# K.S. Rangasamy College of Technology

(Autonomous Institution affiliated to Anna University, Chennai)



## **CURRICULUM & SYLLABI**

FOR

**M.E. Structural Engineering** (For the batch admitted in 2023– 2024)

# R 2022

# Accredited by NAAC with A++ Grade, Approved by AICTE, Affiliated to Anna University, Chennai.

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



## **Department of Civil Engineering**

## VISION OF THE DEPARTMENT

To empower the graduates to excel as a competent Professional in the areas of Design and Development of Safe, Healthy, Sustainable and Eco friendly Infrastructure for overall development of the Society. **MISSION OF THE DEPARTMENT** 

- To provide quality education through interdisciplinary research and innovative practices for the Betterment of human society in teaching and learning.
- To develop creative solutions for a wide range of challenges in Civil Engineering by adopting modern Tools and Techniques.

## **PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

- **PEO1:** Gain knowledge and skills in structural engineering which will enable them to have a career and professional accomplishment in the public or private sector organizations.
- **PEO2:** Become consultants in Structural Engineering and solve complex real-life issues related to the analysis, design and maintenance of structures under various environmental conditions.
- **PEO3:** Contribute to the enhancement of knowledge in Structural Engineering by performing quality research in institutions of international repute or Research organizations or Academia.

## PROGRAMME OUTCOMES (POs)

## Engineering Graduates will be able to:

- **PO1:** Ability to individually carryout the STEM based (Science, Technology, Engineering, and Mathematics) research project.
- **PO2:** Ability to write, present and publish technical articles in reputed international/national conferences and journals.
- **PO3:** The skill developed by the student should be at a level of higher than the requirements in the appropriate bachelor program.
- **PO4:** Ability to acquire in depth knowledge of engineering design concepts and application of the same to solve complex engineering problems.
- **PO5:** Ability to find optimum safe and cost effective solutions in the development of mechanical systems taking into consideration sustainability, societal, environmental and public health aspects.
- **PO6:** Ability to support professional ethics and social responsibilities consistent with their roles as design engineers.

## PROGRAMME SPECIFIC OUTCOMES (PSOs):

Engineering Graduates will be able to:

- **PSO1:** Acquire in-depth knowledge of the Structural Engineering discipline, with an ability to evaluate, and synthesize existing and new knowledge in structural design.
- **PSO2:** Critically analyze complex Structural Engineering problems, apply independent judgment for synthesizing information and make innovative advances in a theoretical, practical and policy context.
- **PSO3:** Conceptualize and solve Structural Engineering problems, evaluate potential solutions and arrive at technically feasible, economically viable and environmentally sound solutions with due consideration of health, safety, and socio-cultural factors.

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

The M.E. Strucutural Programme outcomes leading to the achievement of the objectives are summarized in the following Table.

Programme	Programme Outcomes										
Educational Objectives	PO1	PO2	PO3	PO4	PO5	PO6					
PEO 1	3	2	3	3	2	1					
PEO 2	3	2	3	3	2	1					
PEO 3	3	2	3	3	2	1					

#### Contributions: 1- low, 2- medium, 3- high

R1/ w.e.f. 12.07.2023

Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023



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Year	Sem.	Course Name	1	2	3	4       1       2       2       3       2       3       2	5	6
		Applied Mathematics for Structural Engineering	3	3	2	1	2	
		Theory of Elasticity and Plasticity	3	3	3	2	3	3
		Structural Dynamics and Earthquake Engineering	2	2	3	2	2	3
	I	Research Methodology and IPR	3	3	2	2	2	2
Ι	Advanced Construction Engineering and Experimental Techniques		3	3	3	3	3	3
		Technical Seminar	3	3	3	2	2	2
		Advanced Steel Structures	3	3	3	3	3	3
		Advanced Concrete Structures	3	3	3	3	2	2
	П	Finite Element Analysis in Structural Engineering	3	3	3	3	2	2
		Advanced Structural Engineering Laboratory	3	2	3	2	2	2
		Computer Aided analysis and Design laboratory	3	3	2	2	2	2
		Project Work - Phase I	3	3	3	2	3	2
П		Inplant Training	3	3	3	2	3	2
	IV	Project Work - Phase II	3	3	3	2	3	2

RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

# K.S. RANGASAMY COLLEGE OF TECHNOLOGY

# Credit Distribution for M.E (SE)Programme-2022 -2023 Batch

C. No.	Cotogony	C	redits Pe	r Semes	ter	Total	Percentage
S. No.	Category	Ι	II	III	IV	Credits	%
1	PC	17	14	-	-	31	42.46
2	PE	3	6	6	-	15	20.56
3	CG	1	-	10	16	27	36.98
4	AC	-	-	-	-	-	-
Г	otal	21	20	16	16	73	100

PC - PROFESSIONAL CORE

PE – PROFESSIONAL ELECTIVES

CG - CAREER GUIDANCE COURSES

AC- AUDIT COURSES

tr **R1/ w.e.f. 12.07.2023** Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

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K.S.Rangasamy College of Technology TRUCHENGODE - 637 215

## K.S.RANGASAMY COLLEGE OF TECHNOLOGY,TIRUCHENGODE -637215 (An Autonomous Institution affiliated to Anna University)

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## **PROFESSIONAL CORE COURSES (PC)**

S.No.	Course Code	Course Title	Category	Contact Periods	L	т	Ρ	С	Pre-requisite
1.	60 PSE 101	Applied Mathematics for Structural Engineering	PC	3	3	2	0	4	Engineering Mathematics, Probability and Statistics
2.	60 PSE 102	Theory of Elasticity and Plasticity	PC	3	3	0	0	3	Fundamentals of Mathematics, Strength of Material
3.	60 PSE 103	Structural Dynamics and Earthquake Engineering	PC	3	3	0	0	3	Fundamentals of Mathematics
4.	60 PED 001\ 60 PDB E26	Research Methodology and IPR	PC	3	3	0	0	3	Nil
5.	60 PSE 1P1	Advanced Construction Engineering and Experimental Techniques Laboratory	PC	4	0	0	4	2	Concrete Technology
6.	60 PSE 201	Advanced Steel Structures	PC	3	3	0	0	3	Steel member design and foundation design
7.	60 PSE 202	Advanced Concrete Structures	PC	3	3	0	0	3	Design of RC elements
8.	60 PSE 203	Finite Element Analysis in Structural Engineering	PC	3	3	0	0	3	Knowledge of forces and resolution and equilibrium concepts.
9.	60 PSE 2P1	Advanced Structural Engineering Laboratory	PC	4	0	0	4	2	Basic RC and steel design theory and design
10.	60 PSE 2P2	Computer Aided analysis and Design laboratory	PC	4	0	0	4	2	CAD for structures



