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

CO1	Apply knowledge of IIoT to analyse the evolution of industrial systems and their impact on Industry 4.0.	Apply
CO2	Design and implement sensor-based data acquisition systems for industrial processes using appropriate communication protocols	Analyse
CO3	Utilize cloud computing and edge computing technologies to monitor and analyse real-time industrial data for decision-making.	Apply
CO4	Evaluate the potential of advanced technologies like AR/VR, AI, and Big Data within the context of IIoT applications.	Apply
CO5	Develop and propose an IIoT solution addressing a current societal need, considering project development tools and practical implementation aspects.	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	3	2
CO2	3	3	3	-	-	-	-	-	-	-	-	2	3	2
CO3	3	3	3	-	-	-	-	-	-	-	-	2	3	2
CO4	3	3	3	-	-	-	-	-	-	-	-	2	3	2
CO5	3	3	3	-	-	-	-	-	-	-	-	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	20	10	10
Understand	20	20	30
Apply	10	20	30
Analyse	10	10	30
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 – Electrical and Electronics Engineering</td></tr>
<tr><td colspan="9">60 EE E32 - Industrial Internet of Things</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>VII</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 to Industrial IoT (IIoT) Systems*: introduction, The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, IoT architecture, application based IoT protocol, cloud computing, Fog computing, Industry 4.0 revolutions, Support System for Industry 4.0,</td><td>[9]</td></tr>
<tr><td colspan="8">Implementation systems for IIoT*: IIoT and Industry 4.0, Industrial Internet Systems, Industrial sensing, Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisitions on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols and IoT Hub systems</td><td>[9]</td></tr>
<tr><td colspan="8">IIoT Data Monitoring & Control*: Industrial Data Transmission - Foundation Fieldbus, Profibus, HART, Interbus, Bitbus, CC-Link Wireless HART, LoRa and LoRaWAN. Industrial Data Acquisition - Distributed Control System, PLC, SCADA. IoT Gate way, IoT Edge Systems and It's Programming, Real Time Dashboard for Data Monitoring, Data Analytics and Predictive Maintenance with IIoT technology. Challenges of analytics in industries.</td><td>[9]</td></tr>
<tr><td colspan="8">Cyber Physical Systems*: Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis, Smart Factories, lean manufacturing system, Introduction to machine learning and deep learning in industries.</td><td>[9]</td></tr>
<tr><td colspan="8">Industrial IoT- Applications*: Healthcare, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management. Case studies: manufacturing industry, automotive industry, mining industry</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">S. Misra, C. Roy, and A. Mukherjee, "Introduction to Industrial Internet of Things and Industry 4.0", CRC Press, 2020.</td></tr>
<tr><td>2.</td><td colspan="8">Alasdair Gilchrist, Industry 4.0 The Industrial Internet of Things, Apress, 2016</td></tr>
<tr><td colspan="9">Reference(s):</td></tr>
<tr><td>1.</td><td colspan="8">S. Misra, A. Mukherjee, A. Roy, "Introduction to IoT", Cambridge University Press, 2021.</td></tr>
<tr><td>2.</td><td colspan="8">Christoph Jan Bartodziej, "The Concept Industry 4.0 An Empirical Analysis of Technologies and Applications in Production Logistics", Springer, 2016.</td></tr>
<tr><td>3.</td><td colspan="8">Rajkamal , "Embedded System: Architecture, Programming and Design" McGraw-Hill, 2003.</td></tr>
<tr><td>4.</td><td colspan="8">Dr. OvidiuVermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, 2022</td></tr>
</table>

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of Hours**
1.0	**Introduction to Industrial IoT Systems**	
1.1	Introduction, The Various Industrial Revolutions	2
1.2	Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT)	1
1.3	Industry IoT architecture	1
1.4	Application based IoT protocol,	1
1.5	Cloud computing	1
1.6	Industry 4.0 revolutions,	1
1.7	Support System for Industry 4.0	1
1.8	Smart Factories	1
2.0	**Implementation systems for IIoT**	
2.1	Sensors and Actuators for Industrial Processes	1
2.2	Sensor networks	1
2.3	Process automation and Data Acquisitions on IoT Platform	1
2.4	Microcontrollers and Embedded PC roles in IIoT	2
2.5	Wireless Sensor nodes with Bluetooth	1
2.6	Wireless Sensor nodes with WiFi	1
2.7	Wireless Sensor nodes with LoRa Protocols	1
2.8	IoT Hub systems	1
3.0	**IIoT Data Monitoring & Control**	
3.1	Industrial Data Transmission - Foundation Fieldbus, Profibus,	1
3.2	HART, Interbus, Bitbus, CC-Link	1
3.3	Wireless HART	1
3.4	LoRa and LoRaWAN	1
3.5	IoT Gate way	1
3.6	IoT Edge Systems and It's Programming	1
3.7	Real Time Dashboard for Data Monitoring	1
3.8	Data Analytics and Predictive Maintenance with IIoT technology	1
3.9	Challenges of analytics in industries	1
4.0	**Cyber Physical Systems**	
4.1	Next Generation Sensors	1
4.2	Collaborative Platform and Product Lifecycle Management	1
4.3	Augmented Reality and Virtual Reality	1
4.4	Artificial Intelligence	1
4.5	Big Data and Advanced Analysis	1
4.6	Smart Factories	1
4.7	lean manufacturing system	1
4.8	Introduction to machine learning in industries	1
4.9	Introduction to deep learning in industries	1
5.0	**Industrial IoT- Applications**	
5.1	Healthcare	1
5.2	Inventory Management & Quality Control	2
5.3	Plant Safety and Security (Including AR and VR safety applications)	2
5.4	Facility Management.	1
5.5	Case studies: manufacturing industry	1
5.6	Case studies: automotive industry	1
5.7	Case studies: mining industry	1

Course Designer(s)

1. Mr.N.Rajasekaran - rajasekaran.n@ksrct.ac.in

60 EE E33	Substation Engineering and Substation Automation	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- Understanding the requirement of to design substation
- Understanding of the concepts behind substation equipment selection.
- Exposure the knowledge in protection device used for Substation Automation
- Enhance the knowledge in layout of outdoor substation design.
- Familiarization of site development plan and understand the substation safety systems

Pre-requisites

- Electrical Circuit Analysis, Generation Transmission and Distribution, Power System Analysis.

Course Outcomes

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

CO1	Analyze the sizing and selection of equipment which forms part of substation	Analyze
CO2	Grasp the key deciding factors involved in substation design and operation	Apply
CO3	Analyze the composite layout design aspects of the substation with different services and the challenges including statutory clearances.	Analyze
CO4	Comprehend about substation automation system and different communication protocol involved for efficient operation of a substation.	Analyze
CO5	Comprehend about Interdisciplinary aspects involved in substation design	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	-	-	-	3	3	3
CO2	3	2	3	3	2	2	2	2	2	-	-	2	3	2
CO3	3	2	3	3	2	2	2	2	2	-	-	3	3	2
CO4	3	3	2		2	3	2	2	2	-	-	2	3	2
CO5	3	2	3	2	2	-	2	2	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	20	34
Understand	20	20	46
Apply	10	10	10
Analyse	10	10	10
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E – Electrical and Electronics Engineering								
60 EE E33 - Substation Engineering and Substation Automation								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

SUBSTATION EQUIPMENT: Selection and sizing of main substation equipments-Classification of equipment with a practical overview, and the performance parameters. Classifications of MV Switchgear and Key Design Parameters, MV/LV Switchgear construction and design of control scheme. Station Auxiliary equipment: Diesel Generator System, Basics of AC/DC Auxiliary Power System & Sizing of Auxiliary Transformer, DC System Components, Battery Sizing & Charger Sizing, DG Set Classification, and sizing.	[9]
SUBSTATION DESIGN DEVELOPMENT*: Substation classifications, Transmission substation 200, 132 kV and Distribution substation 33/11kV. Different bus bar switching schemes for Substation. Standards and Practices, Factors Influencing Substation Design - Altitude, Ambient Temperature, Earthquake and seismic zones, pollution and corrosion etc., Testing of Electrical Equipment, Concept and development of Single Line Diagram. Requirement of substation calculation.	[9]
SUBSTATION DESIGN & LAYOUT ENGINEERING*: Layout aspects of outdoor Air Insulated Substation: Statutory Clearances, Equipment Layout engineering aspects for Outdoor Substation and related calculations, and guide lines, Cable routing layout, Erection Key Diagram (EKD), switchyard earthing design as per IEEE80, Earthing Design, Direct stroke Lightning Protection for switchyard with IS/ IEC 62305. LV/MV Cables, Methods for Cable Installation, Cable Sizing and Cable accessories. **Case study** - Direct stroke lightning protection calculation for outdoor switchyard based on IEC 62305	[9]
PROTECTION AND SUBSTATION AUTOMATION*: Power System protection, Over current and Earth Fault protection and coordination. Distribution Feeder Protection, Transformer – Unit/Main Protection, Familiarization of Numerical Relays, distance/differential protection for transmission line. Substation Automation: SCADA, Communication System Fundamentals - Protocol fundamental and choosing the right protocol. Substation integration and automation functional architecture, Substation signal list - DI, DO, AI, AO– Bay Control Unit (BCU), Remote Terminal Unit RTU. **Hands - on:** • Protection and substation control with MATLAB / simulink	[9]
INTERFACE ENGINEERING*: Civil & Structural Engineering - Familiarization of site development plan, equipment supports structures, foundation for equipment, familiarization of control building and substation building, infrastructure development, Mechanical System - Fire Detection, Alarm System and Fire Suppression System for transformer, Heating, Ventilation and Air-conditioning (HVAC) for Substation.	[9]
Total Hours:	**45**

Text Book(s):

1.	Mc Donald John D, “Electric Power Substations Engineering”, CRC Press, 3rd Edition, 2012
2.	Partap Singh Satnam, P.V. Gupta, “Sub-station Design and Equipment”, Dhanpat Rai Publications, 1st Edition, 2013

Reference(s):

1.	Sunil S. Rao, “Switchgear Protection and Power Systems (Theory, Practice & Solved Problems)”, Khanna Publications, 14th Edition, 2019.
2.	Electrical substation and engineering & practice by S.Rao, 3rd Edition, Khanna Publishers 2015
3.	Manual on Substation by Central Board of irrigation and Power (CBIP) Publication No 342.2006.
4.	Substation automation system Design and implementation by Evelio Padilla by Wiley Publications, 1st Edition, 2015 November

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**SUBSTATION EQUIPMENT**	
1.1	Selection and sizing of main substation equipments	1
1.2	Classification of equipment with a practical overview, and the performance parameters.	2
1.3	Classifications of MV Switchgear and Key Design Parameters	1
1.4	MV/LV Switchgear construction and design of control scheme.	1
1.5	Station Auxiliary equipment, Diesel Generator System	1
1.6	Basics of AC/DC Auxiliary Power System & Sizing of Aux. Transformer,	1
1.7	DC System Components,	1
1.8	Battery Sizing & charger Sizing, DG Set Classification, and sizing.	1
2.0	**SUBSTATION DESIGN DEVELOPMENT**	
2.1	Substation Classifications, Transmission substation lay out 132, 220 kV and Distribution substation lay out 33 and 11kV	1
2.2	Different bus bar switching schemes for Substation	1
2.3	Standards and Practices	1
2.4	Factors Influencing Substation Design	1
2.5	Altitude, Ambient Temperature, Earthquake and seismic zones, pollution and corrosion etc.,	2
2.6	Testing of Electrical Equipment	1
2.7	Concept and development of Single Line Diagram	1
2.8	Requirement of substation calculation	1
3.0	**SUBSTATION DESIGN & LAYOUT ENGINEERING**	
3.1	Layout aspects of Outdoor Air Insulated Substation	1
3.2	Statutory Clearances, Equipment Layout engineering aspects for Outdoor Substation and related calculations, and guide lines.	1
3.3	Cable routing layout, Erection Key Diagram (EKD), switchyard earthing design as per IEEE80, Earthing Design	1
3.4	Direct stroke Lightning Protection for switchyard with IS/ IEC 62305.	2
3.5	LV Cables & MV Cables, Cable Sizing and Cable accessories.	1
3.6	Case study.-Direct stroke lightning protection calculation for outdoor switchyard based on IEC 62305	2
4.0	**PROTECTION AND SUBSTATION AUTOMATION**	
4.1	Over current and Earth Fault protection and coordination.	1
4.2	Distribution Feeder Protection, Transformer and Unit/Main Protection,	1
4.3	Numerical relays, distance/differential protection for transmission line.	1
4.4	Substation Automation: SCADA, Communication System Fundamentals	1
4.5	Protocol fundamental and choosing the right protocol.	1
4.6	Substation integration and automation functional architecture,	1
4.7	Substation signal list, DI, DO, AI, AO and Bay Control Unit (BCU), Remote Terminal Unit RTU.	1
4.8	**Hands - on:** Protection and substation control with MATLAB / simulink	2
5.0	**INTERFACE ENGINEERING**	
5.1	Civil & Structural Engineering	1
5.2	Familiarization of site development plan,	1
5.3	Equipment supports structures, foundation for equipment,	1
5.4	Familiarization of control building and substation building, infrastructure	2
5.5	Fire Detection, Alarm and Fire Suppression System for transformer,	2
5.6	Heating, Ventilation and Air-conditioning (HVAC) for Substation	2

Course Designer(s)

Dr.T.Venkatesan - venkatesan@ksrct.ac.in

60 EE E34	Multilevel Power Converters	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To learn multilevel topology (Symmetry & Asymmetry) with common DC bus link.
- To illustrate the various modulation methods and various Topologies of Cascaded H-Bridge Multilevel Inverter
- To enrich the knowledge of Diode Clamped Multilevel Converter
- To learn the concept of Flying Capacitor Multilevel Converter
- To demonstrate the concepts of Multilevel Converter with Reduced Switch Count

Pre-requisites

- Power Electronics

Course Outcomes

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

CO1	Describe the different topologies of Multilevel Inverters (MLIs) with and without DC link capacitor.	Understand
CO2	Demonstrate the performance of MLIs with Bipolar Pulse Width Modulation (PWM) Unipolar PWM Carrier-Based PWM Schemes Phase Level Shifted Multicarrier Modulation	Apply
CO3	Describe the working principles of Cascaded H-Bridge MLI, diode clamped MLI, flying capacitor MLI and MLI with reduced switch count	Understand
CO4	Illustrate the voltage balancing performance in Diode clamped MLI	Understand
CO5	Describe three level, capacitor clamed and diode clamped MLI with R and RL load, MLI with reduced switch configuration using fundamental switching scheme	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	-	-	3	2	3
CO2	3	3	3	3	3	-	-	-	2	-	-	3	2	3
CO3	3	3	3	3	3	-	-	-	2	-	-	3	2	3
CO4	3	3	3	3	3	-	-	-	2	-	-	3	2	3
CO5	3	3	3	3	3	-	-	-	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	20	20	34
Understand	30	40	66
Apply	10	-	-
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E- Electrical and Electronics Engineering

60 EE E34 - Multilevel Power Converters

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

Content	Hours
MULTILEVEL TOPOLOGIES * Introduction, Generalized Topology with a Common DC bus, Converters derived from the generalized topology, symmetric topology without a common DC link, Asymmetric topology. Classification of MLIs based upon number of input sources: Single source topologies and multiple source topologies.	[9]
CASCADED H-BRIDGE MULTILEVEL INVERTERS* Introduction -H-Bridge Inverter, Bipolar Pulse Width Modulation, Unipolar Pulse Width Modulation. Multilevel Inverter Topologies, CHB Inverter with Equal DC Voltage, H-Bridges with Unequal DC Voltages – PWM, Carrier-Based PWM Schemes, Phase-Shifted Multicarrier Modulation, Level Shifted Multicarrier Modulation, Comparison Between Phase- and Level-Shifted PWM Schemes Stair case Modulation Hands on training: (Using MATLAB Software) • Simulation of Fixed PWM for an inverter • Simulation of Sinusoidal PWM for an inverter • Simulation of H bridge inverter with R load	[9]
DIODE CLAMPED MULTILEVEL CONVERTER* Introduction – Converter structure and Functional Description – Modulation of Multilevel converters – Voltage balance Control – Effectiveness Boundary of voltage balancing in DCMC converters – Performance results.	[9]
FLYING CAPACITOR MULTILEVEL CONVERTER* Introduction – Flying Capacitor topology – Modulation scheme for the FCMC – Dynamic voltage balance of FCMC	[9]
MULTILEVEL CONVERTER WITH REDUCED SWITCH COUNT* Recent developments in multilevel inverter topologies. Multilevel inverter with reduced switch count -structures their working. Pulse generation methods. Modulation techniques and their implementation. Applications of MLI in Power Quality Improvement, Renewable Energy Interconnections and Variable Speed Drives.	[9]
Total Hours:	**45**

Text Book(s):

1.	Rashid M.H,"Power Electronics Circuits, Devices and Applications", Prentice Hall India, Third Edition, New Delhi, 2017 Pearson 4th edition
2.	Sergio Alberto Gonzalez, Santiago Andres Verne and Maria Ines Valla, "Multilevel Converters for Industrial Applications", CRC Press, 22-Jul-2013, 2017 1st Edition

Reference(s):

1.	Thomas A. Lipo, "Pulse Width Modulation for Power Converters: Principles and Practice", John Wiley & Sons, Oct-2003, 1st Edition
2.	Fang Lin Luo, Hong Ye, "Advanced DC/AC Inverters: Applications in Renewable Energy", CRC Press, 2017, 1st Edition
3.	Hani Vahedi, Mohamed Trabelsi, "Single-DC-Source Multilevel Inverters", Springer, 2019, 1st Edition.
4.	Ersan Kabalcı, "Multilevel Inverters Introduction and Emergent Topologies", Academic Press Inc,2021, 1st Edition

*** SDG 7 – Affordable and Clean Energy**

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**MULTILEVEL TOPOLOGIES**	
1.1	Introduction, Generalized Topology with a Common DC bus	1
1.2	Converters derived from the generalized topology	1
1.3	symmetric topology without a common DC link	1
1.4	Asymmetric topology	1
1.5	Classification of MLIs based upon number of input sources	2
1.6	Single source topologies	2
1.7	multiple source topologies.	1
2	**CASCADED H-BRIDGE MULTILEVEL INVERTERS**	
2.1	Introduction -H-Bridge Inverter	1
2.2	Bipolar Pulse Width Modulation	1
2.3	Unipolar Pulse Width Modulation	1
2.4	Multilevel Inverter Topologies, CHB Inverter with Equal DC Voltage	1
2.5	H-Bridges with Unequal DC Voltages	1
2.6	PWM, Carrier-Based PWM Schemes	1
2.7	Phase-Shifted Multicarrier Modulation	1
2.8	Level Shifted Multicarrier Modulation	1
2.9	Comparison Between Phase- and Level-Shifted PWM Schemes Stair case Modulation	1
	Simulation of Fixed PWM for an inverter	1
	Simulation of Sinusoidal PWM for an inverter	1
	Simulation of H bridge inverter with R load	1
3	**DIODE CLAMPED MULTILEVEL CONVERTER**	
3.1	Introduction – Converter structure and Functional Description	2
3.2	Modulation of Multilevel converters	2
3.3	Voltage balance Control	1
3.4	Effectiveness Boundary of voltage balancing in DCMC converters	2
3.5	Performance results.	2
4	**FLYING CAPACITOR MULTILEVEL CONVERTER**	
4.1	Introduction	1
4.2	Flying Capacitor topology	2
4.3	Modulation scheme for the FCMC	2
4.4	Dynamic voltage balance of FCMC	1
5	**MULTILEVEL CONVERTER WITH REDUCED SWITCH COUNT**	
5.1	Recent developments in multilevel inverter topologies	1
5.2	Multilevel inverter with reduced switch count-structures their working and simulations	2
5.3	working principles and pulse generation methods	2
5.4	Modulation techniques and their implementation	2
5.5	Applications of MLI in Power Quality Improvement, Renewable Energy Interconnections and Variable Speed Drives.	2