## **PROFESSIONAL ELECTIVES (PE)**

S.No.	Course Code	Course Title	Category	Contact Periods	L	Т	Ρ	С	Pre-requisite
1.	60PSE E11	Theory of Structural Stability	PE	3	3	0	0	3	Foundation Engineering
2.	60PSE E12	Theory of Plates and Shells	PE	3	3	0	0	3	Strength of materials and its mechanics
3.	60PSE E13	Design of Tall Buildings	PE	3	3	0	0	3	Industrial Structures
4.	60PSE E14	Design of Structures for Dynamic Loads	PE	3	3	0	0	3	Structural Dynamics
5.	60PSE E15	Fracture Mechanics of Concrete Structures	PE	3	3	0	0	3	Basic Strength of material
6.	60PSE E16	Advanced Groundwater Hydrology	PE	3	3	0	0	3	-
7.	60PSE E17	Groundwater Modeling and Management	PE	3	3	0	0	3	-

## SEMESTER I. PROFESSIONAL ELECTIVE I

## SEMESTER II, PROFESSIONAL ELECTIVE II

S.No.	Course Code	Course Title	Category	Contact Periods	L	Т	Ρ	С	Pre-requisite
1.	60PSE E21	Structural Health Monitoring	PE	3	3	0	0	3	Nil
2.	60PSE E22	Design of Sub Structures	PE	3	3	0	0	3	Foundation design
3.	60PSE E23	Structural Optimization	PE	3	3	0	0	3	Nil
4.	60PSE E24	Bridge Engineering	PE	3	3	0	0	З	Design concepts of RCC, prestressed concrete and steel structures.
5.	60PSE E25	Non-linear Analysis of Structures	PE	3	3	0	0	3	Finite element methods
6.	60PSE E26	Environmental Monitoring Instruments	PE	3	3	0	0	3	-
7.	60PSE E27	Municipal Solid Waste Management	PE	3	3	0	0	3	-

#### SEMESTER II, PROFESSIONAL ELECTIVE III

S.No.	Course Code	Course Title	Category	Contact Periods	L	Т	Ρ	С	Pre-requisite		
1.	60PSE E31	Soil Structure Interaction	PE	3	3	0	0	3	Geotechnical Engineering		
2.	60PSE E32	Design of Shell and Spatial Structures	PE	3	3	0	0	3	Theory of elasticity and plasticity.		
3.	60PSE E33	Off Shore Structures	PE	3	3	0	0	3	Nil		
4.	60PSE E34	Experimental Techniques and Instrumentation	PE	3	3	0	0	3	Fundamentals of Mathematics		
5.	60PSE E35	Matrix Method of	PE	3	3	0	0	3	Mechanics of structures and		

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		Structural Analysis							structural analysis.
6.	60PSE E36	Secondary Treatment of Wastewater	PE	3	3	0	0	3	-
7.	60PSE E37	Industrial Wastewater Pollution - Prevention and Control	PE	3	3	0	0	3	-

## SEMESTER III, PROFESSIONAL ELECTIVE IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	Т	Ρ	С	Pre-requisite
1.	60PSE E41	CADD for Structures	PE	3	3	0	0	3	Nil
2.	60PSE E42	Design of Industrial Structure	PE	3	3	0	0	3	Steel Structures
3.	60PSE E43	Disaster Resistant Structures	PE	3	3	0	0	3	Nil
4.	60PSE E44	Industrial Steel Structures	PE	3	3	0	0	3	Steel Structures
5.	60 PSE E45	Corrosion Engineering	PE	3	3	0	0	3	RCC and Steel Structures
6.	60PSE E46	Principles and Design of Biological Treatment System	PE	3	3	0	0	3	-
7.	60PSE E47	Transportation of Water and Wastewater	PE	3	3	0	0	3	-

## SEMESTER III, PROFESSIONAL ELECTIVE V

S.No.	Course Code	Course Title	Category	Contact Periods	L	Т	Ρ	С	Pre-requisite
1.	60PSE E51	Prestressed Concrete Structures	PE	3	3	0	0	3	Nil
2.	60PSE E52	Advanced Concrete Technology	PE	3	3	0	0	3	Concrete Technology
3.	60PSE E53	Aseismic Design of Structures	PE	3	3	0	0	3	Dynamics of Structures
4.	60PSE E54	Maintenance and Rehabilitation of Structures	PE	3	3	0	0	3	RCC and Steel Structures
5.	60PSE E55	Modern Construction Materials	PE	3	3	0	0	3	Concrete Technology
6.	60PSE E56	Remote Sensing and GIS for Hydrology and Water Resources	PE	3	3	0	0	3	-
7.	60PSE E57	Principles and Design of Physico Chemical Treatment Systems	PE	3	3	0	0	3	-



## AUDIT COURSES (AC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	Т	Ρ	С	Pre-requisite
1.	60 PAC 001	English For Research Paper Writing	AC	2	2	0	0	0	-NIL-
2.	60 PAC 002	Disaster Management	AC	2	2	0	0	0	-NIL-
3.	60 PAC 003	Constitution Of India	AC	2	2	0	0	0	-NIL-

# CAREER GUIDANCECOURSES (CG)

S.No.	Course Code	Course Title	Category	Contact Periods	L	т	Ρ	С	Pre-requisite
1.	60 PSE 1P2	Technical Seminar	CG	2	0	0	2	1	Nil
2.	60 PSE3P1	Project Work - Phase I	CG	16	0	0	16	80	Nil
3.	60 PSE3P2	Inplant Training	CG	0	0	0	0	2	Nil
4.	60 PSE4P1	Project Work - Phase II	CG	32	0	0	32	16	Project Work - Phase I

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

## (An Autonomous Institution affiliated to Anna University)

## COURSES OF STUDY

## (For the candidates admitted from 2022-2023 onwards)

#### SEMESTER I

S.No.	Course Code	Course Title	Category	Contact Periods	L	Т	Ρ	С
		THEORY						
1.	60 PSE 101	Applied Mathematics for Structural Engineering	PC	5	3	2	0	4
2.	60 PSE 102	Theory of Elasticity and Plasticity	PC	5	3	2	0	4
3.	60 PSE 103	Structural Dynamics and Earthquake Engineering	PC	5	3	2	0	4
4.	60 PED 001\ 60 PDB E26	Research Methodology and IPR	PC	3	3	0	0	3
5.	60 PSE E1*	Professional Elective I	PE	3	3	0	0	3
6.	60 PAC 001	English for Research Paper Writing	AC	2	2	0	0	0
		PRACTICALS						
7.	60 PSE 1P1	Advanced Construction Engineering and Experimental Techniques Laboratory	PC	4	0	0	4	2
8.	60 PSE 1P2	Technical Seminar	CG	2	0	0	2	1
			Total	29	17	6	6	21

#### SEMESTER II

S.No.	Course Code	Course Title Category		Contact Periods	L	Т	Ρ	С
		THEORY						
1.	60 PSE 201	Advanced Steel Structures	PC	3	3	0	0	3
2.	60 PSE 202	Advanced Concrete Structures	PC	3	3	0	0	3
3.	60 PSE 203	Finite Element Analysis in Structural Engineering	PC	5	3	2	0	4
4.	60 PSE E2*	Professional Elective II	PE	3	3	0	0	3
5.	60 PSE E3*	Professional Elective III	PE	3	3	0	0	3
6.	60 PAC 002	Disaster Management	AC	2	2	0	0	0
		PRACTICALS						
7.	60 PSE 2P1	Advanced Structural Engineering Laboratory	PC	4	0	0	4	2
8.	60 PSE 2P2	Computer Aided analysis and Design laboratory	PC	4	0	0	4	2
			Total	27	17	2	8	20



#### **SEMESTER III**

S.No.	Course Code	Course Title	Category	Contact Periods	L	Т	Ρ	С
		THEORY						
1.	60 PSE E4*	Professional Elective IV	PE	3	3	0	0	3
2.	60 PSE E5*	Professional Elective V	PE	3	3	0	0	3
		PRACTICALS			•	•	•	
3.	60 PSE3P1	Project Work - Phase I	CG	16	0	0	16	8
4.	60 PSE3P2	Inplant Training	CG	0	0	0	0	2
	•		Total	22	6	0	16	16

#### **SEMESTER IV**

S.No.	Course Code	Course Title	Category	Contact Periods	L	т	Ρ	С
		THEORY						
		PRACTICALS						
1.	60 PSE4P1	Project Work - Phase II	CG	32	0	0	32	16
			Total	32	0	0	32	16

## TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 73

Note:

PC- Professional Core Courses; PE- Professional Elective Courses; CG-Career Guidance Courses; AC- Audit Courses.

L: Lecture;

T: Tutorial;

P: Practical;

C: Credit

1 Hour Lecture = 1 credit

2 Hours tutorial = 1 credit

2 Hours practical = 1 credit

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

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#### M.E. / M.Tech. Degree Programme SCHEME OF EXAMINATIONS (For the candidates admitted from 2022-2023 onwards) FIRSTSEMESTER

S.No.	Course Code	Name of the	Duration of Internal	Weighta	age of Marks	6	Minimum I for Pass i Semes Exam	n End ter
	Code	Course	Exam	Continuous Assessment *	End Semester Exam	Max. Marks	End Semester Exam	Total
			T	HEORY				
1	60 PSE 101	Applied Mathematics for Structural Engineering	2	40	60	100	45	100
2	60 PSE 102	Theory of Elasticity and Plasticity	2	40	60	100	45	100
3	60 PSE 103	Structural Dynamics and Earthquake Engineering	2	40	60	100	45	100
4	60 PED 001\ 60 PDB E26	Research Methodology and IPR	2	40	60	100	45	100
5	60 PSE E1*	Professional Elective I	2	40	60	100	45	100
6	60 PAC 001	English for Research Paper Writing	2	100	-	100		
			PR	ACTICAL				
7	60 PSE 1P1	Advanced Construction Engineering and Experimental Techniques Laboratory	3	60	40	100	45	100
8	60 PSE 1P2	Technical Seminar	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 wills 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 to60marksfortheawardofterminalexamination marks.



## Objective

- To describe the concepts of solving system of equations.
- To understand the least square method to find the curve of best fit.
- To get exposed to the functional optimization related problems.
- To acquire knowledge of solving partial differential equations using Laplace transform.
- To familiarize the basic concepts on Fourier transform.

#### Prerequisite

NIL

#### Course Outcomes

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

CO1	Apply various iteration techniques to solve the algebraic, transcendental and linear equations.	Remember, Apply
CO2	Use method of least square to find the best fit curves and analyze interpolation problems.	Remember, Understand, Analyze
CO3	Compute the solutions for functional optimization problems.	Remember, Understand, Apply
CO4	Solve partial differential equations using Laplace transform.	Remember, Apply
CO5	Solve the boundary value problems using Laplace transform techniques.	Remember, Apply

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	1	2
CO2	3	3	2	1	2
CO3		3	2	1	2
CO4	3	3	2	1	2
CO5	3	3	2	1	2
	3- Stro	ng; 2-M	edium;	1-Low	

## Assessment Pattern

Bloom's Category		Assessment Tests Marks)	End Sem Examination
Bioom a category	1	2	(Marks)
Remember (Re)	10	10	10
Understand (Un)	10	10	10
Apply (Ap)	20	40	60
Analyze (An)	20	0	20
Evaluate (Ev)	0	0	0
Create (Cr)	0	0	0

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		60 PSE101 - A			Technology–A ATICS FOR S				
					RAL ENGINE				
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Seme	ester —			Р	Total Hrs	Credit	CA	ES	Tota
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A W---RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

S.No.	Торіс	No.of Hours
1	Eigenvalue Problems	
1.1	Matrix operations	1
1.2	Solution of system of linear equation by Gauss Seidal iterative method	1
1.3	Eigen value and eigen vector by iterative methods: Power method	1
1.4	Tutorial	2
1.5	Jacobi method	1
1.6	Given's method	2
1.7	House holder method	2
1.8	Tutorial	2
2	Regression Analysis	
2.1	Curve fitting by the method of least squares	2
2.2	Fitting a curve of the form $y = \alpha x^b$ and $y = \alpha e^{bx}$	2
2.3	Tutorial	2
2.4	Interpolation: polynomial approximation	1
2.5	Lagrange's method	1
2.6	Newton's method	2
2.7	Tutorial	2
3	Calculus of Variations	
3.1	Concept of variation and its properties	1
3.2	Euler's equation	1
3.3	Functional dependent on first andhigher order derivatives	2
3.4	Functionals dependent on functions of several independent variables	1
3.5	Tutorial	2
3.6	Variational problems with moving boundaries	1
3.7	Isoperimetric problems	1
3.8	Ritz method	1
3.9	Tutorial	2
4	Laplace Transform Techniques for Partial Differential Equations	
4.1	Laplace transform: Definitions – Properties	1
4.2	Dirac delta function – Unit step functions	1
4.3	Convolution theorem	1
4.4	Tutorial	2
4.5	Inverse Laplace transform: Complex inversion formula	1
4.6	Solutions to partial differential equations: Heat equation	2