Course Designers

1. R.Radhamani - radhamani@ksrct.ac.in

60 EE E35	Embedded Processors	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To familiarize the basic concepts of embedded processor
- To introduce the architecture of the ARM processor
- To train students in ARM programming
- To discuss memory management and peripheral interfacing with an ARM processor
- To impart the knowledge on single board embedded processor

Pre-requisites

- Microprocessors and microcontroller

Course Outcomes

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

CO1	Categorize and choose the processors for different applications	Understand
CO2	Interpret the basics and functionality of processor functional blocks	Understand
CO3	Apply the essence of RISC processor Architecture in real time applications	Apply
CO4	Incorporate the I/O hardware interface of processor with peripherals	Apply
CO5	Emphasis the communication features of the processor and the applications of 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	-	-	2	2	2	1
CO2	1	1	2	2	1	-	-	3	-	-	2	2	2	2
CO3	1	1	2	2	1	-	-	3	-	-	2	2	3	3
CO4	3	2	3	2	3	3	2	3	3	3	3	3	3	3
CO5	3	2	3	2	3	3	2	3	3	3	3	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	20
Understand	30	30	40
Apply	10	20	40
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 – Electrical and Electronics Engineering</td></tr>
<tr><td colspan="9">60 EE E35 – Embedded Processors</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>VII</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 to Embedded Processors*
Introduction to Embedded Processors – Compare Von Neumann Architecture and Harvard Architecture, RISC Vs CISC – System on Chip (SoC) : Introduction to SoC Architecture, An approach for SoC Design, System Architecture and Complexity, Processor Selection for SoC – Basic Concepts in Processor Architecture.</td><td>[9]</td></tr>
<tr><td colspan="8">ARM Architecture*
Architecture – Memory Organization – Addressing Modes – Registers – Pipeline – Interrupts – Coprocessors – Interrupt Structure.</td><td>[9]</td></tr>
<tr><td colspan="8">ARM Microcontroller Programming*
ARM General Instruction Set – Thumb Instruction Set – Introduction to DSP on ARM – Basic Programming – Programming with IDE.</td><td>[9]</td></tr>
<tr><td colspan="8">Peripherals of ARM*
I/O Memory – EEPROM – I/O Ports – SRAM – Timer – UART – Serial Communication with PC – ADC/DAC Interfacing – Stepper Motor Interfacing – ARM and GSM/GPS Interfacing.</td><td>[9]</td></tr>
<tr><td colspan="8">ARM Communication*
ARM With CAN, I^{2}C, and SPI Protocols
Case Study – Digital Clock, Temperature Sensing, Smart Phone</td><td>[9]</td></tr>
<tr><td colspan="8">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">Steve Furber, “ARM system on chip architecture”, 2nd Edition, Addisonn Wesley, 2015.</td></tr>
<tr><td>2.</td><td colspan="8">Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield’s, “ARM System Developer’s Guide Designing and Optimizing System Software”, 1st Edition, Elsevier 2004.</td></tr>
<tr><td colspan="9">Reference(s):</td></tr>
<tr><td>1.</td><td colspan="8">William Hohl, “ARM Assembly Language’ Fundamentals and Techniques”, 2nd Edition, CRC Press, 2014.</td></tr>
<tr><td>2.</td><td colspan="8">Rajkamal, “Microcontrollers Architecture, Programming, Interfacing, & System Design”, 2nd Edition, Pearson, 2012.</td></tr>
<tr><td>3.</td><td colspan="8">https://nptel.ac.in/courses/117106111</td></tr>
<tr><td>4.</td><td colspan="8">https://onlinecourses.nptel.ac.in/noc20_cs15/preview</td></tr>
</table>

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Embedded Processors**	
1.1	Introduction to Embedded Processors	2
1.2	Compare Von Neumann Architecture and Harvard Architecture, RISC Vs CISC	1
1.3	System on Chip (SoC) : Introduction to SoC Architecture	1
1.4	An approach for SoC Design	1
1.5	System Architecture and Complexity	1
1.6	Processor Selection for SoC	2
1.7	Basic concepts in Processor Architecture	1
2.0	**ARM Architecture**	
2.1	Architecture	2
2.2	Memory Organization	1
2.3	Addressing Modes	1
2.4	Registers	1
2.5	Pipeline	1
2.6	Interrupts	1
2.7	Coprocessors	1
2.8	Interrupt Structure	1
3.0	**ARM Microcontroller Programming**	
3.1	ARM general Instruction set	2
3.2	Thumb instruction set	1
3.3	Introduction to DSP on ARM	2
3.4	Basic Programming	2
3.5	Programming with IDE	2
4.0	**Peripherals of ARM**	
4.1	I/O Memory, EEPROM	1
4.2	I/O Ports, SRAM	1
4.3	Timer	2
4.4	UART	1
4.5	Serial Communication with PC	1
4.6	ADC/DAC Interfacing	1
4.7	Stepper Motor Interfacing	1
4.8	ARM and GSM/GPS Interfacing	1
5.0	**ARM Communication**	
5.1	ARM with CAN Protocol	1
5.2	ARM with I^2C Protocol	1
5.3	ARM with SPI Protocol	1
5.4	Case Study : Digital Clock	2
5.5	Temperature Sensing	2
5.6	Smart Phone	2

Course Designer(s)

Dr.G. Vijaya gowri - vijayagowri@ksrct.ac.in

60 EE E36	Neural Networks and Fuzzy Systems	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To characterize various neural network topologies and apply them to solve electrical engineering problems.
- To introduce students to the concept of fuzzy set theory.
- To demonstrate fuzzy logic control systems and their application in electrical engineering problems.
- To provide an understanding of genetic algorithms and their applications.
- To highlight the features of hybrid systems developed using Fuzzy Logic, Neural Networks, and Genetic Algorithms and their practical applications.

Pre-requisites

- Basic Knowledge on Internet of Things

Course Outcomes

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

CO1	Characterize the concept of artificial neural networks and their topologies.	Remember
CO2	Develop neural network-based controllers and prediction systems for electrical engineering applications using different neural networks and learning methods.	Apply
CO3	Design fuzzy logic controllers for electrical engineering problems using fuzzy concepts and systems.	Analyze
CO4	Understand the concept of genetic algorithms and their functional components.	Understand
CO5	Develop hybrid systems for applications such as direct drive motors and flexible robots.	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	-	-	-	2	-	-	3	2
CO2	3	2			3	2	-	-	-	2	-	-	3	2
CO3	3	2			2	2	-	-	-	2	-	-	3	2
CO4	3	2			2	2	-	-	-	2	-	-	3	2
CO5	3	2			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	10	10	10
Understand	20	20	30
Apply	30	10	30
Analyse	-	20	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E – Electrical and Electronics Engineering								
60 EE E36 - Neural Networks and Fuzzy Systems								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

Neural Network Architectures and Algorithms Biological Neural Network, Artificial Neural Network, common activation functions, network topology, McCulloch Pitts neuron, and learning rules. It includes Supervised Learning Networks like Perceptron networks, Adaline, Madaline, Backpropagation networks; Associative Memory Networks like Hopfield network; and Unsupervised Learning Networks like Kohonen self-organizing feature maps and Adaptive resonance theory.	[9]
Neuro Controller Application * case study on the application of neural computing for lightning, load forecasting, and economic dispatch, along with an introduction to simulation for Neural Networks.	[9]
Fuzzy Theory classical sets, fuzzy set theory including fuzzy set operations and properties, fuzzy relations covering cardinality, operations, properties, and fuzzy composition, linguistic variables, and membership functions**.**	[9]
Fuzzy Logic Controller and Application Fuzzy rule base including the formation of rules and aggregation of fuzzy rules, approximate reasoning, fuzzy inference systems like Mamdani and Sugeno fuzzy systems, fuzzy logic control system design steps, fuzzification and defuzzification methods, adaptive fuzzy systems, and applications such as load frequency control, inverted pendulum, and home heating system, along with an introduction to simulation for fuzzy logic.	[9]
Genetic Algorithm and Hybrid Systems * An introduction to genetic algorithms, basic operators, Simple GA, Neuro-fuzzy systems, concepts, and applications such as the control of direct drive motors, and genetic fuzzy systems with applications like the control of flexible robots.	[9]
Total Hours:	**45**

Text Book(s):

1.	S. N. Sivanandam and S. N. Deepa, “Principles of Soft Computing”, Wiley India (p) Ltd, 3rd Edition, 2018.
2.	S. Rajasekaran, G. A. Vijayalakshmi Pai “Neural Networks, Fuzzy Systems and Evolutionary Algorithms: Synthesis and Applications”, Prentice Hall India, 2017.

Reference(s):

1.	Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, Wiley, 4th edition, 2016.
2.	D. S. Hooda and Vivek Raich “Fuzzy Logic Models and Fuzzy Control: An Introduction”, Alpha Science, 2017.
3.	Tariq Rashid “Make Your Own Neural Network: A Gentle Journey Through the Mathematics of Neural Networks, and Making Your Own Using the Python Computer Language”, 2016.
4.	Charu C. Aggarwal, “Neural Networks and Deep Learning”, Springer, 2018.

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Neural Network Architectures and Algorithms**	9
1.1	Biological Neural Network, Artificial Neural Network	1
1.2	Common activation functions, Network topology	1
1.3	McCulloch Pitts neuron, Learning rules	1
1.4	Supervised Learning Networks: Perceptron networks	1
1.5	Supervised Learning Networks: Adaline	1
1.6	Supervised Learning Networks: Madaline	1
1.7	Supervised Learning Networks: Backpropagation network	1
1.8	Associative Memory Networks: Hopfield network	1
1.9	Unsupervised Learning Networks: Kohonen self-organizing feature maps, Adaptive resonance theory	1
2.0	**Neuro Controller Application**	9
2.1	Case study: Application of neural computing for lightning	1
2.2	Case study: Application of neural computing for load forecasting	1
2.3	Case study: Application of neural computing for economic dispatch	1
2.4	Introduction to simulation for Neural Network	1
2.5	Neural network simulation techniques	1
2.6	Practical implementations and challenges	1
2.7	Hands-on practice: Neural network implementation using C	1
2.8	Hands-on practice: Neural network implementation using C++	1
2.9	Hands-on practice: Single Layer Perceptron and Adaline	1
3.0	**Fuzzy Theory**	9
3.1	Classical sets	1
3.2	Fuzzy set theory: Fuzzy set operations	1
3.3	Fuzzy set theory: Properties of fuzzy sets	1
3.4	Fuzzy relations: Cardinality	1
3.5	Fuzzy relations: Operations	1
3.6	Fuzzy relations: Properties and fuzzy composition	1
3.7	Linguistic variables	1
3.8	Membership function: Introduction	1
3.9	Membership function: Examples and applications	1
4.0	**Fuzzy Logic Controller and Application**	9
4.1	Fuzzy rule base: Formation of rules	1
4.2	Fuzzy rule base: Aggregation of fuzzy rules	1
4.3	Approximate reasoning	1
4.4	Fuzzy inference systems: Mamdani fuzzy systems	1
4.5	Fuzzy inference systems: Sugeno fuzzy systems	1
4.6	Fuzzy logic control system: Design steps	1
4.7	Fuzzification methods	1
4.8	Defuzzification methods	1
4.9	Adaptive fuzzy systems: Applications	1
5.0	**Genetic Algorithm and Hybrid Systems**	9
5.1	Genetic algorithm: Introduction and concepts	1
5.2	Genetic algorithm: Basic operators	1
5.3	Genetic algorithm: Simple GA	1
5.4	Neuro-fuzzy systems: Concept and applications	1
5.5	Control of direct drive motor using neuro-fuzzy systems	1
5.6	Genetic Fuzzy Systems: Concept	1
5.7	Genetic Fuzzy Systems: Application in control of flexible robots	1
5.8	Hands-on practice: Primitive operation on fuzzy set with dynamic components using C	1
5.9	Hands-on practice: Primitive operation on fuzzy set with dynamic components using C++	1

Course Designer(s)

Dr.D.Sri Vidhya- srividhya@ksrct.ac.in

60 EE E37	Electric Vehicle Design, Mechanics and Control	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To gain the knowledge of EV and vehicle mechanics
- To present an overview of Electric Vehicle (EV), Hybrid Electric vehicle (HEV) and their architecture
- To analyze the control preliminaries of electric powertrains
- To derive model for batteries and to know the different types of batteries and its charging methods
- To analyze the modelling of drives.

Pre-requisites

- Fundamental laws of physics and mathematics

Course Outcomes

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

CO1	Explain the concepts related with EV, HEV and to compare the same with internal combustion engine vehicles	Understand
CO2	Determine gain margin & phase margin for various types of transfer functions of boost converter	Apply
CO3	Explain the concepts related with batteries and parameters of battery	Understand
CO4	Illustrate the Control strategies for electric vehicle	Understand
CO5	Demonstrate the Control of Machines	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	-	3	3
CO2	3	3	3	3	3	-	-	-	3	-	2	-	3	3
CO3	3	-	3	3	3	3	3	-	3	-	2	-	3	3
CO4	3	3	3	3	3	-	-	-	3	-	2	-	3	3
CO5	3	3	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	20	20	40
Understand	30	30	50
Apply	10	10	10
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus									
K.S.Rangasamy College of Technology – Autonomous R2022									
B.E- Electrical and Electronics Engineering									
60 EE E37 - Electric Vehicle Design, Mechanics and Control									
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**			
	L	T	P		C	CA	ES	Total	
VII	3	0	0	45	3	40	60	100	

INTERNAL COMBUSTION ENGINES IC Engines, BMEP and BSFC, Vehicle Fuel Economy, Emission Control Systems, Treatment of Diesel Exhaust Emissions- Aerodynamics and vehicle efficiency - Thermal management for EVs -Materials selection for light weighting and performance -Design considerations for autonomous electric vehicles. **Hands on training:** Simulation of electric vehicle assembly and testing	[9]
ELECTRIC VEHICLES AND VEHICLE MECHANICS* Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings- Comparisons of EV with internal combustion Engine vehicles- Fundamentals of vehicle mechanics. Vehicle dynamics and handling characteristics - Chassis design and optimization - Suspension systems for EVs - Braking systems: regenerative braking, ABS, etc.	[9]
BATTERY MODELING, TYPES AND CHARGING Batteries in Electric and Hybrid Vehicles - Battery Basics -Battery Parameters. Types- Lead Acid Battery - Nickel-Cadmium Battery - Nickel-Metal-Hydride (NiMH) Battery - Li-Ion Battery - Li-Polymer Battery, Zinc-Air Battery, Sodium-Sulphur Battery, Sodium-Metal Chloride, Research and Development for Advanced Batteries. Battery Modelling, Electric Circuit Models. Battery Pack Management, Battery Charging.	[9]
CONTROL PRELIMINARIES Control Design Preliminaries - Transfer Functions – Bode plot analysis for First order and second order systems - Stability - Transient Performance- Power transfer function for boost converter - Gain margin and Phase margin study-open loop mode - Control strategies for electric powertrains - Energy management and optimization - Safety systems and fail-safes **Hands on training:** Simulation of calculating gain and phase margin from the transfer function	[9]
CONTROL OF MACHINES Introduction- Reference frame theory, basics- brushed DC motor - BLDC or brushless DC motor – stepper motor - modeling of induction and synchronous machine in various frames- Vector control- Direct torque control - Analysis of real-world electric vehicles and their design choices. **Hands on training:** Simulation of vector control of induction motor	[9]
Total Hours:	**45**

Text Book(s):	
1.	Iqbal Husain "Electric and Hybrid Vehicles, Design Fundamentals", Third Edition, CRC Press, 2021.
2.	Teuvo Suntio, Tuomas Messo & Joonas Puukko, "Power Electronic Converters: Dynamics and Control in Conventional and Renewable Energy Applications", 1st Edition, Wiley 2017.
Reference(s):	
1.	Ali Emadi, Mehrdad Ehsani, John M.Miller, "Vehicular Electric Power Systems", Special Indian Edition, Marcel dekker, Inc 2010.
2.	Prof. Sunil R. Pawar, "Electrical Vehicle Technology: The Future Towards Eco-Friendly Technology... Second Edition 2021.
3.	Wie Liu, "Hybrid Electric Vehicle System Modeling and Control", Second Edition, John Wiley & Sons, 2017, 2nd Edition.
4.	Rubén Molina Llorente, "Practical Control of Electric Machines: Model-Based Design and Simulation (Advances in Industrial Control) First Edition 2020.

***SDG 7 – Affordable & Clean Energy**

Course Content and Lecture Schedule

S.No.	Topic	No. of Hours
1	**INTERNAL COMBUSTION ENGINES**	
1.1	IC Engines, BMEP and BSFC, & Vehicle Fuel Economy	2
1.2	Emission Control Systems & Treatment of Diesel Exhaust Emissions	1
1.3	Aerodynamics and vehicle efficiency - Thermal management for EVs	2
1.4	Materials selection for light weighting and performance -Design considerations for autonomous electric vehicles	2
1.5	**Hands on training:** Simulation of electric vehicle assembly and testing	2
2	**ELECTRIC VEHICLES AND VEHICLE MECHANICS**	
2.1	Electric Vehicles (EV), Hybrid Electric Vehicles (HEV),	2
2.2	Engine ratings, Comparisons of EV with internal combustion Engine vehicles	2
2.3	Fundamentals of vehicle mechanics	1
2.4	Vehicle dynamics and handling characteristics, Chassis design and optimization	2
2.5	Suspension systems for EVs - Braking systems: regenerative braking, ABS, etc.	2
3	**BATTERY MODELING, TYPES AND CHARGING**	
3.1	Batteries in Electric and Hybrid Vehicles	1
3.2	Battery Basics -Battery Parameters	1
3.3	Types- Lead Acid Battery, Nickel-Cadmium Battery	1
3.4	Nickel-Metal-Hydride (NiMH) Battery, Li-Ion Battery	1
3.5	Li-Polymer Battery, Zinc-Air Battery	1
3.6	Sodium-Sulphur Battery, Sodium-Metal Chloride,	1
3.7	Research and Development for Advanced Batteries.	1
3.8	Battery Modelling, Electric Circuit Models.	1
3.9	Battery Pack Management, Battery Charging	1
4	**CONTROL PRELIMINARIES**	
4.1	Control Design Preliminaries - Transfer Functions	1
4.2	Bode plot analysis for First order and second order systems	1
4.3	Stability - Transient Performance	1
4.4	Power transfer function for boost converter	1
4.5	Gain margin and Phase margin study-open loop mode - Control strategies for electric powertrains	1
4.6	Energy management and optimization - Safety systems and fail-safes	2
4.7	**Hands on training:** Simulation of calculating gain and phase margin	2
5	**CONTROL OF MACHINES**	
5.1	Introduction & Reference frame theory	1
5.2	Brushed DC motor - BLDC or brushless DC motor	2
5.3	Stepper motor	1
5.4	Modeling of induction machine in various frames	1
5.5	Modeling of synchronous machine in various frames	1
5.6	Vector control - Direct torque control	1
5.7	Analysis of real-world electric vehicles and their design choices.	
5.8	**Hands on training:** Simulation of vector control of induction motor	2

Course Designers: N.Kayalvizhi – kayalvizhi@ksrct.ac.in

PROFESSIONAL ELECTIVES (PE)

SEMESTER VII, Professional Elective IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 EE E41	Energy Storage Systems	PE	3	3	0	0	3
2.	60 EE E42	Industry 4.0	PE	3	3	0	0	3
3.	60 EE E43	Smart Grid	PE	3	3	0	0	3
4.	60 EE E44	Power Electronics for Renewable Energy Systems	PE	3	3	0	0	3
5.	60 EE E45	IoT for Embedded Systems	PE	3	3	0	0	3
6.	60 EE E46	PLC and SCADA	PE	3	3	0	0	3
7.	60 EE E47	Batteries and its Management System for Electric Vehicle	PE	3	3	0	0	3

60 EE E41	Energy Storage Systems	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To explore the knowledge on various types of energy storage Technologies.
- To analyse thermal storage system.
- To analyse different battery storage technologies.
- To analyse the thermodynamics of Fuel Cell.
- To study the various applications of energy storage systems.