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4.7	Solutions to partial differential equations: Wave equation	2
4.8	Tutorial	2
5	Fourier Transform Techniques for Partial Differential Equations	
5.1	Fourier transform: Definitions – Properties	1
5.2	Transform of elementary functions	1
5.3	Convolution theorem – Parseval's identity	1
5.4	Tutorial	2
5.5	Solutions to partial differential equations: Heat equation	1
5.6	Solutions to partial differential equations: Wave equation	1
5.7	Laplace's equation	2
5.8	Poisson's equation	1
5.9	Tutorial	2
	Total	60

# CourseDesigners

1. Dr.D.TAMIZHARASAN -tamizharasan@ksrct.ac.in

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						i i
60 PSE 102 THEORY OF ELASTIC	CITY AND PLASTICITY	PC	3	2	0	4

## Objective

- To understand the concepts of stresses, strains and stress-strain relationships, basic theory of elasticity and failure criteria.
- To expose the two dimensional problems in Cartesian and polar coordinates.
- To make familiar with problem formulations and solution techniques.
- To familiarize with the principle of torsion of prismatic bars of non circular sections.
- To Learn different energy methods and also basics of plasticity.

#### Prerequisite

Fundamentals of Mathematics, knowledge of basic Science

#### Course Outcomes

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

CO1	Understand the equilibrium equation and stress-strain relationship with various Coordinate Systems.	Remember, Understand, Apply
CO2	Analyze the problem with bi-harmonic equations.	Remember, Understand, Analyze
CO3	Identify the different approaches for solving the torsional problems and thin walled open and closed sections	Remember, Understand, Apply, Analyze
CO4	Analyze the elasticity problems with various energy methods.	Analyze
CO5	State the assumptions of plasticity and solve plastic problems.	Understand and Apply

#### Mapping with Programme Outcomes

COs	P01	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	3	
CO2	3	3	3	2	3	3
CO3	2	3	3	3	2	2
CO4	2	2	3	3	2	1
CO5	2	3	2	3	2	2
	3- 3	Strong;	2-Mediu	im; 1-Lo	ŚW	

#### Assessment Pattern

Bloom'sCategory	Continuous / (I	End Sem Examination	
	1	2	(Marks)
Remember	10	10	10
Understand	10	10	10
Apply	20	10	30
Analyse	20	30	50
Evaluate	-	-	-

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4. Wr **BoS Chairman** 

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		60 PS		EORY OF ELASTIC		ICITY		
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#### **Course Contents and Lecture Schedule**

S.No	Торіс	No.of Hours
1	Elasticity	
1.1	Analysis of stress and strain in 2D and 3D system - Introduction	1
1.2	Longitudinal Vibrations Equation of motion, SDOF analysis	1
1.3	Equation of Equilibrium – 2D (Cartesian & Polar coordinate system) & Problems	1
1.4	Equation of Equilibrium - 3D (Cartesian system) & Problems	2
1.5	Compatibility equation	1
1.6	Analysis of stress – 2D(Cartesian & Polar coordinate system) & Problems	1
1.7	Analysis of strain – 2D(Cartesian & Polar coordinate system) & Problems	1



4.0		
1.8	Specification of stress and strain –2D & 3D & Problems	1
1.9	Generalized Hook's law, Stress-Strain relationship- Mohr Circle	2
<b>2</b> 2.1	Elasticity Solution Plane Stress and Plane Strain Problems.	1
2.1		2
	Derivation of Airy's stress functions in cartesian coordinate system	
2.3	Derivation of Airy's stress functions in polar coordinate system	2
2.4	Application of Airy's stress functions	2
2.5	Problems in airy's stress functions	2
2.6	Thick cylinders under uniform pressure	1
2.7	Bi harmonic equation	1
2.8	Saint Venant's principle	1
2.9	Shrink & Force fit & Problems	2
2.10	Problem	2
3	Torsion of Non Circular Section	
3.1	Torsion of non-circular by St. Venant's approach	2
3.2	Torsion of circular Prismatic bar by St. Venant's approach	2
3.3	Torsion of non-circular by Prandtl approach & Problems	2
3.4	Torsion of Prismatic bar by Prandtl approach & Problems	2
3.5	Membrane analogy of torsion of Closed section	2
3.6	Torsion of thin walled open and closed sections	2
4	Energy Methods	
4.1	Introduction to energy theorem	1
4.2	Strain Energy for 2D & 3D stress system	1
4.3	Complimentary energy theorem	1
4.4	Principle of Virtual Work	1
4.5	Energy theorem	1
4.6	Rayleigh Ritz method	1
4.8	Finite difference method	1
4.9	Engesser's theorem & Castingliano's theorem	1
4.10	Problems in energy method	2
5	Plasticity	
5.1	Physical assumption	1
5.2	Yield criteria and Yield surface	2
5.3	Plastic stress strain relations, Flow rule	2
5.4	Tresca criteria & Problems	2
5.5	Von mises criteria & Problems	2
5.6	Plastic problems in bending	1
5.7	Plastic problems in Torsion	1
5.8	Plastic problems in Thick cylinders	1
	Total	60

## **Course Designers**

Dr.J.Abdul Bari - abdulbari@ksrct.ac.in

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		Category	L	Т	Ρ	Credit
60 PSE 103	STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING	PC	3	2	0	4

## Objective

- To know the fundamentals of vibrations of SDOF system •
- To gain knowledge on free and forced vibration of MDOF system •
- To understand the basic principles of dynamics, different methods of multi degree of freedom • system and their dynamic response, modeling
- To evaluate the free and forced vibration analysis of continuous system
- To know the practical applications of structural dynamics

#### Prerequisite

## Fundamentals of Mathematics, knowledge of basic Science

## **Course Outcomes**

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

CO1	Analyse the single degree of freedom with free vibration.	Analyze
CO2	Analyse the single degree of freedom forced vibration with harmonic excitation.	Analyze
CO3	Analyse the two degree of freedom with free vibration.	Analyze
CO4	Analyse the Multi degree of freedom with free and forced vibration.	Analyze
CO5	Apply the principle of vibration to the sub structure design	Apply

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	3	2	2	3
CO2			3		2	3
CO3	2	2	3	2	2	3
CO4			3		2	3
CO5	1	1	3	2	3	3
	3- 3	Strong;	2-Mediu	ım; 1-Lo	W	

## AssessmentPattern

Bloom's Category	Continuous / (I	End Sem Examination			
	1	2	(Marks)		
Remember	10	10	10		
Understand	10	10	10		
Apply	10	10	30		
Analyse	30	30	50		
Evaluate	-	-	-		
Create	-	-	-		

4. Wr RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

				echnology–A				
	60 PSE 103- STR			RAL ENGINE		ENGINE	ERING	
	Hours	Week	INUCIU		Credit	N	/aximum M	larks
Semester				Total hrs	C	CA	ES	Total
	3	2	0	60	4	40	60	100
Equation	s of Vibration Anal s of Motion by equi freedom systems, E	librium an	nd energy mping – t	/ methods, Fr ransmissibility	ee & Force	ed vibrati	on of sing	[12] le
Formulat	<b>gree of Freedom Sy</b> on of Structure, prop system – Mode shap	erty matrie			ems – probl	ems on t	wo degree	[ <b>12</b> ]
<b>Dynamic</b> Multi deg Dunkerly	Analysis of Multi D gree of freedom sy s method Holzer me perposition technique	egree of I stems, O ethod- Sto	F <b>reedom</b> rthogonal dola met	ity of normal hod-Rayleigh's	method- F	pproxima Rayleigh I	te methods Ritz method	5- d-
<b>Dynamic</b> Free and	Analysis of Contin forced vibration of tion of energy- formu	uous Syst	<b>tems</b> us syster	n –Rayleigh F		1 – formı	ulation usin	[ <b>12</b> ]
Practical Idealizati	Applications on of multi-storeyed non principles of ana	frames -	-		st loading -	- aerodyr	namics, gu	<b>[12</b> ] st
							TotalHou	rs 60
Textboo	k(s):							
1. Mac	lhujith Mukhopadhya	y "Structur	al Dynam	ics (Vibration	& systems)"	' ,Ane boo	oks Pvt.Ltd,	2015.
2. M P	az, " Structural Dyna	mics-Theo	ory and Co	omputation", S	pringer, 200	)7.		
Reference	;e(s):							
	K Chopra, "Dynami ntice Hall,New Delhi,		ictures –	Theory and A	Applications	to Earth	quake Eng	ineering
2. Roy 201	R Craig and Andrev 1.	v J.Kurdila	ı," Fundaı	mentals of Str	uctural dyna	amics", Jo	ohn Wiley a	and Sons
3. R W	Clough and J Penzi	en, "Dynar	mics of St	ructures", McC	Graw Hill Bo	ok Co. Lt	d, 2003.	
4. JL	Humar, "Dynamics of	Structures	s", Prentio	ce Hall on India	a Pvt. Ltd, 2	000.		
Course	Contents and Lectu	re Sched	ule					

S.No	Торіс	No.of
		Hours
1	Principles of Vibration Analysis	
1.1	Free vibration of single degree of freedom systems, Simple Harmonic motion	1
1.2	Longitudinal Vibrations Equation of motion, SDOF analysis	1
1.3	Undamped SDOFs- dynamic equation of motion with electrical equivalent	1
1.4	Tutorial	2
1.5	Newtons law of motion, D'Alemberts principle- equivalent stiffness	1
1.6	Springs are connected in series and parallel, frequency and period, problems	1
1.7	Amplitude of motion, Energy method for the equation of motion	1

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1.8	Damped SDOFs- underdamped, overdamped and critically damped	1
1.9	Logarithmic decrement ,method of determining damping	1
1.10	Tutorial	2
2	Multi Degree of Freedom System	
2.1	Forced vibration of single degree of freedom system	1
2.2	Undamped harmonic excitation	2
2.3	Damped harmonic excitation with electrical equivalent	1
2.4	Tutorial	1
2.5	Response to support motion Torsional vibration and Dynamic Magnification Factor	2
2.6	Impulsive loading problems using Fourier series	1
2.7	Forced vibration problems using Laplace transform method	1
2.8	Numerical evaluation of Duhamel's integral for damped system	2
2.9	Tutorial	2
3	Dynamic Analysis of Multi Degree of Freedom	
3.1	Two degrees of freedom	2
3.2	Principle modes of vibration and equation of motion for two degree of freedom	2
3.3	Two degrees of freedom for torsional system, Vibrations of undamped Two degrees of freedom	2
3.4	Tutorial	2
3.5	Forced Vibrations and Undamped forced vibration for two degrees of freedom	2
4	Multi Degree of Freedom	
4.1	Stiffness, mass, damping matrices and Influence Coefficient	2
4.2	Modal analysis – damped undamped free vibration	2
4.3	Matrix Method and Matrix Iteration Method	2
4.4	Tutorial	2
4.5	Dunkerleys ,Stodola's , Rayleigh's and Holzer Method	2
4.6	Dynamic analysis method to evaluate lateral forces, Static and dynamic condensation	2
4.8	Tutorial	2
5	Vibration Analyse in Sub Structure	
5.1	Base Isolation and design of bearings	2
5.2	Machine foundation- types , basic and design criteria	2
5.3	MSD Method of analysis	2
5.4	Tutorial	2
5.5	EHS Method of Analysis	1
5.6	Tschebotarioff's reduced frequency method- design problems	2
	Total	60

## CourseDesigners

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60 PED 001\ RESEARCH METHODOLOGY AND IPR	Category	L	'	Р	Credit
60 PDB E26	PC	3	0	0	3

## Objective(s)

- To understand the principles of research process.
- To develop knowledge in analytical skills for collection of research data.
- To understand the procedure in the preparation of reports.
- To accomplish basic idea about the process involved in intellectual property rights.
- To enlighten the process of patent filing.

#### Pre-requisite

Nil

#### Course Outcomes

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

CO1	To understand the research process and design.	Remember, Understand, Apply
CO2	To gain the knowledge about sources and collection of research data	Remember, Understand, Aanalyze
CO3	To understand the procedure of data analysis, preparation of reports and checking plagiarism	Remember, Understand, Analyze
CO4	To gain the knowledge on Trade mark and functions of UNESCO in IPR	Remember, Understand, Apply
CO5	To enlighten the benefits, E-filing and Examinations related to patents	Remember, Understand, Apply

## Mapping with Programme Outcomes

COURSE NAME	со	PO						PSO			
		1	2	3	4	5	6	1	2	3	
	CO1	3	3	2	2	2	2	3	1	3	
Research	CO2	3	3	2	2	2	2	3	1	3	
Methodology and	CO3	3	3	2	2	2	2	3	1	3	
IPR	CO4	3	3	2	2	2	2	3	1	3	
	CO5	3	3	2	2	2	2	3	1	3	

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

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## AssessmentPattern

Bloom'sCategory	Continuous Ass (Mar		Model	End Semester Examination (Marks)	
	1	2	Exam (Marks)		
Remember	10	10	20	30	
Understand	20	20	40	30	
Apply	30	30	40	30	
Analyse	0	0	0	10	
Evaluate	0	0	0	0	
Create	0	0	0	0	