Pre-requisites

- Engineering Physics and Engineering Chemistry

Course Outcomes

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

CO1	Comprehend the different types of storage technologies.	Understand
CO2	Analyse the of a thermal storage system.	Analyse
CO3	Model the battery storage system.	Apply
CO4	Analyse the thermodynamics of fuel cell.	Analyse
CO5	Explore the alternative energy storage technologies 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	2	-	-	-	2	-	-	-	-	-	-	3	-
CO2	3	-	2	-	-	2	-	-	-	-	-	-	3	-
CO3	3	-	3	-	-	-	-	-	-	-	-	-	3	2
CO4	3	-	2	2	-	2	-	-	-	-	2	-	3	2
CO5	3	3	-	-	-	3	-	-	-	-	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	10
Understand	10	10	30
Apply	20	20	30
Analyse	20	20	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

<table>
<tr><th colspan="9">K.S.Rangasamy College of Technology – Autonomous R2022</th></tr>
<tr><th colspan="9">B.E - Electrical and Electronics Engineering</th></tr>
<tr><th colspan="9">60 EE E41- Energy Storage Systems</th></tr>
<tr><th rowspan="2">Semester</th><th colspan="3">Hours/Week</th><th>Total</th><th>Credit</th><th colspan="3">Maximum Marks</th></tr>
<tr><td>L</td><td>T</td><td>P</td><th>Hours</th><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>VII</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>
</table>

Introduction of Energy Storage Systems Necessity of energy storage – types of energy storage systems: mechanical, chemical, electrical, electromechanical, magnetic, electromagnetic, energy storage systems and smart grid integration, thermal - comparison of energy storage technologies – Applications. **Hands - on:** Performance analysis of Lead acid batteries**.**	[9]
Thermal storage system Thermal storage – Types – Modelling of thermal storage units – Simple water and rock bed storage system – pressurized water storage system – Modelling of phase change storage system – Simple units, packed bed storage units – Modelling using porous medium approach, Use of TRNSYS.	[9]
Electrical Energy Storage Fundamental concept of batteries – measuring of battery performance, charging and discharging, power density energy density, and safety issues. **Types of batteries*** – Lead Acid, Nickel – Cadmium, Zinc Manganese dioxide, Li-ion batteries - LiFePO4 battery – Mathematical Modelling for Lead Acid Batteries – Flow Batteries. **Hands - on:** Performance analysis of energy storage systems and smart grid integration.	[9]
Fuel Cell **Fuel Cell*** – History of Fuel Cell, Principles of Electrochemical storage – Types – Hydrogen-oxygen cells, Hydrogen air cell, Hydrocarbon air cell, alkaline fuel cell, energy analysis of fuel cell – advantages and disadvantages – Applications. **Hands - on:** Modeling and Performance Analysis of Fuel Cell Systems.	[9]
Alternative Energy Storage Technologies Flywheel, Super Capacitors, Principles and Methods – Applications, Compressed and Energy storage, Concept of Hybrid Storage – Applications, Pumped Hydro Storage – Applications.	[9]
Total Hours:	**45**

Text Book(s):

1.	Ibrahim Dincer and Mark A. Rosen, “Thermal Energy Storage Systems and Applications”, John Wiley & Sons, 3rd Edition 2021.
2.	Ru-Shi Lei Zhang and Xueliang sun, “Electromechanical technologies for energy storage and conversion”, Wiley publications, 2nd Volume set, 2012.

Reference(s):

1.	James Larmine and Andrew Dicks, “Fuel Cell Systems Explained”, Wiley publications, 3rd Edition, 2018.
2.	Lunardini.V. J, “Heat Transfer in cold Climates”, John Wiley and Sons 1981, 1st Edition.
3.	Schmidt.F.W. and Willmott.A.J., “Thermal Energy Storage and Regeneration”, Hemisphere Publishing Corporation, 1981, 1st Edition.
4.	Prof. Subhash Babu Majumder, “Electromechanical Energy Storage”, NPTEL Course, https://nptel.ac.in/courses/113105102

*SDG 7 – Affordable and Clean Energy

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Introduction of Energy Storage Systems**	
1.1	Necessity of energy storage	2
1.2	types of energy storage	2
1.3	comparison of energy storage technologies	1
1.4	Applications	1
1.5	**Hands - on:** Performance analysis of Lead acid batteries**.**	3
2.0	**Thermal storage system**	
2.1	Thermal storage– Types	1
2.2	Modelling of thermal storage units	1
2.3	Simple water and rock bed storage system	1
2.4	pressurized water storage system	1
2.5	Modelling of phase change storage system	1
2.6	Simple units, packed bed storage units	1
2.7	Modelling using porous medium approach	2
2.8	Use of TRNSYS.	1
3.0	**Electrical Energy Storage**	
3.1	Fundamental concept of batteries	1
3.2	measuring of battery performance - charging and discharging	1
3.3	power density energy density, and safety issues	1
3.4	Types of batteries* – Lead Acid, Nickel – Cadmium, Zinc Manganese dioxide, Li-ion batteries	2
3.5	Mathematical Modelling for Lead Acid Batteries – Flow Batteries	1
3.6	Modelling and performance analysis of Lead acid batteries	1
3.7	**Hands - on:** Performance analysis of energy storage systems and smart grid integration.	3
4.0	**Fuel Cell**	
4.1	Fuel Cell– History of Fuel Cell	1
4.2	Principles of Electrochemical storage	1
4.3	Types – Hydrogen-oxygen cells, Hydrogen air cell, Hydrocarbon air cell	3
4.4	alkaline fuel cell, energy analysis of fuel cell	2
4.5	advantages and disadvantages.	1
4.6	**Hands - on:** Modelling and Performance Analysis of Fuel Cell Systems	1
5.0	**Alternative Energy Storage Technologies**	
5.1	Flywheel, Super Capacitors - Principles and Methods	2
5.2	Flywheel, Super Capacitors - Applications	2
5.3	Compressed and Energy storage	2
5.4	Concept of Hybrid Storage – Applications	2
5.5	Pumped Hydro Storage – Applications	1

Course Designer(s)

1. Dr.P Aravindan - aravindan@ksrct.ac.in

60 EE E42	Industry 4.0	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To impart basic idea in Industry 4.0
- To provide students with good depth of knowledge of designing Industrial 4.0 Systems for various applications
- To Learn the design and analysis of Industry 4.0 systems for different energy storage systems
- To develop the knowledge on smart grid in Industry 4.0
- To acquire the design and analysis of Industry 4.0 systems for smart vehicular applications

Pre-requisites

- Basic Knowledge on Internet of Things

Course Outcomes

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

CO1	Realize the basic concepts of Industry 4.0 and the other related fields.	Remember
CO2	Understand cyber physical system and the emerging applications.	Understand
CO3	Evaluate the different energy storage systems.	Understand
CO4	Analyze a smart grid system.	Analyze
CO5	Design of smart vehicle and analyze its performance.	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	2
CO2	3	2	3	2	3	2	-	-	-	2	-	-	3	2
CO3	3	2	3	2	2	2	-	-	-	2	-	-	3	2
CO4	3	2	3	2	2	2	-	-	-	2	-	-	3	2
CO5	3	2	3	2	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	10	10	10
Understand	20	20	30
Apply	30	10	30
Analyse	-	20	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E – Electrical and Electronics Engineering

60 EE E42 - Industry 4.0

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 INDUSTRY 4.0* Introduction, Historical Context, General framework, Application areas, Dissemination of Industry 4.0 and the disciplines that contribute to its development, Artificial intelligence, 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.	[9]
INDUSTRY 4.0 AND CYBER PHYSICAL SYSTEM* Introduction to Cyber Physical Systems (CPS), Architecture of CPS- Components, Data science and technology for CPS, Emerging applications in CPS in different fields. Case study: Application of CPS in health care domain.	[9]
SMART ENERGY SOURCES* Energy Storage for Mitigating the Variability of Renewable Electricity Sources-Types of electric energy storage, Potential of Sodium-Sulfur Battery Energy Storage to Enable Integration of Wind-Case study. Electric Vehicles as Energy Storage: V2G Capacity Estimation.	[9]
SMART GRID* Smart grid definition and development Smart Grid, Understanding the Smart Grid, Smart grid solutions, Design challenges of smart grid and Industry 4.0.	[9]
SMART APPLICATIONS* Understanding Smart Appliances -Smart Operation-Smart Monitoring-Smart Energy Savings-Smart Maintenance, Case study-Smart Cars, Self-Driving Cars, Introducing Google‘s Self-Driving Car, Intellectual Property Rights.	[9]
Total Hours:	**45**

Text Book(s):

1.	Jean-Claude André, “Industry 4.0”, Wiley- ISTE, July 2019.
2.	Diego Galar Pascual, Pasquale Daponte, Uday Kumar, “Handbook of Industry 4.0 and SMART Systems”, Taylor and Francis, 2020.

Reference(s):

1.	Miller M, “The internet of things: How smart TVs, smart cars, smart homes, and smart cities are changing the world”, Pearson Education, 2015.
2.	Pengwei Du and Ning Lu, “Energy storage for smart grids: planning and operation for renewable and variable energy resources VERs”, Academic Press, 2018, Reprint edition.
3.	Hossam A. Gabbar, “Smart Energy Grid Engineering”, Academic Press, 2017.
4.	Mini S. Thomas, John Douglas McDonald, “Power System SCADA and Smart Grids”, CRC Press, 2017.

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Industry 4.0**	
1.1	Introduction, Historical Context, General framework, Application areas	1
1.2	Dissemination of Industry 4.0 and the disciplines that contribute to its development	2
1.3	Artificial intelligence, The Internet of Things and Industrial Internet of Things	2
1.4	Additive manufacturing	1
1.5	Robotization and automation	1
1.6	Current situation of Industry 4.0	1
1.7	Introduction to Industry 4.0 to Industry 5.0 Advances	1
2.0	**Industry 4.0 and Cyber Physical System**	
2.1	Introduction to Cyber Physical Systems (CPS)	1
2.2	Architecture of CPS- Components	2
2.3	Data science and technology for CPS	2
2.4	Emerging applications in CPS in different fields	2
2.5	Case study: Application of CPS in health care domain	2
3.0	**Smart Energy Sources**	
3.1	Energy Storage for Mitigating the Variability of Renewable Electricity Sources	2
3.2	Types of electric energy storage	2
3.3	Potential of Sodium-Sulfur Battery Energy Storage to Enable Integration of Wind-Case study.	3
3.4	Electric Vehicles as Energy Storage: V2G Capacity Estimation.	2
4.0	**Smart Grid**	
4.1	Smart grid definition and development Smart Grid	2
4.2	Understanding the Smart Grid	1
4.3	Smart grid solutions	2
4.4	Design challenges of smart grid	2
4.5	Design challenges of Industry 4.0	2
5.0	**Smart Applications**	
5.1	Understanding Smart Appliances	1
5.2	Smart Operation-Smart Monitoring	1
5.3	Smart Energy Savings	1
5.4	Smart Maintenance	1
5.5	Case study - Smart Cars, Self-Driving Cars	2
5.6	Introducing Google‘s Self-Driving Car	1
5.7	Intellectual Property Rights	2

Course Designer(s)

2. Mr.M.Dhanapal - dhanapalm@ksrct.ac.in

60 EE E43	Smart Grid	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To interpret the evolution of smart and interconnected energy systems, various challenges and benefits of smart grid
- To impart the concepts related with transmission in smart grid technologies
- To enrich the knowledge on distribution in smart grid technologies
- To get an insight of the various smart measurement technologies
- To identify the various computing technologies for smart operation of the grid

Pre-requisites

- Generation, Transmission and Distribution, Power System Analysis

Course Outcomes

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

CO1	Familiarize the fundamental elements and challenges in electric grid, international policies with initiatives of smart grid	Understand
CO2	Design a system for monitoring and control of smart transmission system	Analyze
CO3	Elucidate the challenges faced by distribution networks and provide smart network with suitable distribution components.	Apply
CO4	Enhance the knowledge in smart meters and their application for monitoring and protection	Apply
CO5	Elaborate the communication systems, networking and sensing technologies involved in smart grid and know the cyber security and applications of IoT in smart grid.	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	2	2	-	-	-	-	-	-	-	2	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	2	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	2	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	2	3
CO5	3	2	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	10
Understand	10	10	30
Apply	20	40	30
Analyse	20	-	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Rev.No. 00 / w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E – Electrical and Electronics Engineering								
60 EE E43 – Smart Grid								
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 Architecture of Smart Grid System – Elements and Technologies of Smart Grid System - Smart grid drivers, functions, opportunities, challenges and benefits - Difference between conventional & Smart Grid – Grid Resiliency and Self-Healing concept - National and International initiatives in Smart Grid – Seven essential domains from NIST Standards: bulk generation, transmission, distribution, markets, operations, service provider and customer.	[9]
Smart Grid Technologies on Transmission Side* Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, WAMPAC Protection and control. **Hands on practice:** Demonstration of Grid Connected DC microgrid Demonstration of Energy management in Microgrid	[9]
Smart Grid Technologies on Distribution Side* DMS, Volt/VAr control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV). **Hands on practice:** Demonstration of PHIL experimentation for symmetric and asymmetric fault analysis of grid connected DFIG wind turbine	[9]
Smart Meters and Advanced Metering Infrastructure* Introduction to Smart Meters - Advanced Metering infrastructure (AMI) drivers and benefits- AMI protocols, standards and initiatives, AMI needs in the smart grid - Phasor Measurement Unit (PMU), Intelligent Electronic Devices (IED) & their application for monitoring & protection.	[9]
High Performance Computing for Smart Grid Applications* Local Area Network (LAN) - House Area Network (HAN) - Wide Area Network (WAN) - Broadband over Power line (BPL) - IP based Protocols-Basics of web service and CLOUD Computing - Cyber Security for Smart Grid. Applications of IoT in Smart Grid. **Hands on practice: (MATLAB)** Demonstration of peak energy management using energy storage system Demonstration of ancillary support from virtual synchronous generator	[9]
Total Hours:	**45**

Text Book(s):

1.	Bharat Modi, Anu Prakash and Yogesh Kumar, “Smart Grid Technology”, S.K.Kataria & Sons Publisher of Engineering and Computer Books, New Delhi, Edition: 2015, Reprint: 2016.
2.	Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, “Smart Grid: Technology and Applications”, Wiley and Sons Canada, 2012.

Reference(s):

1.	Stuart Borlase, “Smart Grid: Infrastructure, Technology and Solutions”, CRC press 2012.
2.	James Momoh, “Smart Grid Fundamentals of Design and Analysis”, IEEE press 2012.
3.	Vehbi C. Güngör, Dilan Sahin, TaskinKocak, SalihErgüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke, “Smart Grid Technologies: Communication Technologies and Standards”, IEEE Transactions on Industrial Informatics, Vol. 7, No. 4, November 2011.
4.	https://nptel.ac.in/courses/108/107/108107113/

*SDG -9 (Industry Innovation and Infrastructure)

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Introduction**	
1.1	Architecture of Smart Grid System	1
1.2	Elements and Technologies of Smart Grid System	1
1.3	Smart grid drivers, functions, opportunities, challenges and benefits	1
1.4	Difference between conventional & Smart Grid	1
1.5	Grid Resiliency and Self-Healing concept	1
1.6	National and International initiatives in Smart Grid	1
1.7	Seven essential domains from NIST Standards	1
1.8	Bulk generation, transmission, distribution	1
1.9	Operations, service provider and customer	1
2.0	**Smart Grid Technologies on Transmission Side**	
2.1	Technology Drivers	1
2.2	Smart energy resources, Smart substations	1
2.3	Substation Automation, Feeder Automation	2
2.4	Transmission systems	1
2.5	EMS, FACTS and HVDC	1
2.6	Wide area monitoring, WAMPAC Protection and control	1
2.7	Demonstration of Grid Connected DC microgrid	1
2.8	Demonstration of Energy management in Microgrid	1
3.0	**Smart Grid Technologies on Distribution Side**	
3.1	DMS, Volt/VAr control	1
3.2	Fault Detection, Isolation and service restoration	2
3.3	Outage management	1
3.4	High-Efficiency Distribution Transformers	1
3.5	Phase Shifting Transformers	1
3.6	Plug in Hybrid Electric Vehicles (PHEV)	1
3.7	Demonstration of PHIL experimentation for symmetric and asymmetric fault analysis of grid connected DFIG wind turbine	2
4.0	**Smart Meters and Advanced Metering Infrastructure**	
4.1	Introduction to Smart Meters	1
4.2	Advanced Metering infrastructure (AMI) drivers and benefits	2
4.3	AMI protocols, standards and initiatives	2
4.4	AMI needs in the smart grid	1
4.5	Phasor Measurement Unit (PMU)	1
4.6	Intelligent Electronic Devices (IED)	1
4.7	Application for monitoring & protection	1
5.0	**High Performance Computing for Smart Grid Applications**	
5.1	Local Area Network (LAN)	1
5.2	House Area Network (HAN)	1
5.3	Wide Area Network (WAN) - Broadband over Power line (BPL)	2
5.4	IP based Protocols-Basics of web service and CLOUD Computing	1
5.5	Cyber Security for Smart Grid	1
5.6	Applications of IoT in Smart Grid	1
5.7	Demonstration of peak energy management using energy storage system	1
5.8	Demonstration of ancillary support from virtual synchronous generator	1

Course Designer(s)

3. Dr. M. K. Elango - elango@ksrct.ac.in

60 EE E44	Power Electronics for Renewable Energy Systems	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To study the principle of generation of different renewable energy sources.
- To model the electrical machines used for renewable energy conversion systems.
- To apply the power converters used for renewable energy systems
- To analyze the operation of standalone and grid integrated renewable energy systems
- To study the hybrid operation of wind and PV systems and features of MPPT tracking.

Pre-requisites

- Basic Knowledge on Electrical Machines, Control System, Power Electronics

Course Outcomes

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

CO1	Understand the features of different renewable energy sources.	Understand
CO2	Analyze electrical machines used for renewable energy conversion.	Analyze
CO3	Classify various topologies of power converters used for interfacing renewable energy systems.	Understand
CO4	Interpret Wind and PV systems in grid connected systems.	Apply
CO5	Contrast different MPPT algorithms in Hybrid renewable energy systems.	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	3	2	3	1	2	1	1	3	2	1
CO2	3	3	2	2	3	3	3	-	2	1	1	3	2	2
CO3	3	3	2	2	3	3	3	-	2	1	1	2	2	2
CO4	3	2	2	2	3	3	3	-	2	1	1	2	2	2
CO5	3	2	2	2	3	3	3	1	2	1	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	10	10	10
Understand	20	20	30
Apply	10	10	30
Analyse	20	20	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E – Electrical and Electronics Engineering								
60 EE E44 - Power Electronics for Renewable Energy Systems								
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 Renewable Energy Sources * Environmental aspects of electric energy conversion- Solar PV Systems - Equivalent Circuit model, Performance Characteristics, Charge Controllers, Types of Solar PV Systems and Applications. Wind Energy System- Important terms-TSR, Cp, SRC, Performance Characteristics of Wind turbine- Control System and strategy. **Hands - on:** 1. Simulation on modelling of Solar PV System- V I Characteristics.	[9]
Electrical Machines For Renewable Energy Conversion * Principle of operation and analysis: Squirrel Cage Induction Generator (SCIG), Doubly Fed Induction Generator (DFIG) - Permanent Magnet Synchronous Generator (PMSG). **Hands - on:** 1. Simulation of self- excited Induction Generator.	[9]
Power Converters for Solar and Wind Energy * Solar: Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing and array sizing Wind: Three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.	[9]
Analysis of Wind and PV Systems * Standalone operation of fixed and variable speed wind energy conversion systems - Grid integrated PMSG, SCIG Based WECS, Standalone and grid Integrated solar system- Grid connection Issues.	[9]
Hybrid Renewable Energy Systems * Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT)	[9]
Total Hours:	**45**

Text Book(s):

1.	Bhadra S N, Kastha.D & Banerjee S.,"Wind Electrical Systems", Oxford University Press, 12th impression, 2013.
2.	Rashid .M. H, "Power Electronics Hand book", Academic press,4th Edition, 2017.

Reference(s):

1.	Seyazhai R and Ramaprabha R, "Power Electronics For Renewable Energy Systems", Scitechpublications, 2018.
2.	S. Sumathi, L. Ashok Kumar, P. Surekha, "Solar PV and Wind Energy Conversion Systems", Green Energy and Technology, Springer, 2015.
3.	Khan.B.H., "Non-conventional Energy sources ",Tata McGraw-hill Publishing Company, New Delhi, 3rd Edition, 2017.
4.	Rai. G.D, "Non-conventional energy sources", Khanna publishers, 6th Edition, 2017.

*SDG 7 – Affordable and Clean Energy

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Introduction To Renewable Energy Sources**	
1.1	Environmental aspects of electric energy conversion	1
1.2	Solar PV Systems - Equivalent Circuit model	2
1.3	Performance Characteristics, Charge Controllers,	1
1.4	Types of Solar PV Systems and Applications.	1
1.5	Wind Energy System- Important terms-TSR, Cp, SRC.	2
1.6	Performance Characteristics of Wind turbine	1
1.7	Wind turbine Control System and strategy	1
2.0	**Electrical Machines For Renewable Energy Conversion**	
2.1	Introduction to Electrical Machines for Renewable Energy Conversion	1
2.2	Principle of operation and analysis of Electrical Machines	2
2.3	Squirrel Cage Induction Generator	2
2.4	Doubly Fed Induction Generator	2
2.5	Permanent Magnet Synchronous Generator (PMSG).	2
3.0	**Power Converters for Solar and Wind Energy**	
3.1	Solar: Principle of operation	1
3.2	Line commutated converters (inversion-mode)	1
3.3	Boost and buck-boost converters-	1
3.4	Selection of inverter, battery sizing and array sizing	1
3.5	Wind: Three phase AC voltage controllers	1
3.6	AC-DC-AC converters: uncontrolled rectifiers	1
3.7	PWM Inverters	1
3.8	Grid Interactive Inverters	1
3.9	Matrix Converters	1
4.0	**Analysis Of Wind And PV Systems**	
4.1	Standalone operation of fixed speed wind energy conversion systems	1
4.2	Standalone operation of variable speed wind energy conversion systems	1
4.3	Grid integrated PMSG	1
4.4	SCIG Based WECS	2
4.5	Standalone Integrated solar system	2
4.6	Grid Integrated solar system	1
4.7	Grid connection Issues	1
5.0	**Hybrid Renewable Energy Systems**	
5.1	Hybrid Systems	1
5.2	Need for Hybrid Systems	2
5.3	Range and type of Hybrid systems	2
5.4	Case studies of Wind	2
5.5	PV Maximum Power Point Tracking (MPPT)	2

Course Designer(s)

Mr.S. Shree Ram Senthil - shreeramsenthil@ksrct.ac.in

60 EE E45	IoT for Embedded Systems	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To study about Internet of Things technologies and its role in real time applications
- To introduce the infrastructure required for IoT
- To familiarize the accessories and communication techniques for IoT
- To provide insight about the embedded processor and sensors required for IoT
- To familiarize the different platforms and Attributes for IoT

Pre-requisites

- Basic knowledge on Microprocessors and Microcontroller

Course Outcomes

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

CO1	Analyze the concepts of IoT and its present developments.	Analyze
CO2	Compare and contrast different platforms and infrastructures available for IoT	Apply
CO3	Explain different protocols and communication technologies used in IoT	Apply
CO4	Analyze the big data analytic and programming of IoT	Analyze
CO5	Implement IoT solutions for smart applications	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	2	3	3	-	-	2	2	3	3	2	-
CO2	3	3	3	3	2	3	3	-	-	2	2	3	3	2	-
CO3	3	3	3	3	2	3	3	-	-	2	2	3	3	2	-
CO4	3	3	3	3	2	3	3	-	-	2	2	3	3	2	-
CO5	3	3	3	3	2	3	3	-	-	2	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	10	10	10
Understand	20	20	30
Apply	10	10	30
Analyse	20	20	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E – Electrical and Electronics Engineering								
60 EE E45 – IoT for Embedded Systems								
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 INTERNET OF THINGS* Overview, Hardware and software requirements for IOT, Sensor and actuators, Technology drivers, Business drivers, Typical IoT applications, Trends and implications.	[9]
IOT ARCHITECTURE* IoT reference model and architecture - Node Structure - Sensing, Processing, Communication, Powering, Networking - Topologies, Layer/Stack architecture, IoT standards, Cloud computing for IoT.	[9]
PROTOCOLS AND WIRELESS TECHNOLOGIES FOR IOT* **Protocols:** NFC, RFID, Zigbee MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe GSM, CDMA, LTE, GPRS, small cell. **Wireless technologies for IoT:** WiFi (IEEE 802.11), Bluetooth/Bluetooth Smart, ZigBee/ZigBee Smart, MQTT, CoAP, UWB (IEEE 802.15.4), 6LoWPAN, LPWAN- LoRa®, Proprietary systems - Recent trends.	[9]
IOT PROCESSORS* **Services/Attributes:** Big-Data Analytics for IOT, Dependability, Interoperability, Security, Maintainability. **Embedded processors for IOT:** Introduction to Python programming -Building IOT with RASPERRY PI and Arduino. **Hands-on:** 1.Modules and Sensors Interfacing using ESP32 2.Modules and Actuators Interfacing using ESP32	[9]
CASE STUDIES* Industrial IoT, Home Automation, Applications for smart cities, Smart Grid, connected vehicles, electric vehicle charging, Environment, Agriculture, Productivity Applications, IOT Défense.	[9]
Total Hours:	**45**

Text Book(s):

1.	Oliver Hersent, David Boswarthick and Omar Elloumi "The Internet of Things", Wiley,2016.
2.	ArshdeepBahga and Vijai Madisetti: A Hands-on Approach "Internet of Things", Universities Press 2015.

Reference(s):

1.	Danick Briand, Eric Yeatman, Shad Roundy,"Micro Energy Harvesting" Wiley VCH ,April 2015
2.	Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", John Wiley and sons, 2014.
3.	Jean- Philippe Vasseur, Adam Dunkels, "Interconnecting Smart Objects with IP: The Next Internet" Morgan Kuffmann Publishers, 2010.
4.	Upena Dalal,"Wireless Communications & Networks, Oxford, 2015.

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**INTRODUCTION TO INTERNET OF THINGS**	
1.1	Overview	1
1.2	Hardware and software requirements for IoT	1
1.3	Sensor and actuators	2
1.4	Technology drivers	1
1.5	Business drivers	1
1.6	Typical IoT applications	2
1.7	Trends and implications	1
2.0	**IOT ARCHITECTURE**	
2.1	IoT reference model and architecture	2
2.2	Node Structure - Sensing, Processing, Communication, Powering	2
2.3	Networking – Topologies	2
2.4	Layer/Stack architecture	1
2.5	IoT standards	1
2.6	Cloud computing for IoT	1
3.0	**PROTOCOLS AND WIRELESS TECHNOLOGIES FOR IOT**	
3.1	**Protocols:** NFC, RFID	1
3.2	Zigbee MIPI, M-PHY, UniPro	1
3.3	SPMI, SPI	1
3.4	M-PCIe GSM, CDMA, LTE, GPRS, Small cell.	2
3.5	**Wireless technologies for IoT:** WiFi (IEEE 802.11), Bluetooth/Bluetooth Smart	1
3.6	ZigBee/ZigBee Smart	1
3.7	MQTT, CoAP, UWB (IEEE 802.15.4)	1
3.8	6LoWPAN, LPWAN- LoRa®	1
3.9	Proprietary systems - Recent trends.	1
4.0	**IOT PROCESSORS**	
4.1	**Services/Attributes:** Big-Data Analytics for IOT	1
4.2	Dependability, Interoperability, Security, Maintainability	1
4.3	**Embedded processors for IOT:** Introduction to Python programming	1
4.4	Building IOT with RASPERRY PI	1
4.5	Building IOT with Arduino	1
4.6	**Hands-on:** Modules and Sensors Interfacing using ESP32	2
4.7	**Hands-on:** Modules and Actuators Interfacing using ESP32	2
5.0	**CASE STUDIES**	
5.1	Industrial IoT	1
5.2	Home Automation	1
5.3	Applications for Smart Cities, Smart Grid	2
5.5	Connected Vehicles, Electric Vehicle Charging	2
5.6	Environment, Agriculture, Productivity Applications	2
5.7	IoT Defense	1

Course Designer(s)

Mr.M.Dhanapal - dhanapalm@ksrct.ac.in

60 EE E46	PLC and SCADA	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- Learn about components, working of PLC and its wiring diagram.
- Understand the design of ladder logic diagram and its programming languages.
- Basic knowledge about the Distributed Control System.
- Understand HART and Field bus communication protocols.
- Familiarized about SCADA features and its types

Pre-requisites

- Control Systems

Course Outcomes

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

CO1	Develop the architecture of PLC and their functions and able to write the PLC programs using ladder diagram.	Apply
CO2	Employ in advanced intermediate functions to perform industrial control functions.	Apply
CO3	Analyse the working of networks and model of HART communication protocol.	Analyse
CO4	Analyse the architecture of distributed control system, local control unit and process interface issues.	Analyse
CO5	Describe the key features of SCADA systems and analyse the types of typical DCS and SCADA systems.	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	2	3	3	-	3	2	3	-	3	-	3	3
CO2	3	3	2	3	3	3	-	2	3	-	3	-	3	3
CO3	3	3	2	3	3	2	-	2	3	-	3	-	3	3
CO4	3	3	2	3	3	-	2	2	3	-	2	-	3	3
CO5	3		2	3	3	-	-	2	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	20	15	20
Understand	20	15	20
Apply	20	10	30
Analyse	-	20	30
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E- Electrical and Electronics Engineering								
60 EE E46- PLC and SCADA								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VII	3	0	0	45	3	40	60	100

PROGRAMMABLE LOGIC CONTROLLER Evolution of PLCs-Components of PLC-Architecture of PLC-Discrete and analog I/O modules, Power supplies and Isolators-PLC Programming languages using Ladder diagram, programming on-off inputs/outputs. PLC basic functions, Register basics, timer functions, counter functions, AI based automation of PLC. **Hands - on:** 1. Power supplies and Isolators for PLC.	[9]
PLC INTERMEDIATE FUNCTIONS Arithmetic functions- Skip and MCR functions- Data transfer operations- Data compare instructions- PLC Advanced intermediate functions- Mechanical sequencer- Sequencer instruction- Sequencer programs- Bit shift registers. Networking of PLC, PLC – PID functions, PLC installation, trouble shooting and maintenance. Design of interlocks and alarms using PLC.	[9]
COMMUNICATION PROTOCOLS* Evolution of signal standards - HART Communication protocol – Communication modes - HART networks -Control system interface - HART Model – Foundation Field bus introduction - General Field bus architecture - Basic requirements of field bus standard - Field bus topology - Inter operability.	[9]
DISTRIBUTED CONTROL SYSTEMS Definition, DCS architecture, Local Control Unit (LCU), Process interfacing issues, communication facilities, Redundancy concept, Engineering and Operator interface.	[9]
SCADA SYSTEMS* Basics of SCADA - SCADA key features - Remote Terminal Units (RTU) - PLC used as RTU - DCS versus SCADA terminology - SCADA software packages - Application example of SCADA - Typical DCS and SCADA systems - Delta system, Citect and Wonder ware- AI based automation of SCADA SYSTEM. **Hands – on:** 1.Simulation of Honeywell Plant Scape SCADA System 2. Application example of SCADA	[9]
Total Hours:	**45**

Text Book(s):

1.	Frank D.Petruzella "Programmable logic controllers", McGraw-Hill,5th Edition,2019
2.	Stuart Boyer A., "SCADA Supervisory Control and Data Acquisition", Fourth Edition ISA, USA, 2009.

Reference(s):

1.	John.W.Webb and Ronald A Reis, "Programmable Logic Controllers- Principles and Applications", 5th edition, Prentice HallInc., New Jersey, 2016
2.	Jit,ender Singh, "PLC and SCADA", University science press, 2015.
3.	Bela G. Liptak, "Instrument Engineers" Handbook, Process Software and Digital Networks" fourth edition, CRC Press, 2018.
4.	http://www.nptel.ac.in/courses/112102011/11

***SDG 9 – Industry Innovation and Infrastructure**

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**PROGRAMMABLE LOGIC CONTROLLER**	
1.1	Evolution of PLCs	1
1.2	Components of PLC	1
1.3	Architecture of PLC-Discrete and analog I/O modules, Power supplies and Isolators	1
1.4	PLC Programming languages using Ladder diagram	1
1.5	programming on-off inputs/outputs	1
1.6	PLC basic functions	1
1.7	Register basics	1
1.8	Timer functions	1
1.9	Counter functions	1
2.0	**PLC INTERMEDIATE FUNCTIONS**	
2.1	Arithmetic functions- Skip and MCR functions, Data transfer operations, Data compare instructions	1
2.2	PLC Advanced intermediate functions	1
2.3	Mechanical sequencer, Sequencer instruction, Sequencer programs	1
2.4	Bit shift registers	1
2.5	Networking of PLC	1
2.6	PLC –PID function	1
2.7	PLC installation	1
2.8	Troubleshooting and maintenance	1
2.9	Design of interlocks and alarms using PLC.	1
3.0	**COMMUNICATION PROTOCOLS**	
3.1	Evolution of signal standards	1
3.2	HART Communication protocol	1
3.3	Communication modes - HART networks	1
3.4	Control system interface - HART Model	1
3.5	Foundation Field bus introduction	1
3.6	General Field bus architecture	1
3.7	Basic requirements of field bus standard	1
3.8	Field bus topology	1
3.9	Inter Operability	1
4.0	**DISTRIBUTED CONTROL SYSTEMS**	
4.1	Definition	1
4.2	DCS architecture	2
4.3	Local Control Unit (LCU)	1
4.4	Process interfacing issues	1
4.5	communication facilities	2
4.6	Redundancy concept	1
4.7	Engineering and Operator interface	1
5.0	**SCADA SYSTEMS**	
5.1	Basics of SCADA., SCADA key features	1
5.2	Remote Terminal Units (RTU), PLC used as RTU	1
5.3	DCS versus SCADA terminology, SCADA software packages	1
5.4	Application example of SCADA, Typical DCS and SCADA systems	1
5.5	Honeywell Plant Scape system	2
5.6	Foxboro I/A series DCS	1
5.7	Delta system	1
5.8	Citect and Wonder ware.	1

Course Designer(s)

S. SRINIVASAN – srinivasan@ksrct.ac.in

60 EE E47	Batteries and Its Management System for Electric Vehicle	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To interpret their role in ensuring safety and efficient operation of battery-powered EV.
- To Recognize and articulate the specific technical requirements that need to be considered in the design and implementation of Battery Management Systems (BMS).
- To Analyze and interpret the complex processes involved in battery charging and discharging, including factors influencing efficiency, safety, and performance.
- To effectively assess and optimize their performance.
- To create and optimize models of battery packs, considering factors such as cell configuration, thermal management, and safety protocols.

Pre-requisites

Basics of Electrical Engineering (or equivalent subject), Control System, Circuit Network, Chemistry, Physics

Course Outcomes

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

CO1	Interpret the role of battery management system	Understand
CO2	Identify the requirements of Battery Management System	Understand
CO3	Interpret the concept associated with battery charging / discharging process	Understand
CO4	Calculate the various parameters of battery and battery pack	Apply
CO5	Design the model of battery pack	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	-
CO2	3	1	-	-	-	1	1	-	1	-	-	-	1	1
CO3	3	3	-	-	3	-	1	-	1	-	-	1	-	-
CO4	3	3	3	2	3	-	-	2	-	-	-	-	2	2
CO5	3	3	3	2	3	-	-	2	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	20	20	35
Understand	40	20	30
Apply	-	20	35
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E – Electrical and Electronics Engineering								
60 EE E47 - Batteries and its Management System for Electric Vehicle								
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 Introduction to Battery Management System, Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel, Electrochemical and lithium-ion cells, Rechargeable cell, Charging and Discharging Process, Overcharge and Undercharge, Modes of Charging	[9]
Battery Management System Requirement Introduction and BMS functionality, Battery pack topology, BMS Functionality, Voltage Sensing, Temperature Sensing, Current Sensing, BMS Functionality, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation, State-of charge estimation, Cell total energy and cell total power.	[9]
Battery State of Charge and State of Health Estimation, Cell Balancing* Battery state of charge estimation (SOC), voltage-based methods to estimate SOC, Model-based state estimation, Battery Health Estimation, Lithium-ion aging: Negative electrode, Lithium ion aging: Positive electrode, Cell Balancing, Causes of imbalance, Circuits for balancing	[9]
Modelling and Simulation* Equivalent-circuit models (ECMs), Physics-based models (PBMs), Empirical modelling approach, Physics-based modelling approach, Simulating an electric vehicle, Vehicle range calculations, Simulating constant power and voltage, Simulating battery packs	[9]
Design of BMS* Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system	[9]
Total Hours:	**45**

Text Book(s):

1.	Dirk Soffker, “Battery Management System for Future Electric Vehicles”, MDPI Publisher, 2020
2.	JHA A. R, ”Next-Generation Batteries and Fuel Cells for Commercial, Military, and Space Applications”, CRC Press, 1st Edition, 2016..

Reference(s):

1.	Davide Andrea,” Battery Management Systems for Large Lithium-ion Battery Packs” Artech House, 2018
2.	Pop, Valer, et al., “Battery management systems: Accurate state-of-charge indication for battery-powered applications”. Vol. 9. Springer Science & Business Media, 2022
3.	Bergveld, H.J., Kruijt, W.S., Notten, P.H.L “Battery Management Systems -Design by Modelling” Philips Research Book Series 2002 Edition 2021.
4.	Vladimir S. Bagotsky, “Electrochemical Power Sources: Batteries, Fuel Cells, and Super capacitors”, John Wiley, 1st Edition, 2015.

***SDG 07 –** Affordable and Clean Energy

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Introduction**	
1.1	Introduction to Battery Management System	1
1.2	Cells & Batteries, Nominal voltage and capacity	1
1.3	C rate, Energy and power	1
1.4	Cells connected in series, Cells connected in parallel	1
1.5	Electrochemical and lithium-ion cells	1
1.6	Charging and Discharging Process	2
1.7	Overcharge and Undercharge	1
1.8	Modes of Charging	1
2.0	**Battery Management System Requirement**	
2.1	Introduction and BMS functionality	1
2.2	Battery pack topology, BMS Functionality	1
2.3	Voltage Sensing, Temperature Sensing	1
2.4	Current Sensing	1
2.5	High-voltage contactor control	1
2.6	Isolation sensing	1
2.7	Thermal control, Protection, Communication Interface	1
2.8	Range estimation, State-of charge estimation	1
2.9	Cell total energy and cell total power	1
3.0	**Battery State of Charge and State of Health Estimation, Cell Balancing**	
3.1	Battery state of charge estimation (SOC)	1
3.2	voltage-based methods to estimate SOC	1
3.3	Model-based state estimation	1
3.4	Battery Health Estimation	2
3.5	Lithium-ion aging: Negative electrode	1
3.6	Lithium ion aging: Positive electrode	1
3.7	Cell Balancing, Causes of imbalance	1
3.8	Circuits for balancing	1
4.0	**Modelling and Simulation**	
4.1	Equivalent-circuit models (ECMs)	1
4.2	Physics-based models (PBMs)	1
4.3	Empirical modelling approach	1
4.4	Physics-based modelling approach	1
4.5	Simulating an electric vehicle	1
4.6	Vehicle range calculations	1
4.7	Simulating constant power and voltage	1
4.8	Simulating battery packs	2
5.0	**Design of battery BMS**	
5.1	Design principles of battery BMS	2
5.2	Effect of distance on battery life	1
5.3	Effect of load on battery life	1
5.4	Effect force on battery life	1
5.5	Battery management system (BMS)	2
5.6	Energy balancing with multi-battery system	2

Course Designer(s)

Lt E CHANDRA KUMAR- chandrakumar@ksrct.ac.in

PROFESSIONAL ELECTIVES (PE)

SEMESTER VIII, Professional Elective V

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 EE E51	Hybrid Energy Technology	PE	4	2	0	2	3
2.	60 EE E52	IoT for Industrial Automation	PE	4	2	0	2	3
3.	60 EE E53	Restructured Power Market	PE	4	2	0	2	3
4.	60 EE E54	Control of Power Electronic Circuits	PE	4	2	0	2	3
5.	60 EE E55	Embedded Control for Electrical Drives	PE	4	2	0	2	3
6.	60 EE E56	Virtual Instrumentation Systems	PE	4	2	0	2	3
7.	60 EE E57	Design of Electric Vehicle Charging System	PE	4	2	0	2	3

60 EE E51	Hybrid Energy Technology	Category	L	T	P	Credit
		PE	2	0	2	3

Objective

- To provide knowledge about different types of hybrid energy systems.
- To analyze the various electrical Generators used for the Wind Energy Conversion systems.
- To design the power converters used in SPV Systems.
- To analyze the various power converters used in hybrid energy systems and to understand the importance of standalone and grid-connected operation in Hybrid renewable energy systems.
- To analyze the performance of the various hybrid energy systems.