#### Syllabus

				e of Technology				
		60 PED		B E26 - Researd		ogy and IPR		
	- 1		Co	mmon to all Bra		1		
Semeste	r H	ours/Week		Total hrs	Credit		aximum Marks	
	L	T	Р		С	CA	ES	Total
<u> </u>	3	0	0	45	3	40	60	100
question, C	of research pro	earch, Observ	ation studie	s, Experiments a	•	•	ver the research le Right Medium	[9]
Measurem	<b>ction and Sou</b> ents, Measure Exploring, exa	ement Scale		naires and Inst	ruments, Sa	mpling and m	iethods. Data -	[9]
Overview	sing written re	Analysis, Hy	•	•			ing Insights and Fabrication, and	[9]
n <b>tellectua</b> Intellectual process, T Right of F	rade secrets,	ne concept o utility Models mon rules o	s, IPR & Bio f IPR practi	diversity, Role	of WIPO an	d WTO in IPR	PR development establishments, ent, Trademark,	[9]
Intellectual Intellectual process, T Right of F Functions of Patents Patents – of patent ap	Property – Tr rade secrets, Property, Com of UNESCO in objectives and plication, proc	ne concept o utility Models non rules o IPR mainten benefits of p cess E-filling	s, IPR & Bic f IPR practi ance. atent, Conce g, Examinat	o diversity, Role ces, Types and pt, features of p	of WIPO an Features o atent, Inventi Grant of p	d WTO in IPR f IPR Agreem ve step, Specif patent, Revoc	establishments, ent, Trademark, ication, Types of ation, Equitable	
ntellectual Intellectual process, T Right of F Functions of Patents Patents – of patent ap Assignmer	Property – Th rade secrets, Property, Comp of UNESCO in objectives and plication, proc its, Licences, L	ne concept o utility Models non rules o IPR mainten benefits of p cess E-filling	s, IPR & Bic f IPR practi ance. atent, Conce g, Examinat	o diversity, Role ces, Types and pt, features of p ion of patent,	of WIPO an Features o atent, Inventi Grant of p	d WTO in IPR f IPR Agreem ve step, Specif patent, Revoc	establishments, ent, Trademark, ication, Types of ation, Equitable	[9]
ntellectual Intellectual process, T Right of F Functions of Patents Patents – of patent ap Assignmer	Property – Th rade secrets, Property, Comp of UNESCO in objectives and plication, proc its, Licences, L	ne concept o utility Models mon rules o IPR mainten benefits of p bess E-filling icensing of re	s, IPR & Bic f IPR practi ance. atent, Conce g, Examinat elated patent	o diversity, Role ces, Types and ept, features of p ion of patent, is, patent agents	of WIPO an Features o atent, Inventi Grant of p , Registration	d WTO in IPR f IPR Agreem ve step, Specif patent, Revoc	establishments, ent, Trademark, ication, Types of ation, Equitable ts.	[9]
Intellectual Intellectual process, T Right of F Functions of Patents Patents – of patent ap Assignmer	Property – Th rade secrets, Property, Comp of UNESCO in objectives and plication, proc its, Licences, L	ne concept o utility Models mon rules o IPR mainten benefits of p bess E-filling icensing of re	s, IPR & Bic f IPR practi ance. atent, Conce g, Examinat elated patent	o diversity, Role ces, Types and pt, features of p ion of patent,	of WIPO an Features o atent, Inventi Grant of p , Registration	d WTO in IPR f IPR Agreem ve step, Specif patent, Revoc	establishments, ent, Trademark, ication, Types of ation, Equitable ts.	[9]
ntellectua Intellectual process, T Right of F Functions of Patents Patents – of patent ap Assignmer Text Book 1. David 2 Coope 11e (2)	Property – Th rade secrets, Property, Composition of UNESCO in objectives and plication, proc ats, Licences, L (s): I. Bainbridge, " er Donald R, S 012)	ne concept o utility Models mon rules o IPR mainten benefits of p cess E-filling icensing of re	s, IPR & Bic f IPR practi ance. atent, Conce g, Examinat elated patent	o diversity, Role ces, Types and ept, features of p ion of patent, is, patent agents ngman, 9th Editio	of WIPO an Features o atent, Inventi Grant of µ , Registration on, 2012.	d WTO in IPR f IPR Agreem ve step, Specif patent, Revoci of patent agen	establishments, ent, Trademark, ication, Types of ation, Equitable ts.	[9] [9] 45
ntellectual Intellectual process, T Right of F Functions of Patents Patents – of patent ap Assignmer Text Book 1. David 2 Coope	Property – Th rade secrets, Property, Composition of UNESCO in objectives and plication, proc ats, Licences, L (s): I. Bainbridge, " er Donald R, S 012)	ne concept o utility Models mon rules o IPR mainten benefits of p cess E-filling icensing of re	s, IPR & Bic f IPR practi ance. atent, Conce g, Examinat elated patent	o diversity, Role ces, Types and ept, features of p ion of patent, is, patent agents ngman, 9th Editio	of WIPO an Features o atent, Inventi Grant of µ , Registration on, 2012.	d WTO in IPR f IPR Agreem ve step, Specif patent, Revoci of patent agen	establishments, ent, Trademark, ication, Types of ation, Equitable ts. <u>Total Hours</u>	[9] [9] 45

A Your RAC Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy Collige of Tachnology TIRUCHENGODE - 637 215

	Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007
3.	David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007
	Arun K. Narasani, Kankanala K.C., Radhakrishnan V., "Indian Patent Law and Practice", Oxford University Press, 2010.
5.	Richard Stim, "Patent, Copyright & Trademark - An Intellectual Property Desk Reference", NOLO Publishers, 2020.
	The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.

## **Course Content and Lecture Schedule**

S.No.	Topics	No.of hours
1.0	Research Design	
1.1	Overview of research process and design	1
1.2	Use of Secondary and exploratory data to answer the research question	2
1.3	Qualitative research	1
1.4	Observation studies	1
1.5	Experiments and Surveys	1
1.6	Selection of the Right Medium and Journal for publication	2
1.7	Translation of Research	1
2.0	Data Collection and Sources	1
2.1	Measurements, Measurement Scales	2
2.2	Questionnaires and Instruments	2
2.3	Sampling and methods	2
2.4	Data - Preparing, Exploring, examining and displaying	3
3.0	Data Analysis and Reporting	1
3.1	Overview of Multivariate analysis	1
3.2	Hypotheses testing and Measures of Association	2
3.3	Presenting Insights	1
3.4	Findings using written reports and oral presentation	2
3.5	Checks for Plagiarism	1
3.6	Falsification	1
3.7	Fabrication, and Misrepresentation	1
4.0	Intellectual Property Rights	