Prerequisite

Engineering Physics, Power Electronics, Introduction to MATLAB Simulation

Course Outcomes

At the end of the course, the students will be able to

CO1	Analyze the impacts of hybrid energy technologies on the environment and demonstrate them to harness electrical power.	Analyse
CO2	Select a suitable Electrical machine for wind Energy Conversion Systems and simulate wind energy conversion systems.	Understand
CO3	Design the power converters such as AC-DC, DC-DC, and AC-AC converters for SPV systems.	Apply
CO4	Analyze the power converters such as AC-DC, DC-DC, and AC-AC converters for Hybrid energy systems.	Analyse
CO5	Interpret the hybrid renewable energy systems.	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	-	-	-	-	-	3	-	3	3	-
CO2	3	3	3	2	3	-	-	-	-	3	-	3	3	-
CO3	3	3	3	2	3	-	-	-	-	3	-	3	3	2
CO4	3	3	3	2	3	-	-	-	-	3	-	3	3	2
CO5	3	3	3	2	-	-	-	-	-	3	-	3	3	-
3 - Strong;2 - Medium;1 – Some														

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)				Madal Examination (Marks)	End Sem Examination (Marks)	
	Test 1		Test 1				
	Theory	Lab	Theory	Lab	Lab	Theory	Lab
Remember	20	--	20	--	--	20	--
Understand	40	--	40	--	--	80	--
Apply	--	50	--	50	50	--	50
Analyse	--	50	--	50	50	--	50
Evaluate	--		--	--	--	--	--
Create	--		--	--	--	--	--
Total	60	100	60	--	100	100	100

K. S. Rangasamy College of Technology–Autonomous R2022								
B.E. Electrical and Electronics Engineering								
60 EE E51- Hybrid Energy Technology								
Semester	Hours/Week			Total hrs.	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	2	0	2	60	3	50	50	100

Content	Hours
Introduction to Hybrid Energy Systems Hybrid Energy Systems – Need for Hybrid Energy Systems – Solar-Wind-Fuel Cell-Diesel, Micro-hydel-PV, Classification of Hybrid Energy systems – Importance of Hybrid energy systems – Advantages and Disadvantages – Environmental aspects of renewable energy – impacts of renewable energy generation on the environment – Present Indian and international energy scenario of conventional and RE sources.	[6]
Electrical Machines for Wind Energy Conversion Systems (WECS)* Review of reference of theory fundamentals – Construction, Principle of operation and analysis: Squirrel Cage Induction Generator (SCIG), Doubly Fed Induction Generator (DFIG) – Permanent Magnet Synchronous Generator (PMSG).	[6]
Power Converters and Analysis of Solar PV Systems* Power convertors for SPV Systems – Line commutated converters (inversion-mode) – Boost and buck – boost converters – selection of inverter, battery sizing, array sizing – Analysis of SPV Systems – Block diagram of the solar PV systems – Types of Solar PV systems: Stand-alone PV systems.	[6]
Analysis of Power Converters for Hybrid Energy Systems* Introduction to Power Converters – Stand -alone Converters – AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters – Bi - Directional Converters – Grid -Interactive Inverters – Matrix converter – Merits and Limitations.	[6]
Case Studies for Hybrid Renewable Energy Systems* Hybrid Systems – Range and type of Hybrid systems – Performance Analysis – Cost Analysis – Case studies of Diesel-PV, wind-PV-Fuel-cell, Micro-hydel-PV, Biomass-Diesel-Fuel cell systems.	[6]
Practical: 1. Performance Analysis of DFIG based Grid connected wind energy conversion system. 2. Performance study on load and total power developed by solar -Wind hybrid system. 3. Performance analysis of Wind-Solar-Fuel cell hybrid system. 4. Experiment of performance assessment on PMSG based wind energy conversion system. 5. Performance analysis of Matrix converters with Resistive and Dynamic loads. Tools used: MATLAB Simulink.	[30]
Total Hours	**60**

Text book(s):

1.	Bahman Zohuri, “Hybrid Energy Systems”, Springer, First Edition, 2018.
2.	Md. Rabiul Islam, Md. Rakibuzzam Shah, Mohd Hasan Ali, “Emerging Power Converters for Renewable and Electric Vehicles”, CRC Press, First Edison, 2021.

Reference(s):

1.	S.M. Muyeen, “Wind Energy Conversion Systems’, Springer First Edition, 2012.
2.	S.N. Bhadra, D. Kastha, & S. Banerjee, “Wind Electrical Systems”, Oxford University Press, 7th Impression, 2005.
3.	Rashid.M.H, “Power Electronics Hand Book”, Academic Press, 4th Edition, 2018.
4.	B.H. Khan “Non-conventional Energy Sources”, Tata McGraw Publishing Company, New Delhi, 2017, 3rd Edition.

*- SDG7 – Affordable and Clean Energy

Course Contents and Lecture Schedule

S. No.	Topics	# H
1	**Introduction to Hybrid Energy Systems**	
1.1	Hybrid Energy Systems – Need for Hybrid Energy Systems	1
1.2	Block Diagram for - Solar-Wind-Fuel Cell-Diesel	1
1.3	Block Diagram for - Micro-hydel-PV	1
1.4	Importance of Hybrid energy systems – Advantages and Disadvantages – Environmental aspects of renewable energy	1
1.5	Environmental aspects of renewable energy – impacts of renewable energy generation on the environment.	1
1.6	Present Indian and international energy scenario of conventional and RE sources.	1
2	**Electrical Machines for Wind Energy Conversion Systems (WECS)***	
2.1	Review of reference of theory fundamentals - Electrical Machines for Wind Energy Conversion Systems.	1
2.2	Construction, Principle of operation- Squirrel Cage Induction Generator (SCIG).	1
2.3	Characteristics and analysis- Squirrel Cage Induction Generator (SCIG) for Renewable Energy Generation perspective.	1
2.4	Construction, Principle of operation and analysis- Doubly Fed Induction Generator (DFIG).	1
2.5	Construction and principle of operation - Permanent Magnet Synchronous Generator (PMSG).	1
2.6	Characteristics and analysis- Permanent Magnet Synchronous Generator (PMSG) for Renewable energy generation – case study.	1
3	**Power Converters and Analysis of Solar PV Systems***	
3.1	Power convertors for SPV Systems – Line commutated converters (inversion-mode).	1
3.2	Boost – converters for SPV Systems.	1
3.3	Boost buck converters for SPV Systems.	
3.4	selection of inverter, battery sizing, array sizing	1
3.5	Analysis of SPV Systems – Block diagram of the solar PV systems	1
3.6	Types of Solar PV systems: Stand-alone PV systems.	1
4	**Analysis of Power Converters for Hybrid Energy Systems***	
4.1	Introduction to Power Converters – for Hybrid Energy Systems	1
4.2	Stand-alone Converters for Hybrid Energy Systems	1
4.3	AC-DC-AC converters: uncontrolled rectifiers	1
4.4	PWM Inverters – Bi - Directional Converters	1
4.5	Grid -Interactive Inverters	1
4.6	Matrix converter – Merits and Limitations.	1
5	**Case Studies for Hybrid Renewable Energy Systems***	
5.1	Hybrid Systems – Range and type of Hybrid systems.	1
5.2	Performance Analysis – Cost Analysis of Hybrid Renewable Energy Systems.	1
5.3	Case studies of Diesel-PV	1
5.4	Case studies of wind-PV-Fuel-cell	1
5.5	Case studies of Micro-hydel-PV	1
5.6	Case studies of Biomass-Diesel-Fuel cell systems	1
	Practical:	
1	Performance Analysis of DFIG based Grid connected wind energy conversion system.	6
2	Performance study on load and total power developed by solar -Wind hybrid system.	6
3	Performance analysis of Wind-Solar-Fuel cell hybrid system.	6
4	Experiment of performance assessment on PMSG based wind energy conversion system.	6
5	Performance analysis of Matrix converters with Resistive and Dynamic loads.	6
	Tools used: MATLAB Simulink.	

Course Designer(s):

Dr.P.Aravindan - aravindan@ksrct.ac.in

60 EE E52	IoT for Industrial Automation	Category	L	T	P	Credit
		PE	2	0	2	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 control techniques employed in process automation
- To provide a overview about the various protocol standards deployed in the Internet of Things (IoT) domain and to make informed choices.
- To provide a comprehensive understanding of IoT protocol layered architecture and infrastructure protocols

Pre-requisites

- Basic Knowledge on PLC, Internet of Things

Course Outcomes

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

CO1	Familiar with various automation technologies in manufacturing and process industries.	Remember
CO2	Implement various control and automation method in process industries.	Apply
CO3	Apply various control techniques used in process automation for effective industrial process control.	Apply
CO4	Identify, compare, and select appropriate IoT protocol standards for specific application requirements.	Understand
CO5	Understand IoT protocol architectures and analyze, compare, and select appropriate infrastructure	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	-	-	-	2	-	-	3	2
CO2	3	2	-	-	3	2	-	-	-	2	-	-	3	2
CO3	3	2	-	-	2	2	-	-	-	2	-	-	3	2
CO4	3	2	-	-	2	2	-	-	-	2	-	-	3	2
CO5	3	2	-	-	2	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)	
	Test 1		Test 2				
	Theory	Lab	Theory	Lab	Lab	Theory	Lab
Remember	20	-	20	-	-	30	-
Understand	20	-	20	-	-	30	-
Apply	20	50	-	50	50	20	50
Analyse	-	50	20	50	50	20	50
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

Rev.No. 00 / w.e.f. 04/01/2026
Passed in BoS Meeting held on 15/12/2025
Approved in Academic Council Meeting held on 03/01/2026

BoS Chairman Signature

Syllabus

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AUTOMATION IN MANUFACTURING INDUSTRIES* 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	[6]
AUTOMATION IN PROCESS INDUSTRIES* Introduction to computer based industrial automation- Direct Digital Control (DDC), Distributed Control System (DCS) and supervisory control and data acquisition (SCADA) based architectures. Leak-flow studies of pipelines, Transport Automation.	[6]
PROGRAMMABLE LOGIC CONTROLLER* Programmable Logic Controller (PLC)- Block diagram of PLC, Programming languages of PLC, Basic instruction sets, Design of alarm and interlocks, Networking of PLC, Overview of safety of PLC with case studies.	[6]
INTRODUCTION TO THE INTERNET OF THINGS* IoT Definition, Elements of an IoT ecosystem, IoT applications, trends and implications, sensing components and devices, Wearable sensors and their Applications, operating System for IoT, Industrial IoT	[6]
INTERNET OF THINGS– ARCHITECTURE AND COMMUNICATION Protocol Layered Architecture for IoT, Protocol Architecture of IoT, Infrastructure Protocols: MAC protocols for sensor network, S-MAC, IEEE 802.15.4, Near Field Communication (NFC), RFID, ZigBee, Bluetooth Low Energy (BLE),IPv6 over LowPower Wireless Personal Area Networks (6LoWPAN).	[6]
Practical: 1. Logic implementation for traffic Control Application 2. Programming logic gates function in PLC 3. Use PLC to test the START STOP logic for two inputs and one output. 4. Develop /Execute a ladder program for the given application using counter. 5. Study the fundamental of IOT softwares and components	[30]
Total Hours:	**60**

Text Book(s):

1.	SudipMisra, “Introduction to IoT”, Cambridge University Press; First edition , 2021
2.	Frank D. Petruzella, “Programmable Logic Controllers”, 5th Edition, McGraw- Hill, New York, 2016.

Reference(s):

1.	Mikell P. Groover, “Automation, Production Systems and Computer Integrated Manufacturing”, Third Edition, Pearson Education, 2009
2.	Raj, Pethuru, and Anupama C. Raman.The Internet of things: Enabling technologies, platforms, and use cases. Auerbach Publications, 2017.
3.	Bahga, Arshdeep, and Vijay Madisetti.Internet of Things: A hands-on approach. Vpt, 2014.
4.	Buyya, Rajkumar, and Amir VahidDastjerdi, eds. Internet of Things: Principles and paradigms. Elsevier, 2016.

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**AUTOMATION IN MANUFACTURING INDUSTRIES**	
1.1	Introduction- Automation in production system	1
1.2	Principles and strategies of automation, Basic elements of an automated system	2
1.3	Advanced automation functions, Levels of automations	1
1.4	Automated flow lines and transfer mechanisms	2
2.0	**AUTOMATION IN PROCESS INDUSTRIES**	
2.1	Introduction to computer based industrial automation- Direct Digital Control (DDC)	2
2.2	Distributed Control System (DCS) and supervisory control and data acquisition (SCADA) based architectures	2
2.3	Leak-flow studies of pipelines	1
2.4	Transport Automation	1
3.0	**PROGRAMMABLE LOGIC CONTROLLER**	
3.1	Programmable Logic Controller (PLC)- Block diagram of PLC	2
3.2	Programming languages of PLC, Basic instruction sets	2
3.3	Design of alarm and interlocks, Networking of PLC	1
3.4	Overview of safety of PLC with case studies	1
4.0	**INTRODUCTION TO THE INTERNET OF THINGS**	
4.1	IoT Definition, Elements of an IoT ecosystem	1
4.2	IoT applications, trends and implications, sensing components and devices	2
4.3	Wearable sensors and their Applications, operating System for IoT	2
4.4	Industrial IoT	1
5.0	**INTERNET OF THINGS– ARCHITECTURE AND COMMUNICATION**	
5.1	Protocol Layered Architecture for IoT, Protocol Architecture of IoT	1
5.2	Infrastructure Protocols: MAC protocols for sensor network, S-MAC, IEEE 802.15.4	2
5.3	Near Field Communication (NFC), RFID, ZigBee, Bluetooth Low Energy (BLE)	2
5.4	IPv6 over Low Power Wireless Personal Area Networks (6LoWPAN)	1
Practical		
1.	Logic implementation for traffic Control Application.	7
2.	Programming logic gates function in PLC	6
3.	Use PLC to test the START STOP logic for two inputs and one output.	7
4.	Develop /Execute a ladder program for the given application using counter.	7
5.	Study the fundamental of IOT softwares and components	3

Course Designer(s)

1. Ms.S.Jaividhya- jaividhya@ksrct.ac.in

60 EE E53	Restructured Power Market	Category	L	T	P	Credit
		PE	2	0	2	3

Objectives

- To understand the philosophy and need for restructuring and deregulation of the electric power Market.
- To acquire theoretical and practical knowledge of transmission congestion management techniques.
- To calculate locational marginal prices and study the role of financial transmission rights in congestion risk management.
- To study ancillary service management and evaluate transmission network pricing methods
- To understand the restructuring frame work US and Indian power sector.

Pre-requisites

- Electrical Circuit Analysis, Power system Analysis

Course Outcomes

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

CO1	Interpret the restructuring and deregulation of the power industry, covering market behavior, cost analysis, contractual market models, and ISO functions.	Understand
CO2	Analyze and design the various methods of congestion management in deregulated power system.	Analyze
CO3	Analyze and calculate locational marginal prices and financial transmission rights.	Analyze
CO4	Analyze the ancillary service management and analyze transmission pricing paradigm	Analyze
CO5	Summarize the evolution of deregulation in Indian power sector.	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	3	3
CO2	3	2	2	-	2	3	2	-	-	-	2	2	3	2
CO3	3	2	2	-	2	3	2	-	-	-	2	2	3	2
CO4	3	2	2	-	2	3	2	-	-	-	3	2	3	2
CO5	3	2	2	-	2	3	2	-	-	-	3	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)	
	Test1		Test2				
	Theory	Lab	Theory	Lab	Lab	Theory	Lab
Remember	20	-	20	-	-	34	-
Understand	40	-	40	-	-	66	-
Apply	-	50	-	50	50	-	50
Analyse	-	50	-	50	50	-	50
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

Rev.No.00/w.e.f.04/01/2026
Passed in BoS Meeting held on 15/12/2025
Approved in Academic Council Meeting held on 03/01/2026

BoS Chairman Signature

Syllabus

K.S.Rangasamy College of Technology –A utonomousR2022								
B.E–Electrical and Electronics Engineering								
60 EE E53 – Restructured Power Market								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VIII	2	0	2	60	3	50	50	100

Introduction to restructuring of power industry: Deregulation of various power systems across the world – Consumer and Supplier behavior – Market equilibrium – Short and long run costs – Various costs of production. The Philosophy of Market Models– Market models based on contractual arrangements **Market architecture***-Role of Independent System Operator	[6]
Transmission congestion Management: * Definition of Congestion, Importance of congestion management, and classification of congestion management methods –Calculation of ATC - Non –market methods – Market based methods–Nodal pricing–Inter-zonal and Intra-zonal congestion management–Price area congestion management–Capacity alleviation method.	[6]
Locational Marginal Prices (LMP) And Financial Transmission Rights: * Fundamentals of locational marginal pricing – Loss less DCOPF model for LMP calculation –Loss compensated DCOPF model for LMP calculation*- ACOPF model for LMP Calculation – Risk Hedging Functionality of financial Transmission Rights- FTR and market power.	[6]
Ancillary service management and pricing of transmission network: Ancillary services – Load generation balancing related services –Voltage control and reactive power support devices– Markets for ancillary services– Co-optimization of energy and reserve services. **Pricing of transmission network***: wheeling – pricing ethods – Marginal transmission pricing paradigm–Composite pricing paradigm– loss allocation methods.	[6]
Power market evolution: US markets: PJM market - The Nordic power market - Reforms in Indian power sector: Frame work of Indian power sector- Reform initiatives-availability based tariff (ABT)-The Electricity Act 1910, 1956, 2003 & 2012 - Open Access issues - Power exchange.	[6]
Practical: 1. Calculation of electricity cost in restructured market. 2. Simulation of inter & intra zonal congestion management in distribution system. 3. Simulation of Transmission loss analysis in electric power system. 4. Analysis of Available Transfer Capability calculations. 5. DCOPF based Locational marginal Prices calculations. **Tools used: MATLAB**	[30]
Total Hours: (Lecture-30;Practical-30)	**60**

Text Book(s):	
1.	Mohammad Shahidehpour and Muwaffaq Alomoush, “Restructured electrical power systems: operation, trading and volatility” CRC Press,1st Edition.2017
2.	Kankar Bhattacharya, MathH.J.Boolen, and Jaap E.Daadler, "Operation of restructured power systems”, Kluwer Academic Pub.,2001, 1st Edition.
Reference(s):	
1.	Dr.Rajib Mishra, V.K.Khanija and P.P. Wahi, “Indian Power Market (Electricity Marketing Simplified)” Central Board of Irrigation and Power (CBIP), Govt of India, 2016.
2.	Tripathi M M. “Restructured Power System and Electricity Market” Create space Independent Pub., 1stEdition, 2015.
3.	Lorrin Philipson,H. Lee Willis, “Understanding Electric Utilities and De-Regulation” CRC Press, 2019
4.	Khaparde S A, Abhyankar A R, "Restructured Power Systems", NPTEL Course, https://nptel.ac.in/courses/108101005/.

*SDG9–Industry Innovation and Infrastructure

Course Contents and Lecture Schedule

S. No.	Topics	No. of Hours
1	**Introduction to restructuring of power industry:**	
1.1	Deregulation of various power systems across the world	1
1.2	Consumer and Supplier behaviour, Market equilibrium,	1
1.3	Short and long run costs and Various costs of production	1
1.4	The Philosophy of Market Models:	1
1.5	Market models based on contractual arrangements	1
1.6	Market architecture and Role of Independent System	1
2	**Transmission congestion management:**	
2.1	Definition of Congestion, Importance of congestion management, and classification of congestion management methods	1
2.2	Calculation of ATC,	1
2.3	Non-market methods and Market based methods	1
2.4	Nodal pricing, Inter-zonal and Intra-zonal congestion management	1
2.5	Price area congestion management	1
2.6	Capacity alleviation method.	1
3	**Fundamentals of locational marginal pricing and Lossless DCOPF model for LMP calculation**	
3.1	Loss compensated DCOPF model for LMP calculation	1
3.2	ACOPF model for LMP calculation	1
3.3	Risk Hedging Functionality of financial Transmission Rights	1
3.4	Treatment of revenue shortfall	1
3.5	Secondary trading of FTRs, FTR and market power.	1
3.6	Fundamentals of locational marginal pricing and Lossless DCOPF model for LMP calculation	1
4	**Ancillary service management and pricing of transmission network**	
4.1	Ancillary services and Load generation balancing related services	1
4.2	Voltage control and reactive power support devices	1
4.3	Markets for ancillary services and Co-optimization of energy and reserve services.	1
4.4	**Pricing of transmission network**: wheeling and pricing methods	1
4.5	Marginal transmission pricing paradigm and Composite pricing paradigm	1
4.6	Loss allocation methods.	1
5	**Power market evolution:**	
5.1	US markets: PJM market and the Nordic power market	1
5.2	Reforms in Indian power sector: Framework of Indian power sector	1
5.3	Reform initiatives - availability based tariff (ABT)	1
5.4	The Electricity Act 2012	1
5.5	Open Access issues	1
5.6	Power exchange	1
Practical:		
1.	Calculation of electricity cost in restructured market.	6
2.	Analysis of Available Transfer Capability calculations.	6
3.	Simulation of inter & intra zonal congestion management in distribution system.	6
4.	Simulation of contingency analysis in electric power system.	6
5.	DCOPF based Locational marginal Prices calculations.	6

Course Designer(s)

1. Dr.T.Venkatesan- venkatesan@ksrct.ac.in

60 EE E54	Control of Power Electronic Circuits	Category	L	T	P	Credit
		PE	2	0	2	3

Objectives

- To acquire the basics of control system simulation.
- To select Symbolic equations for solving problems related with matrices, polynomial and vectors
- To study the principles of sliding mode control and the way of applying it to DC-DC converter.
- To impart the concept of power factor correction circuits.
- To design a power factor correction circuit with controller.

Pre-requisites

- Power Electronics

Course Outcomes

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

CO1	Calculate the transfer function for constant, differential, integral, first order and second order factors.	Understand
CO2	Illustrate the effect of poles and zeros in the S plane.	Analyse
CO3	Apply the sliding mode control for DC-DC converters.	Apply
CO4	Design a Single-Phase PFC systems with integrated control loops for optimal power factor correction and voltage regulation.	Apply
CO5	Determine the controller expression for power factor correction circuits.	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	-	-	1	2	2	1	2	2	3
CO2	3	3	3	3	3	-	-	1	2	2	1	2	2	3
CO3	3	3	3	3	3	-	-	1	2	2	1	2	2	3
CO4	3	3	3	3	3	-	-	1	2	2	1	2	2	3
CO5	3	3	3	3	3	-	-	1	2	2	1	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)	
	Test 1		Test 2					
	Theory	Lab	Theory	Lab	Theory	Lab	Theory	Lab
Remember	20	-	20	-	34	-	34	-
Understand	40	-	40	-	66	-	66	-
Apply	-	50	-	50	-	50	-	50
Analyse	-	50	-	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 – Electrical and Electronics Engineering								
60 EE E54 - Control of Power Electronic Circuits								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VIII	2	0	2	60	3	50	50	100

Simulation Basics in Control Systems Transfer Function-How to build transfer function, identify Poles, zeros, draw time response plots, Bode plot (Bode Plots for Multiplication Factors, Constant, Single and Double Integration Functions, Single Pole and Single Zero Functions, RHP Pole and RHP Zero Functions), state space modelling-transfer function from state space Model.	[6]
Symbolic Calculations Symbolic Variables - Symbolic Vector Variables, Commands for Handling Polynomial Expressions - Extracting Parts of a Polynomial -. Factorization and Roots of Polynomials, Symbolic Matrix Algebra - Operations with Symbolic Matrices - Other Symbolic Matrix Operations.	[6]
Sliding Mode Control Basics Introduction- Introduction to Sliding-Mode Control- Basics of Sliding-Mode Theory-Application of Sliding-Mode Control to DC-DC Converters—Principle-Sliding mode control of buck converter.	[6]
Power Factor Correction Circuits* Introduction, Operating Principle of Single-Phase PFCs, Control of boost converter based PFCs, Designing the Inner Average-Current-Control Loop, Designing the Outer Voltage-Control Loop, Example of Single-Phase PFC Systems.	[6]
Controller Design for PFC Circuits Power factor correction circuit using other SMPS topologies: Cuk and SEPIC converter – PFC circuits employing bridgeless topologies.	[6]
Practical: 1. Simulation of sliding mode control of DC-DC converter. 2. Simulation of Power Factor Correction for CCM Boost converter. 3. Simulation of Single-Phase PFC circuit employing Cuk converters. 4. Simulation of Single-Phase PFC circuit employing SEPIC converters. 5. Simulation of Totem-Pole Bridgeless PFC topology for the AC-DC converter. **Tools used: MATLAB**	[30]
Total Hours: (Lecture - 30; Practical - 30)	**60**

Text Book(s):

1.	M.H. Rashid, 'Power Electronics: Circuits, Devices and Applications', 4th Edition, Pearson Education, New Delhi, 2023.
2.	Ned Mohan, Siddharth Raju, "Power Electronics, A First Course: Simulations and Laboratory Implementations", 2nd Edition, Wiley, 2022.

Reference(s):

1.	P.S.Bimbra "Power Electronics" Khanna Publishers, 7th Edition, 2022.
2.	Dean K Frederick, Dean Frederick and Joe Chow, "Feedback Control problems using MATLAB and the Control system tool box", 1st Edition, Cengage Learning, 2017.
3.	Slew-Chong Tan, Yuk Ming Lai Chi-Kong Tse, "Sliding mode control for Switching Power Converters:, Techniques and Implementation",1st Edition, CRC Press, 2015.
4.	M.D Singh, " Power Electronics", 2nd Edition, Tata McGraw-Hill Education, 2017
5.	https://nptel.ac.in/courses/108101126

*SDG 7 – Affordable and Clean Energy

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of Hours**
1	**Simulation Basics in Control Systems**	
1.1	Transfer Function-How to build transfer function, identify Poles, zeros, draw time response plots	2
1.2	Bode plot (Bode Plots for Multiplication Factors, Constant, Single and Double Integration Functions, Single Pole and Single Zero Functions, RHP Pole and RHP Zero Functions),	2
1.3	State space modelling	1
1.4	Transfer function from state space Model	1
2	**Symbolic Calculations**	
2.1	Symbolic Variables - Symbolic Vector Variables, Commands for Handling Polynomial Expressions	2
2.2	Extracting Parts of a Polynomial, Factorization and Roots of Polynomials	2
2.3	Symbolic Matrix Algebra, Operations with Symbolic Matrices, Other Symbolic Matrix Operations.	2
3	**Sliding Mode Control Basics**	
3.1	Introduction to Sliding-Mode Control	1
3.2	Basics of Sliding-Mode Theory	1
3.3	Application of Sliding-Mode Control to DC-DC Converters	2
3.4	Principle-Sliding mode control of buck converter	2
4	**Power Factor Correction Circuits**	
4.1	Introduction, Operating Principle of Single-Phase PFCs	2
4.2	Control of boost converter based PFCs	1
4.3	Designing the Inner Average-Current-Control Loop	1
4.4	Designing the Outer Voltage-Control Loop, Example of Single-Phase PFC Systems.	2
5	**Controller Design for PFC circuits**	
5.1	Power factor correction circuit using other SMPS topologies:	1
5.2	Cuk converter	2
5.3	SEPIC converter	2
5.4	PFC circuits employing bridgeless topologies	1
Practical:		
1.	Simulation of sliding mode control of DC-DC converter	6
2.	Simulation of Power Factor Correction for CCM Boost converter	6
3.	Simulation of Single-Phase PFC circuit employing Cuk converters	6
4.	Simulation of Single-Phase PFC circuit employing SEPIC converters	6
5.	Simulation of Totem-Pole Bridgeless PFC topology for the AC-DC converter	6

Course Designer(s)

1. Dr.R.Balamurugan – balamurugan@ksrct.ac.in

60 EE E55	Embedded Control for Electrical Drives	Category	L	T	P	Credit
		PE	2	0	2	3

Objectives

- To learn about the fundamental of electrical drives.
- To illustrate the architecture of embedded processor and various algorithm for power converters
- To enrich the knowledge about the various speed controls methods of induction motor
- To familiarize the various speed controls methods of BLDC
- To provide knowledge about speed controls methods of SRM

Pre-requisites

- Electrical machines I & II, Embedded Systems

Course Outcomes

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

CO1	Interpret the significance of embedded control of electrical drives.	Apply
CO2	Implement the various control strategy of electrical drives for various Industrial applications	Analyze
CO3	Select an appropriate control method for Induction motor using advanced optimization techniques.	Apply
CO4	Develop embedded system solution for real time application such as Electric vehicles and UAVs.	Analyze
CO5	Apply an appropriate control method for Switched Reluctance Motor using advanced optimization techniques.	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	-	-	3	2	3
CO2	3	3	3	3	3	-	-	-	2	-	-	3	2	3
CO3	3	3	3	3	3	-	-	-	2	-	-	3	2	3
CO4	3	3	3	3	3	-	-	-	2	-	-	3	2	3
CO5	3	3	3	3	3	-	-	-	2	-	-	3	2	3

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	-	20	-	-	34	-
Understand	40	-	40	-	-	66	-
Apply	-	50	-	50	50	-	50
Analyze	-	50	-	50	50	-	50
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100

Syllabus

K.S. Rangasamy College of Technology – Autonomous R2022								
B.E- Electrical and Electronics Engineering								
60 EE E55 - Embedded Control for Electrical Drives								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
VIII	2	0	2	60	3	50	50	100

INTRODUCTION ELECTRICAL DRIVES* Electric drive and its classifications, Four-quadrant drive, Dependence of load torque on various factors, Dynamics of motor-load combination-Solid State Controlled Drives-Machine learning and optimization techniques for electrical drives- IoT for Electrical drives applications.	[6]
EMBEDDED PROCESSOR** Embedded Processor architecture - RTOS - Hardware/software co-design Programming and optimization with SoC processors - control algorithms implementation for power converter.	[6]
INDUCTION MOTOR CONTROL* Types - Speed control methods - PWM techniques- VSI fed three - phase induction motor-Fuzzy logic Based speed control for three phase induction motor - FPGA based three phase induction motor control.	[6]
BLDC MOTOR CONTROL* Overview of BLDC Motor - Speed control methods - PWM techniques - ARM processor based BDLC motor control - ANN for BLDC Motor control and operation.	[6]
SRM MOTOR CONTROL* Overview of SRM Motor - Speed control methods - PWM techniques - FPGA based SRM motor control - DNN for SRM Motor control and operation	[6]
Practical: 1. Simulation of 3-phasee inverter. 2. Simulation of CSI fed three - phase induction motor 3. Simulation of Fuzzy logic Based speed control for three phase induction motor 4. Simulation of Speed control of BLDC motor. 5. Simulation of Speed control of SRM **Tools used: MATLAB**	[30]
Total Hours: (Lecture - 30; Practical - 30)	**60**

Text Book(s):

1.	Krishnan R, "Electric Motor Drives - Modeling, Analysis and Control", Prentice-Hall of India Pvt. Ltd., New Delhi,2010
2.	Vedam Subramanyam, "Electric Drives - Concepts and Applications", Tata McGraw- Hill publishing company Ltd., New Delhi, 2002

Reference(s):

1.	Venkataratnam K, "Special Electrical Machines", Universities Press, 2014
2.	Steve Furber, "ARM system on chip architecture", Addision Wesley,2010.
3.	Ron Sass and Anderew G. Schmidt, "Embedded System design with platform FPGAs: Principles and Practices", Elsevier, 2010
4.	Steve Kilts, "Advanced FPGA Design: Architecture, Implementation, and Optimization" Willey, 2007

*** SDG 7 – Affordable and Clean Energy**

**** SDG 9 - Industry, Innovation, and Infrastructure.**

Course Contents and Lecture Schedule

S. No	Topic	No. of Hours
1	**INTRODUCTION ELECTRICAL DRIVES**	
1.1	Electric drive and its classifications	1
1.2	Four-quadrant drive	1
1.3	Dependence of load torque on various factors	1
1.4	Dynamics of motor-load combination, Solid State Controlled Drives	1
1.5	Machine learning and optimization techniques for electrical drives	1
1.6	IoT for Electrical drives applications.	1
2	**EMBEDDED PROCESSOR**[**]	
2.1	Embedded Processor architecture	1
2.2	RTOS	1
2.3	Hardware/software co-design Programming and optimization with SoC processors	1
2.4	Hardware/software co-design Programming	1
2.5	Optimization with SoC processors	1
2.6	Control algorithms implementation for power converter	1
3	**INDUCTION MOTOR CONTROL**	
3.1	Types - Speed control methods	1
3.2	PWM techniques	1
3.3	VSI fed three - phase induction motor	1
3.4	Fuzzy logic Based speed control for three phase induction motor	1
3.5	FPGA based three phase induction motor control.	2
4	**BLDC MOTOR CONTROL**	
4.1	Overview of BLDC Motor	1
4.2	Speed control methods	2
4.3	PWM techniques	1
4.4	ARM processor based BDLC motor control	1
4.5	ANN for BLDC Motor control and operation	1
5	**SRM MOTOR CONTROL**	
5.1	Overview of SRM Motor	1
5.2	Speed control methods	2
5.3	PWM techniques	1
5.4	FPGA based SRM motor control	1
5.5	DNN for SRM Motor control and operation	1
	Practical:	
1	Simulation of 3-phasee inverter.	6
2	Simulation of CSI fed three - phase induction motor	6
3	Simulation of Fuzzy logic Based speed control for three phase induction motor	6
4	Simulation of Speed control of BLDC motor.	6
5	Simulation of Speed control of SRM	6

Course Designers

R.Radhamani - radhamani@ksrct.ac.in

60 EE E56	Virtual Instrumentation Systems	Category	L	T	P	Credit
		PC	2	0	2	3

Objectives

- To enhance the basic knowledge about virtual instruments
- To perceive the different programming methods used in virtual instrumentation
- To familiarize the interfaces of virtual instrumentation
- To explore the various VI tool sets for process control
- To demonstrate the use of LABVIEW for GSD applications

Pre-requisites

- Measurements and Instrumentation, Digital Electronics

Course Outcomes

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

CO1	Apply the basic concepts of Virtual Instrumentation	Apply
CO2	Utilize different software tools in Virtual Instrumentation	Apply
CO3	Develop simple Virtual Instruments (VIs) using various structures	Apply
CO4	Implement I/O and hardware interfaces in Virtual Instrumentation projects	Apply
CO5	Integrate graphical system design in real-world applications.	Apply

Mapping with Programme Outcomes

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3	-	-	-	-	-	-	-	2	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	2	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	2	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	2	3	3
CO5	3	3	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	60	-	-	-	20	-	20	-
Understand	-	-	-	-	20	-	20	-
Apply	-	50	30	50	60	50	60	50
Analyse	-	50	30	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. Electrical and Electronics Engineering								
60 EE E56 – Virtual Instrumentation Systems								
Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
VIII	2	0	2	60	3	50	50	100

INTRODUCTION Definition and Architecture of Virtual Instrumentation - Virtual Instruments Versus Traditional Instruments - Conventional Virtual Instrumentation - Virtual Instruments using LabVIEW - Virtual Instrumentation in the Engineering process. LabView Environment: Front panel and Block Diagram - Tools palette.	**[6]**
VIRTUAL INSTRUMENTATION SYSTEM: Data flow programming - 'G' programming - Data types and Conversion - Representation and precision - Creating and saving VIs - Writing - Editing - Debugging and Running a VI - Creating sub-Vis.	**[6]**
PROGRAMMING STRUCTURES FOR loop - WHILE loop - Shift register - Feedback node - CASE structure - Sequence structures - Formula nodes - Array operations - Cluster functions - Waveform Graphs and Charts - File I/O Functions - Attribute modes: Local and Global variables.	**[6]**
I/O ASPECTS Components of measuring system - Classification of signals - Transducers and sensors - Signal conditioning functions - Signal Grounding - Digital I/O techniques - Data Acquisition using VI – Components of DAQ.	**[6]**
GSD APPLICATIONS* Motion Control - Machine Vision – Control Design and Simulation Tools – PID control Tool kit - Image acquisition and processing - Simulation Interface Tool – Sequential Process Designs.	**[6]**
LABORATORY EXPERIMENTS: 1. Debugging a VI, Sub-VI's 2. Programming with FOR Loop, WHILE Loop & Local and Global variables 3. Programming with Cluster and Structures 4. Waveform measurement using VI 5. Design and simulation of stepper motor control. **Tools used: LabVIEW**	**[30]**
Total Hours: (Lecture - 30; Practical - 30)	**60**

Text Book(s):	
1.	Jeffrey Travis, Jim Kring, "LabVIEW for Everyone", Prentice Hall, 2009.
2.	Jovitha Jerome, "Virtual Instrumentation Using Lab VIEW", Prentice Hall of India, 2011.
Reference(s):	
1.	Christopher G Relf, "Image Acquisition and Processing with LabVIEW", CRC Press, 2004.
2.	Rick Bitter, Taqi Mohiuddin, Matt Nawrocki, "LabVIEW Advanced Programming Techniques", CRC Press, 2007.
3.	Robert H. Bishop, "Learning with LabVIEW", 1st Edition, Pearson, 2014.
4.	Sanjay Gupta and Joseph John, "Virtual Instrumentation using LabVIEW", Tata McGraw Hill Inc., 2006.