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4.1	Intellectual Property – The concept of IPR	1
4.2	Evolution and development of concept of IPR, IPR development process	2
4.3	Trade secrets, utility Models, IPR & Bio diversity	2
4.4	Role of WIPO and WTO in IPR establishments	1
4.5	Right of Property, Common rules of IPR practices	1
4.6	Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance	2
5.0	Patents	
5.1	Patents – objectives and benefits of patent, Concept, features of patent	2
5.2	Inventive step, Specification, Types of patent application	2
5.3	Process E-filling, Examination of patent	1
5.4	Grant of patent, Revocation	1
5.5	Equitable Assignments, Licences, Licensing of related patents	2
5.6	Patent agents, Registration of patent agents	1
	Total Hrs	45

## CourseDesigner

Dr.A.Murugesan – murugesana@ksrct.ac.in

R1/ w.e.f. 12.07.2023 Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/07/2023

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Category	L	т	Ρ	Credit
PC	0	0	4	2

#### Objectives

- To impart knowledge on various test of concrete making materials
- To perform mix design using IS and ACI method
- To learn the various test for self-compacting & hardened concrete
- To acquire skills on non- destructive test of concrete
- To conduct various durability test available for concrete
- **Pre-requisite**

Courses – Construction Materials & Concrete Technology

#### **Course Outcomes**

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

CO1	Identify the suitable test available for concrete making materials	Apply
CO2	Execute mix design for manufacturing the concrete	Apply
CO3	Perform various test for self - compacting & hardened concrete	Apply
CO4	Examine the strength of existing structure by non - destructive testing methods	Apply
CO5	Analyze the durability performance of concrete	Analyse

#### Mapping with Programme outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	2	3	3
CO2	3	3	3	3	2	3
CO3	3	2	3	3	3	3
CO4	3	2	3	3	3	3
CO5	3	3	3	3	3	3
	3- Str	ong; 2- <b>I</b>	Medium	; 1-Low		

#### List of Experiments

- 1. Tests on concrete making materials
  - a) Test on cement Specific gravity, Setting time, Soundness, Fineness & Compressive strength
  - b) Test on aggregate Flakiness & Elongation, Density and Fineness modulus
- 2. Concrete Mix Design as per IS 10262 2019 method & ACI Method
- 3. Tests on self-compacting concrete
- 4. Tests on hardened concrete
  - a) Mechanical properties of concrete & their relationship
  - b) Stress strain behavior of concrete

#### 5. Non-Destructive testing Methods

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- a) Ultra sonic Pulse Velocity Meter
- b) Rebound hammer
- 6. Durability test on hardened concrete
  - a) Water absorption test
  - b) Sulphate attack
  - c) Chloride attack
  - d) RCPT Test

Тех	t book(s):
1.	A R Santhakumar, "Concrete Technology, Oxford Higher Education, New Delhi, 2018
	P. Kumar Mehta, Paulo J. M. Monteiro, Concrete: Microstructure, Properties, and Materials,
	McGraw Hill Education, 2014
Ref	erence(s)
1.	IS 383 – 2016, Coarse and Fine Aggregate for Concrete - Specification (Third Revision)
2.	IS: 10262 – 2019, Concrete Mix Proportioning - Guidelines (Second Revision)
3.	IS 456 – 2000, Code of Practice - Plain and reinforced concrete (Fourth Revision)
4.	IS: 516 – 1959, (Reaffirmed 2018) - Methods of Tests for Strength of Concrete

## **Course Designer**

1. Mr.K. Angu Senthil - angusenthil@ksrct.ac.in

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		Category	L	Т	Ρ	Credit
60 PSE 1P2	TECHNICAL SEMINAR	CG	0	0	2	1

## Objective

- To encourage the students to study advanced engineering developments.
- To prepare and present technical reports.
- To encourage the students to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.
- To enrich the communication skills of the student and presentations of technical topics of interest, this
  course is introduced.
- To encouraged the students to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.

#### Prerequisite

Basic knowledge about Civil Engineering Topics.

## Course Outcomes

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

CO1	Establish motivation for any topic of interest and develop a thought process for technical presentation.	Apply
CO2	Organize a detailed literature survey and build a document with respect to technical presentations.	Apply
CO3	Analysis and comprehension of proof-of-concept and related data.	Analyze
CO4	Effective presentation and improve soft skills.	Apply
CO5	Make use of new and recent technology (e.g. graphical abstract) for creating technical reports.	Analyze

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	3	2	3
CO2	3	3	3	2	2	2
CO3	3	3	2	3	2	2
CO4	3	3	2	2	2	2
CO5	3	3	2	3	3	3
	3- 8	Strong;2	2-Mediu	m;1-Sor	ne	

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4. 15

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	K.S.Rangas	amy Coll	ege of Te	chnology–Au	tonomous	R2022		
		60 PSE	1P2- TE	CHNICAL SEN	/INAR			
		M.E. S	FRUCTU	RAL ENGINEE	RING			
Semester	Hours	Week		Total hrs	Credit	Ν	/laximum I	Marks
Semester	L	Т	Р	Totarnis	С	CA	ES	Total
I	0	0	2	45	1	100	-	100

The students will work for two hours per week guided by a group of staff members. They will be asked to talk on any topic of their choice related to Structural Engineering and to engage in dialogue with the audience.

A brief copy of their talk also should be submitted. Similarly, the students will have to present a seminar of not less than fifteen minutes and not more than thirty minutes on the technical topic.

They will also answer the queries on the topic. The students as the audience also should interact.

Evaluation will be based on the technical presentation and the report and also on the interaction during the seminar.

Total Hours 45

## **Course Designers**

1. Dr.S.GUNASEKAR -<u>gunasekar@ksrct.ac.in</u>

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9. Wr

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

(An Autonomous Institution affiliated to Anna University)

#### M.E. / M.Tech. Degree Programme SCHEME OF EXAMINATIONS (For the candidates admitted from 2022-2023 onwards) SECOND SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal	Weighta	ige of Marks	6	Minimum for Pass i Semes Exan	n End ter
	Code	Course	Exam	Continuous Assessment *	End Semester Exam	Max. Marks	End Semester Exam	Total
			тн	EORY				
1	60 PSE 201	Advanced Steel Structures	2	40	60	100	45	100
2	60 PSE 202	Advanced Concrete Structures	2	40	60	100	45	100
3	60 PSE 203	Finite Element Analysis in Structural Engineering	2	40	60	100	45	100
4	60 PSE E2*	Professional Elective II	2	40	60	100	45	100
5	60 PSE E3*	Professional Elective III	2	40	60	100	45	100
6	60 PAC 002	Disaster Management	2	100	-	100	-	100
			PRA	CTICAL				
7	60 PSE 2P1	Advanced Structural Engineering Laboratory	3	60	40	100	45	100
8	60 PSE 2P2	Computer Aided analysis and Design Iaboratory	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 wills 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 award of terminal examination marks.