*SDG 7 – Affordable and Clean Energy

Course Contents and Lectures

S.No.	Topic	No. of Hours
1	**INTRODUCTION**	
1.1	Definition and Architecture of Virtual Instrumentation	1
1.2	Virtual Instruments Versus Traditional Instruments	1
1.3	Conventional Virtual Instrumentation	1
1.4	Virtual Instruments using LabVIEW	1
1.5	Virtual Instrumentation in the Engineering process	1
1.6	LabView Environment: Front panel and Block Diagram - Tools palette.	1
2	**VIRTUAL INSTRUMENTATION SYSTEM:**	
2.1	Data flow programming - 'G' programming	1
2.2	Data types and Conversion	1
2.3	Representation and precision	1
2.4	Creating, saving, Writing, Editing Vis	1
2.5	Debugging and Running a VI	1
2.6	Creating sub-Vis.	1
3	**PROGRAMMING STRUCTURES**	
3.1	FOR loop & WHILE loop	1
3.2	Shift register, Feedback node & CASE structure	1
3.3	Sequence structures & Formula nodes	1
3.4	Array operations & Cluster functions	1
3.5	Waveform Graphs and Charts & File I/O Functions	1
3.6	Attribute modes: Local and Global variables.	1
4	**I/O ASPECTS**	
4.1	Components of measuring system	1
4.2	Classification of signals	1
4.3	Transducers and sensors	1
4.4	Signal conditioning functions, Signal Grounding	1
4.5	Digital I/O techniques	1
4.6	Data Acquisition using VI & Components of DAQ	1
5	**GSD APPLICATIONS**	
5.1	Motion Control & Machine Vision	1
5.2	Control Design and Simulation Tools	1
5.3	PID control Tool kit	1
5.4	Image acquisition and processing	1
5.5	Simulation Interface Tool	1
5.6	Sequential Process Designs.	1
	LABORATORY EXPERIMENTS:	
1	Debugging a VI, Sub-VI's	6
2	Programming with FOR Loop, WHILE Loop & Local and Global variables	6
3	Programming with Cluster and Structures	6
4	Waveform measurement using VI	6
5	Design and simulation of stepper motor control.	6
	Total	**60**

Course Designer(s)

Mr. A.Thangadurai - thangaduraia@ksrct.ac.in

60 EE E57	Design of Electric Vehicle Charging System	Category	L	T	P	Credit
		PE	2	0	2	3

Objectives

- To gain comprehensive knowledge regarding the overview of Electric Vehicle (EV) Technology, encompassing key concepts, components, and emerging trends in the field.
- To comprehend the various types of charging stations available for Electric Vehicles (EVs) and their design ratings.
- To analyze and evaluate different types of chargers used in Electric Vehicle (EV) charging systems.
- To explore and understand the diverse types of connectors utilized in Electric Vehicle (EV) charging systems.
- To apply principles of engineering design in developing modules for Electric Vehicle (EV) Charging stations.

Pre-requisites

- Basics of Electrical Engineering (or equivalent subject), Control System, Circuit Network, Measurements & Instrumentation

Course Outcomes

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

CO1	Acquire knowledge about the overview of EV Technology	Remember
CO2	Recognize the different types of charging stations and design ratings.	Understand
CO3	Study different chargers and technical specification.	Remember
CO4	Understand types of connectors.	Understand
CO5	Design module of EV Charging station.	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	-	-	1	1	-	-	-	-	-	1	-
CO2	3	-	-	-	-	1	-	-	-	-	-	1	1	1
CO3	3	2	2	-	-	-	-	2	-	-	-	1	-	-
CO4	3	-	-	-	-	1	-	-	-	-	-	-	-	-
CO5	3	3	3	-	3	-	-	-	-	-	1	1	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	Theory	Lab	Theory	Lab
Remember	20	-	20	-	35	-	35	-
Understand	20	-	20	-	30	-	30	-
Apply	10	50	10	50	20	50	20	50
Analyse	10	50	10	50	15	50	15	50
Evaluate	-	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-	-
Total	60	100	60	100	100	100	100	100

Syllabus								
K.S.Rangasamy College of Technology – Autonomous R2022								
B.E – Electrical and Electronics Engineering								
60 EE E57 - Design of Electric Vehicle Charging 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 Introduction of Electric Vehicle, Components of Electric Vehicle, Basic working of EV Vs BS6, Comparison with Internal Combustion Engine, EV Technology, classification and their electrification levels.	[6]
Types of EV Chargers Block diagram and working of charger, Types of EV Charging stations, Implementation Mechanism, Slow charger design rating, Fast charger design rating, AC charging and DC charging, and In-board and off-board charger specification.	[6]
Selection and sizing of fast and slow charger (AC & DC) Selection and sizing of the fast and slow charger (AC & DC), EVSE Power Module selection, and technical specification, Communication Interface between the charger and CMS (central management system), Components of EV charging station	[6]
Selection and sizing of Common types of connectors and applications Selection and sizing of Common types of connectors and applications, Selection of DC charger connector GB/T, CCS1 and CSS2, Selection of EVA sheet, Bus bar, and frame, Assembling EV Charging station.	[6]
Public Charging infrastructure / Electrical system design * Public Charging infrastructure / Electrical system design, Design module of EV Charging station, Assessment of site location for Public charging station, Selection and sizing of Distribution transformer, Selection and sizing of HT Equipment (VCB, CT, PT, Metering, Cables)	[6]
Practical: **1.** Design a bidirectional battery circuit using buck boost converter. 2. Design a battery controller based on SOC for charging and discharging of battery in EV 3. Model and Simulate a BMS for Passive cell Balancing in EV 4. Design a SOC controller for Li ion Battery in MATLAB 5. Simulate a bidirectional operation in EV Charger using single – Phase Model **Tools used: MATLAB**	[30]
Total Hours: (Lecture - 30; Practical - 30)	**60**

Text Book(s):

1.	Anupam Singh,"Electric Vehicles: And the End of ICE age",Adhyyan Books Publisher, 2019
2.	Sanjeev Singh, Sanjay Gairola ,Sanjeet Dwivedi,"Electric Vehicle Components and Charging Technologies: Design, modeling, simulation and control",2023

Reference(s):

1.	Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2020.
2.	C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2023.
3.	James Larminie Oxford Brookes University, Oxford, UK John Lowry Acenti Designs Ltd., UK, Electric Vehicle Technology Explained 2017
4.	James Larminie, John Lowry, Electric Vehicle Technology Explained Wiley, 2021.

* SDG 07 - Ensure access to affordable, reliable, sustainable and modern energy for all

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of Hours**
1	**Introduction**	
1.1	Introduction of Electric Vehicle	1
1.2	Components of Electric Vehicle	1
1.3	Basic working of EV Vs BS6	1
1.4	Comparison with Internal Combustion Engine,	1
1.5	EV Technology, classification	1
1.6	Electrification levels	1
2	**Types of EV Chargers**	
2.1	Block diagram and working of charger	1
2.2	Types of EV Charging stations	1
2.3	Implementation Mechanism	1
2.4	Slow charger design rating and Fast charger design rating	1
2.5	In-board specification.	1
2.6	Off-board charger specification.	1
3	**Selection and sizing of fast and slow charger (AC & DC)**	
3.1	Selection and sizing of the fast charger (AC & DC)	1
3.2	Selection and sizing of the slow charger (AC & DC)	1
3.3	EVSE Power Module selection, and technical specification	1
3.4	Communication Interface between the charger	1
3.5	CMS (central management system)	1
3.6	Components of EV charging station.	1
4	**Selection and sizing of Common types of connectors and applications**	
4.1	Selection and sizing of Common types of connectors	1
4.2	Sizing of Common types of connectors and applications	1
4.3	Selection of DC charger connector GB/T	1
4.4	CCS1 and CSS2	1
4.5	Selection of EVA sheet, Bus bar, and frame	1
4.6	Assembling EV Charging station.	1
5	**Public Charging infrastructure / Electrical system design**	
5.1	Public Charging infrastructure / Electrical system design	1
5.2	Design module of EV Charging station	1
5.3	Assessment of site location for Public charging station	1
5.4	Selection and sizing of Distribution transformer	1
5.5	Selection and sizing of HT Equipment (VCB, CT)	1
5.6	Selection and sizing of HT Equipment (PT, Metering, Cables)	1
Practical:		
1.	Design a bidirectional battery circuit using buck boost converter.	6
2.	Design a battery controller based on SOC for charging and discharging of battery in EV	6
3.	Model and Simulate a BMS for Passive cell Balancing in EV	6
4.	Design a SOC controller for Li ion Battery in MATLAB	6
5.	Simulate a bidirectional operation in EV Charger using single – Phase Model	6

Course Designer(s)

1. Lt E.CHANDRA KUMAR- chandrakumar@ksrct.ac.in

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

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 EE L01	Energy Auditing and Conservation	OE	3	3	0	0	3
2.	60 EE L02	Graphical System Interface using LabVIEW	OE	3	3	0	0	3
3.	60 EE L03	Electric Vehicle Technology	OE	3	3	0	0	3
4.	60 EE L04	Sensor Technology	OE	3	3	0	0	3
5.	60 EE L05	Industrial Automation with PLC and SCADA	OE	3	3	0	0	3

60 EE L01	Energy Auditing and Conservation	Category	L	T	P	Credit
		OE	3	0	0	3

Objectives

- To gain the knowledge of basic elements of energy conservation
- To calculate the energy efficiency in thermal utilities.
- To Estimate the energy efficiency in electrical utilities.
- To import the knowledge of energy audit and management.
- To distinguish the various energy audit instruments.

Pre-requisites

- Basic Electrical Engineering

Course Outcomes

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

CO1	Illustrate the scope of energy conservation and energy conservation standards.	Understand
CO2	Determine the energy conservation in thermal utilities.	Apply
CO3	Identify and analyze the energy conservation/saving opportunities in different electric utilities.	Apply
CO4	Interpret the procedure for energy audits and various tariffs.	Apply
CO5	Identify the instruments used in the energy audit system.	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	2	2	2	-	-	2	-	1	2	2	
CO2	3	3	2	2	2	2	-	-	2	-	-	2		
CO3	3	3	3	2	2	2	-	-	2	-	-	2	2	
CO4	3	3	3	3	3	3	-	-	3	3	3	2	2	
CO5	3	2	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	10	20
Understand	30	30	50
Apply	20	20	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
Common to all branches								
60 EE L01 – Energy Auditing and Conservation								
Semester	Hours/Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
V/VI/VII	3	0	0	45	3	40	60	100

Energy Conservation Basics * Energy scenario: Primary and secondary Energy, Energy demand and supply, National Scenario. Energy Conservation and audit: concepts and difference, Energy Conservation Act 2001- relevant clauses of energy conservation. BEE and Rolls, MEDA and its Roles, Star labelling - Needs and its benefits, Introduction to Energy Conservation Building Codes (ECBC)	[9]
Energy Efficiency in Thermal Utilities * Fuels and combustion – Boilers - Steam systems - Furnaces - Co-generation, Tri-generation & Waste Energy Recovery, Heat pump, Insulation & Refractories, Energy savings possibilities in Boilers, Steam, and Furnaces.	[9]
Energy Efficiency in Electrical Utilities * Electrical system - HVAC - Electrical motors: Fans and Blowers and Variable speed drives - Pumps - Compressors - Lighting system Case study: Motor efficiency testing, Monitoring of power and energy usage of electrical machines by power quality analyzer - Access the condition of electrical motor by thermal imager. Energy Efficiency in Diesel generators, cooling Towers, and heat exchangers. **Hands-on Practices: (MATLAB /SCILAB/ any other open source)** • Study on Power savings calculator based on replacing filament bulbs by CFLs replacing Filament bulbs by CFL and LED bulbs using GUI-based MATLAB V.2023 • Design and simulate a power factor controller using the “Simulink model of digitally controlled boost power factor correction	[9]
Energy Audit and Energy Management * Definition and Objective of Energy Management – Energy Conservation Measures - Energy Audit: Need, Types, Methodology and Approach - Procedures and Techniques – Role of energy Managers- Energy Policy Planning and Implementation - Energy monitoring and targeting. Financial management to calculate simple payback – Return of Investment (RoI)	[9]
Energy Audit Instruments Basic measurements – Electrical measurements - Light, flux. Instruments Used in Energy systems: Load and power factor measuring equipment (Power Quality Analyzer) - Mechanical Measurement: Velocity-Vane anemometer, Pressure, Temperature-IR Thermometer, Heat flow rate, Vibrations, Flue gas analysis, Temperature and thermal loss measurements, air quality analysis	[9]
Total Hours:	**45**

Text Book(s):

1.	Dale R. Patrick, Stephen W. Fardo, Ray E. Richardson, Steven R. Patrick, “Energy Conservation Handbook” Prepared & Supported by: Uttarakhand and Renewable Energy Development Agency (UREDA) March 2013.
2.	BEE, “General aspect of energy management and energy audit, Energy efficiency in electrical utilities energy performance assessment for equipment & utility systems” - Bureau of Energy Efficiency, New Delhi, India, fourth edition, 2015.

Reference(s):

1.	Sivaganaraju. S, “Electric Energy Generation, Utilization and Conservation” Pearson, New Delhi, 2012.
2.	Albert Thumann, Terry Niehus and William J. Younger, "Handbook of Energy Audits", Fairmont Press. 2013.
3.	Abbi Y. P. , "Handbook on Energy Audit and Environment Management", Teri Press. 2014.
4.	http://www.cercind.gov.in/Act-with-amendment.pdf

* SDG12 – Responsible Consumption and Production

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Energy Conservation Basics.**	
1.1	Energy scenario: Primary and secondary Energy	1
1.2	Energy demand and supply	1
1.3	Energy Conservation and Audit- concepts and difference	1
1.4	Energy Conservation Act 2001	1
1.5	relevant clauses of energy conservation	1
1.6	BEE and Rolls, MEDA and its Roles	1
1.7	Star labeling - Needs and its benefits	1
1.8	Introduction to Energy Conservation Building Codes (ECBC)	2
2.0	**Energy Efficiency in Thermal Utilities.**	
2.1	Fuels and combustion	1
2.2	Boilers - Steam systems	1
2.3	Furnaces - Co-generation	2
2.4	Tri-generation & Waste Energy Recovery	2
2.5	Heat pump, Insulation & Refractories	1
2.6	Energy savings possibilities in Boilers, Steam, and Furnaces.	2
3.0	**Energy Efficiency in Electrical Utilities**	
3.1	Electrical system-HVAC	1
3.2	Electrical motors	1
3.3	Fans and Blowers and Variable speed drives	1
3.4	Pumps-Compressors-Lighting system Case study	1
3.5	Motor efficiency testing, Monitoring of power and energy	1
3.6	Usage of electrical machines by power quality analyzer	1
3.7	Access the condition of the electrical motor by thermal imager	1
3.8	Energy Efficiency in Diesel Generators	1
3.9	Cooling Towers, and heat exchangers.	1
4.0	**Energy Audit and Energy Management**	
4.1	Definition and Objective of Energy Management	1
4.2	Energy Conservation Measures	1
4.3	Energy Audit: Need, Types, Methodology and Approach	1
4.4	Procedures and Techniques	1
4.5	Role of energy Managers	1
4.6	Energy Policy Planning and Implementation	1
4.7	Energy monitoring and targeting.	1
4.8	Financial management to calculate simple payback	1
4.9	Return of Investment (RoI)	1
5.0	**Energy Audit Instruments**	
5.1	Basic measurements – Electrical measurements	1
5.2	Light, flux. Instruments Used in Energy Systems	1
5.3	Load and power factor measuring equipment (Power Quality Analyzer)	2
5.4	Mechanical Measurement: Velocity	1
5.5	Vane anemometer, Pressure, Temperature	1
5.6	IR Thermometer, Heat flow rate	1
5.7	Vibrations, Flue gas analysis	1
5.8	Temperature and thermal	1

Course Designer(s)

1. Dr.P.Aravindan - P/EEE aravindan@ksrct.ac.in

Rev.No. 00 / w.e.f. 25/07/2025
Passed in BoS Meeting held on 11/06/2025
Approved in Academic Council Meeting held on 19/07/2025

BoS Chairman Signature

60 EE L02	Graphical System Interface using LabVIEW	Category	L	T	P	Credit
		OE	3	0	0	3

Objectives

- To enhance the basic knowledge about virtual instruments
- To perceive the different programming methods used in virtual instrumentation
- To familiarize the interfaces of virtual instrumentation
- To explore the various VI tool sets for process control
- To demonstrate the use of LabVIEW for GSD applications

Pre-requisites

- Measurements & Instrumentation

Course Outcomes

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

CO1	Explain the architecture of Virtual Instruments and classify the concepts of graphical programming.	Understand
CO2	Cultivate the simple VIs using structures, file I/O using data types.	Apply
CO3	Identify the significance of virtual instruments in signal processing.	Understand
CO4	Recall the principles and pin configuration of bus interface standards.	Understand
CO5	Design, develop and manage VIs for real time 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	2	3	-	-	-	-	-	-	1		2
CO2	3	3	2	2	3	-	-	2	-	1	-	3		
CO3	3	3	3	3	3	2	2	2	3	2	2	2		2
CO4	3	3	3	3	3	-	-	-	2	2	3	3		2
CO5	3	3	3	3	3	2	2	2	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	10	30
Understand	20	20	30
Apply	30	30	40
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
B.E. Electrical and Electronics Engineering								
60 EE L02 - Graphical System Interface using LabVIEW								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V/VI/VII	3	0	0	45	3	40	60	100

Content	Hours
Introduction Graphical System Design (GSD) Model - Design flow with GSD - Virtual Instrumentation: Historical perspective, Advantages, Architecture of a virtual instrument, Data-flow techniques, Graphical programming in data flow, Comparison with conventional programming.	[9]
Programming Techniques in LabVIEW Concepts of graphical programming language LabVIEW, Concept of VIs and Sub VI, Graphs &charts, Data flow programming Loops, Cases and sequence structures, String and file I/O, Types of data, Arrays & clusters, Formula nodes, Math scrip integration, Local and global variables, Event Structure, Building executable and installers.	[9]
Data Acquisition and Signal Processing Introduction to data acquisition on PC, Sampling fundamentals, Input / Output techniques and buses. ADC, DAC, counters and timers, DMA, Software and hardware installation, Data acquisition interface requirements. Signal Processing: Basic Wave Information, Signal Analysis, Filters, Spectrum Analysis, Conditioning & Measurements, Transforms.	[9]
Interface Standards and Embedded Platform* Common Instrument Interfaces: Current loop, RS232C / RS485, GPIB. Introduction to System approach, System architecture, RIO architecture in system design, Concept of Real time, Real time terms, Multithreading, RTOS, LabVIEW Real Time System, RT Target (cRIO/PXI Platform).	[9]
Applications* Virtual Instrumentation for test, control and design - Virtual Instrumentation in the engineering process – GSD applications - Virtual Instruments beyond Personal Computer - Home security system with remote user interface - Real-time audio processor.	[9]
Total Hours:	**45**

Text Book(s):

1.	Garry M. Johnson, "LabVIEW Graphical Programming", TATA McGraw Hill, Second Edition, 2006.
2.	Jovitha Jerome, "Virtual Instrumentation using LabVIEW", PHI Learning Pvt. Ltd, New Delhi, 2010.

Reference(s):

1.	Jim Kring& Jeffrey Travis, "LabVIEW for everyone: Graphical Programming Made Easy and Fun", Prentice Hall, Third Edition 2006.
2.	Sanjay Gupta and Joseph John, "Virtual Instrumentation using LabVIEW", Tata McGraw Hill Inc., 2005.
3.	http://www.nptel.ac.in/courses/112104039/lecture13/138
4.	http://www.nptel.ac.in/courses/112106139/pdf/5_1.pdf
5.	https://learn-cf.ni.com/teach/riodevguide/guide/application-examples.html

*SDG 9 - industry, innovation, and infrastructure

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	Graphical System Design (GSD) Model	1
1.2	Design flow with GSD	1
1.3	Virtual Instrumentation: Historical perspective	1
1.4	Advantages	1
1.5	Architecture of a virtual instrument	1
1.6	Data-flow techniques	1
1.7	Graphical programming in data flow	1
1.8	Comparison with conventional programming	2
2.0	**Programming Techniques in LabVIEW**	
2.1	Concepts of graphical programming language LabVIEW	1
2.2	Concept of VIs and Sub VI	1
2.3	Graphs &charts	1
2.4	programming Loops, Cases and sequence structures, String and file I/O	1
2.5	Types of data, Arrays & clusters	1
2.6	Formula nodes, Math scrip integration	1
2.7	Local and global variables	1
2.8	Event Structure	1
2.9	Building executable and installers.	1
3.0	**Data Acquisition and Signal Processing**	
3.1	Introduction to data acquisition on PC	1
3.2	Sampling fundamentals	1
3.3	Input / Output techniques and buses	1
3.4	ADC, DAC, counters and timers, DMA	1
3.5	Software and hardware installation	1
3.6	Data acquisition interface requirements	1
3.7	Signal Processing: Basic Wave Information, Signal Analysis, Filters, Spectrum Analysis, Conditioning & Measurements, Transforms	3
4.0	**Interface Standards and Embedded Platform**	
4.1	Common Instrument Interfaces: Current loop, RS232C / RS485, GPIB	2
4.2	Introduction to System approach, System architecture	2
4.3	RIO architecture in system design	1
4.4	Concept of Real time	1
4.5	Real time terms	1
4.6	Multithreading, RTOS, LabVIEW Real Time System	1
4.7	RT Target (cRIO/PXI Platform).	1
5.0	**Applications**	
5.1	Virtual Instrumentation for test	1
5.2	control and design	1
5.3	Virtual Instrumentation in the engineering process	2
5.4	GSD applications	1
5.5	Virtual Instruments beyond Personal Computer	1
5.6	Home security system with remote user interface	1
5.7	Real-time audio processor.	1

Course Designer(s)

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

60 EE L03	Electric Vehicle Technology	Category	L	T	P	Credit
		OE	3	0	0	3

Objectives

- To acquire the basic knowledge of architecture and operation of an electric vehicle
- To categorize the different types of energy
- To Estimate the energy efficiency in Electrical utilities
- To import the knowledge of energy audit and management
- To distinguish the various energy audit instruments

Pre-requisites

- Basic Electrical and Electronics Engineering

Course Outcomes

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

CO1	Understand the operation and architecture of electric and hybrid vehicles	Analyze
CO2	Identify various energy source options like battery and fuel cell	Analyze
CO3	Select suitable electric motor for applications in hybrid and electric vehicles.	Analyze
CO4	Explain the role of power electronics in hybrid and electric vehicles	Analyze
CO5	Analyze the energy and design requirement for hybrid and electric vehicles.	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	-	-	-	-	3	2	
CO2	3	3	-	-	-	3	3	-	3	-	3	3	2	
CO3	3	3	3	-	3	3	3	-	3	3	3	3	2	
CO4	3	3	3	3	3	3	3	-	3	-	3	3	2	
CO5	3	3	3	3	3	3	3	-	3	3	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	10	10	30
Understand	10	10	40
Apply	20	20	10
Analyse	20	20	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
Common to all branches								
60 EE L03 - Electric Vehicle Technology								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
V/VI/VII	3	0	0	45	3	40	60	100

INTRODUCTION AND DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES Need for Electric vehicle- Comparative study of diesel, petrol, hybrid and electric Vehicles. Advantages and Limitations of hybrid and electric Vehicles. - Design requirement for electric vehicles- Range, maximum velocity, acceleration, power requirement, mass of the vehicle. Various Resistance- Transmission efficiency- Electric vehicle chassis and Body Design, Electric Vehicle Recharging and Refuelling Systems. **Hands On (MATLAB /SCILAB/ any other open source)** • Simulation of battery using for Electric Vehicle	[9]
ENERGY SOURCES Battery Parameters- - **Different types of batteries – Lead Acid- Nickel Metal Hydride - Lithium ion- Sodium based- Metal Air***. Battery Modelling - Equivalent circuits, Battery charging- Quick Charging devices. Fuel Cell- Fuel cell Characteristics- Fuel cell types-Half reactions of fuel cell. Ultra capacitors. Battery Management System. **Hands On (MATLAB /SCILAB/ any other open source)** • Simulation of fuel cell for Electric Vehicle	[9]
MOTORS AND DRIVES Types of Motors- DC motors- AC motors, PMSM motors, BLDC motors, Switched reluctance motors working principle, construction and characteristics.	[9]
POWER CONVERTERS AND CONTROLLERS Solid state Switching elements and characteristics – BJT, MOSFET, IGBT, SCR and TRIAC - Power Converters – rectifiers, inverters and converters - Motor Drives - DC, AC motor, PMSM motors, BLDC motors, Switched reluctance motors – four quadrant operations –operating modes **Hands On (MATLAB /SCILAB/ any other open source)** • Simulation of Buck-Boost converter circuit	[9]
HYBRID AND ELECTRIC VEHICLES **Main components and working principles of a hybrid and electric vehicles, Different configurations of hybrid and electric vehicles****. Power Split devices for Hybrid Vehicles - Operation modes - Control Strategies for Hybrid Vehicle - Economy of hybrid Vehicles - Case study on specification of electric and hybrid vehicles.	[9]
Total Hours:	**45**

Text Book(s):

1.	Iqbal Husain, " Electric and Hybrid Vehicles-Design Fundamentals", CRC Press,2021
2.	Mehrdad Ehsani, " Modern Electric, Hybrid Electric and Fuel Cell Vehicles", CRCPress,2017

Reference(s):

1.	James Larminie and John Lowry, "Electric Vehicle Technology Explained " John Wiley & Sons,2012
2.	Lino Guzzella, " Vehicle Propulsion System" Springer Publications,2005
3.	Ron HodKinson, "Light Weight Electric/ Hybrid Vehicle Design", Butterworth Heinemann Publication,2005
4.	https://onlinecourses.nptel.ac.in/noc23_ee01

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

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**INTRODUCTION AND DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES**	
1.1	Need for Electric vehicle	1
1.2	Comparative study of diesel, petrol, hybrid and electric Vehicles	1
1.3	Advantages and Limitations of hybrid and electric Vehicles	1
1.4	Design requirement for electric vehicles- Range, maximum velocity	1
1.5	acceleration, power requirement, mass of the vehicle	1
1.6	Various Resistance- Transmission efficiency	1
1.7	Electric vehicle chassis and Body Design	1
1.8	Electric Vehicle Recharging and Refuelling Systems.	2
2.0	**ENERGY SOURCES**	
2.1	Battery Parameters- -	1
2.2	Different types of batteries– Lead Acid- Nickel Metal Hydride - Lithium ion- Sodium based- Metal Air	2
2.3	Battery Modelling - Equivalent circuits	1
2.4	Battery charging- Quick Charging devices	1
2.5	Fuel Cell- Fuel cell Characteristics	1
2.6	Fuel cell types-Half reactions of fuel cell	1
2.7	Ultra capacitors	1
2.8	Battery Management System	1
3.0	**MOTORS AND DRIVES**	
3.1	Types of Motors- DC motors- AC motors	2
3.2	PMSM motors	2
3.3	BLDC motors	2
3.4	Switched reluctance motors working principle, construction and characteristics.	3
4.0	-POWER CONVERTERS AND CONTROLLERS	
4.1	Solid state Switching elements and characteristics	1
4.2	BJT, MOSFET, IGBT, SCR and TRIAC	1
4.3	Power Converters – rectifiers, inverters and converters	1
4.4	Motor Drives - DC, AC motor	2
4.5	PMSM motors, BLDC motors	2
4.6	Switched reluctance motors – four quadrant operations –operating modes	2
5.0	**HYBRID AND ELECTRIC VEHICLES**	
5.1	Main components and working principles of a hybrid and electric vehicles	2
5.2	Different configurations of hybrid and electric vehicles	1
5.3	Power Split devices for Hybrid Vehicles, Operation modes	2
5.4	Control Strategies for Hybrid Vehicle	2
5.5	Economy of hybrid Vehicles	1
5.6	Case study on specification of electric and hybrid vehicles	1

Course Designer(s)

1. Dr.S.Gomathi -gomathi@ksrct.ac.in

60 EE L04	Sensor Technology	Category	L	T	P	Credit
		OE	3	0	0	3

Objectives

- To educate about the working of various types of sensors.
- To impart the knowledge on the functional aspects of various sensor
- To transfer the concept of self-generating temperature sensors
- To infer about the fundamental working of digital and semiconductor sensors
- To transmit knowledge about latest sensors.

Pre-requisites

- Physics for Electrical Engineering and Analog Electronics

Course Outcomes

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

CO1	Differentiate about various sensors based on requirements	Understand
CO2	Analyze various physical parameters for various applications	Analyze
CO3	Suggest the application areas for self-generating temperature sensors.	Apply
CO4	Propose about necessity for digital and semiconductor sensors.	Understand
CO5	Acquire knowledge on the latest sensors.	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	2	2	2	2	-	2	2	2	2
CO2	3	3	3	-	3	-	-	-	-	2	2	2	2	2
CO3	3	3	3	-	3	2	2	-	2	-	2	2	2	2
CO4	3	3	3	-	3	-	-	2	-	-	2	2	2	2
CO5	2	2	2	-	2	-	-	-	2	-	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	20	20	30
Understand	30	30	50
Apply	-	10	10
Analyse	10	-	10
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E – Electrical and Electronics Engineering

60 EE L04 – Sensor Technology

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

Introduction to Sensors Introduction to sensor-based measurement systems: General concepts and terminology, sensor classification, primary sensors, material for sensors, micro sensor technology, magneto-resistors, light dependent resistors, resistive hygrometers, resistive gas sensors, liquid conductivity **Hands - on:** 1. LED Control using Arduino with SIMULINK	[9]
Resistive, Reactance Variation, Electromagnetic Sensors Reactance Variation and Electromagnetic Sensors: -Capacitive Sensors, Inductive Sensors, Electromagnetic Sensors. Signal Conditioning for Reactance Variation Sensors-Problems and Alternatives, AC Bridges Carrier Amplifiers, Coherent Detection, Specific Signal Conditioners for Capacitive Sensors, Resolver-to-Digital and Digital-to-Resolver Converters.	[9]
Self-Generating Temperature Sensors Thermoelectric Sensors: Thermocouples, Piezoelectric Sensors, Pyroelectric Sensors, Electrochemical Sensors, Acoustic Temperature Sensors, Magnetic Thermometer, Semiconductor Types, Thermal Radiation, Quartz Crystal, NQR, Heat Flux Sensors.	[9]
Digital and Semiconductor Sensors Position Encoders, Resonant Sensors, SAW Sensors, Sensors Based on Semiconductor Junctions, Sensors Based on MOSFET Transistors, Charge-Coupled and CMOS Image Sensors, Fiber-Optic Sensors, Ultrasonic based Sensors, Biosensors. **Hands - on:** 1. Ultrasonic Sensor for Object Detection using MATLAB	[9]
Latest Sensors * Proximity Sensors: Typical Sensor Characteristics, Technologies for Proximity Sensing, Electro-Optical Sensors, Capacitive Sensors, Magnetic Sensors, IoT sensors, green- IoT Sensors, prospects and challenges for smart sensors, Pollution sensors, RFID sensors, Wearable sensors, Optical Image sensors, Biometric sensors, Printed sensors and MEMS **Hands - on:** 1. IoT Integration with ThingSpeak	[9]
Total Hours:	**45**

Text Book(s):

1.	Patranabis D, “Sensors and Transducers”, 2nd Edition, PHI, New Delhi, 2022.
2.	Sawney A K, Puneet Sawney, “A Course in Mechanical Measurements and Instrumentation and Control”, 12th Edition, Dhanpat Rai and Co, New Delhi, 2017.

Reference(s):

1.	G R Sinha, “Advances in Modern Sensors, Physics, design, simulation and Applications” , IOP science, 2020
2.	Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs and Applications", 5th Edition, Springer, 2016.
3.	Ernest O Doebelin, “Measurement Systems – Applications and Design”, Tata McGraw-Hill, 2009.
4.	Walter Lang, “Sensors and Measurement Systems”, 2nd Edition, River Publishers, 2021.
5.	https://nptel.ac.in/courses/108106193 https://onlinecourses.nptel.ac.in/noc21_ee32/preview https://www.coursera.org/learn/sensor-manufacturing-process-control/home/welcome

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of Hours**
1	**Introduction to Sensors**	
1.1	Introduction to sensor based measurement systems: General concepts and terminology, sensor classification, primary sensors	2
1.2	Material for sensors, micro sensor technology	2
1.3	Magneto-resistors, light dependent resistors	2
1.4	Resistive hygrometers, resistive gas sensors, liquid conductivity	2
1.5	Hands - on: LED Control using Arduino with SIMULINK	1
2	**Resistive, Reactance Variation, Electromagnetic Sensors**	
2.1	Reactance Variation and Electromagnetic Sensors: -Capacitive Sensors, Inductive Sensors	2
2.2	Electromagnetic Sensors	1
2.3	Signal Conditioning for Reactance Variation Sensors-Problems and Alternatives, AC Bridges Carrier Amplifiers	2
2.4	Coherent Detection, Specific Signal Conditioners for Capacitive Sensors	2
2.5	Resolver-to-Digital and Digital-to-Resolver Converters	2
3	**Self-Generating Temperature Sensors**	
3.1	Thermoelectric Sensors: Thermocouples, Piezoelectric Sensors	2
3.2	Pyroelectric Sensors	1
3.3	Electrochemical Sensors, Acoustic Temperature Sensors	2
3.4	Magnetic Thermometer, Semiconductor Types, Thermal Radiation	2
3.5	Quartz Crystal, NQR, Heat Flux Sensors.	2
4	**Digital and Semiconductor Sensors**	
4.1	Position Encoders, Resonant Sensors, SAW Sensors	2
4.2	Sensors Based on Semiconductor Junctions	1
4.3	Sensors Based on MOSFET Transistors	1
4.4	Charge-Coupled and CMOS Image Sensors	2
4.5	Fiber-Optic Sensors, Ultrasonic based Sensors, Biosensors	2
4.6	Hands - on: Ultrasonic Sensor for Object Detection using MATLAB	1
5	**Latest Sensors**	
5.1	Proximity Sensors: Typical Sensor Characteristics, Technologies for Proximity Sensing	1
5.2	Electro-Optical Sensors, Capacitive Sensors, Magnetic Sensors	2
5.3	IoT sensors, green- IoT Sensors, prospects and challenges for smart sensors	2
5.4	Pollution sensors, RFID sensors, Wearable sensors, Optical Image sensors,	2
5.5	Biometric sensors, Printed sensors and MEMS	1
5.6	Hands - on: IoT Integration with ThingSpeak	1

Course Designer(s)

1. Dr.R.Balamurugan – balamurugan@ksrct.ac.in

60 EE L05	Industrial Automation with PLC and SCADA	Category	L	T	P	Credit
		OE	3	0	0	3

Objectives

- To observe the evolving trend in industrial automation
- To enhance the knowledge of Programmable Logic Controllers
- To familiarize with the PLC programming and instructions
- To demystify the core structure, functions and design principles of SCADA system
- To perceive the concept of networking in PLC and SCADA

Pre-requisites

- Basic Electrical Engineering

Course Outcomes

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

CO1	Recognize the need for automation in various industrial applications	Understand
CO2	Comprehend the concepts and types of PLC with its building blocks	Apply
CO3	Manipulate the programming languages and PLC instructions for industrial applications	Apply
CO4	Elucidate the architecture, protocols, hardware and software components of SCADA	Apply
CO5	Intrepret the functionality of various networks in automation environment using PLC and SCADA	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	2	2	2	3	3	3	2	
CO2	3	3	3	2	-	-	-	-	-	2	-	-		
CO3	3	3	3	3	3	-	-	-	2	3	-	2	2	
CO4	3	2	3	2	-	-	-	-	-	3	-	-	2	
CO5	3	3	3	2	3	3	2	2	3	3	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	20	10	30
Understand	30	20	30
Apply	10	30	40
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022

B.E – Electrical and Electronics Engineering

60 EE L05 - Industrial Automation with PLC and SCADA

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

Introduction to Industrial Automation* Industrial Automation, History of industrial automation, Need and benefits of industrial automation, Automation Hierarchy, Basic components of automation, Types of automation system: Fixed, Programmable, Flexible, Different systems for Industrial Automation: PLC, HMI, SCADA, DCS and drives.	[9]
PLC Fundamentals Introduction to Programmable Logic Controllers, Evolution of PLC, Building blocks of PLC: CPU, Memory organization, Communication Network, Power supply, I/O Modules: Analog and Discrete, Special I/O Modules, Type of PLC: Fixed and Modular, I/O Module selection criteria, PLC in industrial automation.	[9]
PLC Programming PLC programming instructions, Relay type, ON Delay, OFF Delay, Retentive, Data handling, Arithmetic, Timer and Counter instructions, PLC programming languages: Instruction List, Functional Block Diagram, Structured Text, Sequential Flow Chart, Ladder Diagram, Simple programming examples using Ladder programming. **Hands on Training -** Control the lamp by timer.	[9]
Supervisory Control And Data Acquisition Introduction to SCADA- architecture, generations, benefit, hardware and Software, Remote Terminal Units: RTU configuration, Testing and Environmental consideration, Master Station: Features and functions, Structure of Master function, Communication protocols in SCADA.	[9]
Networking of PLC and SCADA Interfacing of SCADA with PLC's: Typical connection diagram, Object Linking and Embedding process control, OSI Layers, Open Platform Communication functions, Process Filed Bus, Applications of SCADA in industries, Case Study: Siemens SCADA System manages tunnel.	[9]
Total Hours:	**45**

Text Book(s):

1.	Frank D. Petruzella, "Programmable Logic Controllers", 5th Edition, McGraw- Hill, New York, 2019.
2.	Stuart A. Boyer, —"SCADA- Supervisory Control and Data Acquisition", Instrument Society of America Publications, USA, The Instrumentation system and Automation Society, 4th Edition, 2010.

Reference(s):

1.	John W. Webb and Ronald A. Reis, "Programmable Logic Controllers: Principles and Application", PHI Learning, New Delhi, 5th Edition, 2011.
2.	Bailey, David: Wright, Edvin, —Practical SCADA for Industry‖, Newnes International Edition, 2003.
3.	Katariya Sanjay B, " Industrial Automation Solutions for PLC, SCADA, drive and field instruments : easy to learn industrial automation", May 2020
4.	Rajesh mehra, Vikrant Vij ,"PLCs & SCADA theory and practice", Laxmi Publications Private Limited,2019

*SDG 9 – Industry Innovation and Infrastructure

Course Contents and Lecture Schedule		
S. No.	**Topics**	**No. of hours**
1.0	**Introduction to Industrial Automation**	
1.1	Industrial Automation, History of industrial automation, Need and benefits of industrial automation	2
1.2	Automation Hierarchy	1
1.3	Basic components of automation, Types of automation system: Fixed, Programmable, Flexible	3
1.4	Different systems for Industrial Automation: PLC, HMI, SCADA, DCS and drives	3
2.0	**PLC Fundamentals**	
2.1	Introduction to Programmable Logic Controllers, Evolution of PLC	2
2.2	Building blocks of PLC: CPU, Memory organization, Communication Network, Power supply	2
2.3	I/O Modules: Analog and Discrete, Special I/O Modules	2
2.4	Type of PLC: Fixed and Modular, I/O Module selection criteria	2
2.5	PLC in industrial automation.	1
3.0	**PLC Programming**	
3.1	PLC programming instructions, Relay type, ON Delay, OFF Delay, Retentive, Data handling	2
3.2	Arithmetic, Timer and Counter instructions	1
3.3	PLC programming languages: Instruction List, Functional Block Diagram, Structured Text	2
3.4	Sequential Flow Chart, Ladder Diagram	1
3.5	Simple programming examples using Ladder programming	1
3.6	**Hands on Training -** Control the lamp by timer.	2
4.0	**Supervisory Control And Data Acquisition**	
4.1	Introduction to SCADA- architecture, generations, benefit, hardware and Software	2
4.2	Remote Terminal Units: RTU configuration,	2
4.3	Master Station: Features and functions, ,	1
4.4	Structure of Master function	2
4.5	Communication protocols in SCADA.	2
5.0	**Networking of PLC and SCADA**	
5.1	Interfacing of SCADA with PLC's: Typical connection diagram	2
5.2	Object Linking and Embedding process control, OSI Layers	2
5.3	Open Platform Communication functions, Process Filed Bus	2
5.4	Applications of SCADA in industries	1
5.5	Case Study: Siemens SCADA System manages tunnel	2

Course Designer(s)

1. S.Jaividhya- jaividhya@ksrct.ac.in