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## Objective

- To know about the analysis and design of steel structures.
- To understand about the different types of steel connections
- To know about the analysis and design of cold formed steel structures
- To understand the analysis and design of special steel structures
- To demonstrate advanced design philosophies and concepts.

#### Prerequisite

Courses –Strength of Materials, Design of Steel Structures Course Outcomes

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

CO1	Assess the general behaviour of beam –column employ them to design beam-	Remember/
001	column – crane column.	Understand/
		Analyse/Apply
CO2	Classify the different types of connection and identity suitable connections to	Remember/
	apply for required situation.	Understand/ Analyse/Apply
CO3	Analyse the cold formed steel sections and design them.	Remember/ Understand/
		Analyse/Apply
CO4	Evaluate the various forces acting on self-supporting chimney guyed steel	Remember/
	chimney and design them.	Understand/
		Analyse/Apply
CO5	Calculate the base shear and employ them to design a structure.	Remember/
		Understand/
		Analyse/Apply

## Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	3	3	2
CO2	3	3	3	3	3	3
CO3	3	3	3	3	3	3
CO4	3	3	3	3	3	2
CO5	3	3	3	3	3	3
	3- 8	Strong;2	2-Mediu	m;1-Sor	ne	-

#### **Assessment Pattern**

Bloom's Category		Assessment Tests Marks)	End Sem Examination
Bioonin's outegory	1	2	(Marks)
Remember(Re)	05	05	10
Understand(Un)	05	05	20
Apply (Ap)	15	20	30
Analyse (An)	35	30	40
Create (Cr)	-	-	-

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4. Wr **BoS Chairman** CHAIRMAN BocHAIRMAN Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

				echnology-A				
	60			CED STEEL STRAL ENGINE		S		
_	Hours				Credit	l l	Maximum I	Marks
Semester	L	T	Р	Total hrs	C	CA	ES	Total
	3	0	0	45	3	40	60	100
ntroduction-	<b>Id Design of Beam</b> -General Behaviour Ins-Beams column	of beam					g- Design	of <b>[9]</b>
Behaviour a Connection stiffened Sea	<b>and Design of Joir</b> Behaviour – Desigr at connection – Fra	n Requiren med conne	nents of E ection – N	Bolted and weld	ded Connection	tion – Ur	Stub and	End
	cept of semi rigid co			einforcements -	- design of	moment	resistant b	ase
olateconc <b>Analysis an</b> Types of cro and tension	ept of semi rigid co <b>Id Design of Cold</b> pss sections – Con members – Conc	nnections. Formed S cept of loc ept of late	<b>teel Stru</b> cal buckli eral buckl	<b>ctures</b> ng and effectiv ing- Design of	ve width –D f beams-Co	esign of	compressi	<b>[9]</b> on
plateconc Analysis an Types of cro and tension connections Analysis an	ept of semi rigid co <b>Id Design of Cold</b> oss sections – Con members – Conco – Empirical design <b>Id Design of Speci</b>	nnections. Formed S cept of loc ept of late of Z –Purl al Structu	teel Stru cal buckli ral buckl ins with li ires	<b>ctures</b> ng and effectiv ing- Design of ips and wall stu	ve width –D f beams-Co uds.	esign of mbined s	compressi stresses a	on [9]
plateconc Analysis an Types of cro and tension connections Analysis an Design of se Seismic De	cept of semi rigid co ad Design of Cold bass sections – Con members – Conce – Empirical design ad Design of Speci elf-supporting chimm sign of Steel Struct r calculations –IS	nnections. Formed S cept of loc ept of late of Z –Purl al Structu ney and gu ctures	teel Stru cal buckli ral buckl ins with li ines yed steel	ctures ng and effectiv ing- Design of ips and wall stu stacks-Desigr	ve width –D f beams-Co uds. n of bunkers	esign of mbined s	compressi stresses a	on nd [9]

Tex	Textbook(s):					
1.	Subramaniam.N., "Design of Steel Structures ", (As per IS 800-2007), Oxford University Press, 2014.					
2.	Bhavikatti SS, "Design of Steel Structures", I.K.International Publishing House Pvt. Ltd 2012					
Re	ference(s):					
1.	Duggal S K., "Limit State Design of Steel Structures, Tata McGraw Hill, New Delhi, 2014.					
2.	S.Ramachandra "Design of Steel Structures" Standard Publications, New Delhi,2011					
3.	Teaching Resources for Structural Steel Design, INSDAG, Kolkatta.					
4.	Design of Steel Structure, Punmia B.C, Jain Ashok K.R, Jain Arun K.R, Lakshmi Publishers, 2011.					

## Course Contents and Lecture Schedule

S.No	Торіс	No.of Hours
1	Analysis and Design of Beam Column	
1.1	Introduction-General Behaviour of beam column	1

A.W. Ro Chairman CHAIRMAN BOCK OF Studies Faculty to Chi Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

	Total	45
5.3	Design and detailing-IS 800-2007(Theory only)	2
5.2	IS 1893-2002,codal provisions	3
5.1	Base shear calculations	3
5	Seismic Design of Steel Structures	
4.4	Design of silos.	3
4.3	Design of bunkers.	3
4.2	Guyed steel stacks.	3
4.1	Design of self-supporting chimney.	3
4	Analysis and Design of Special Structures	
3.8	Purlins with lips and wall studs.	2
3.7	Empirical design of Z.	1
3.6	Design of beams-Combined stresses and connections	1
3.5	Concept of lateral buckling	1
3.4	Tutorial	2
3.3	Design of compression and tension members	1
3.2	Concept of local buckling and effective width	1
3.1	Types of cross sections	1
3	Analysis and Design of Cold Formed Steel Structures	
2.7	Concept of semi rigid connections.	1
2.6	Design of moment resistant base plate	2
2.5	Column Stiffeners and other reinforcements	1
2.4	Moment resistant connection – Tee Stub and End plate connections	1
2.3	Un stiffened and stiffened Seat connection – Framed connection	1
2.2	Design Requirements of Bolted and welded Connection	1
2.1	Connection Behaviour	1
2	Behaviour and Design of Joints	
1.5	Bending-crane column	2
1.4	Columns-Beams column subjected to tension	1
1.3	Design of beam	2

# CourseDesigner

1. Dr.M.VELUMANI

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60	PSE	202
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Category	L	Т	Ρ	Credit
PC	3	0	0	3

## Objective

- To apply various limit states and design beams & columns
- To learn the design of special RC elements
- To perform the design of flat slab and grid floors
- To study the inelastic behavior of RC beams
- To gain knowledge in detailing codes

#### Prerequisite

Courses –Structural Analysis &RCC Design

#### **Course Outcomes**

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

CO1	Design the elements under flexure, shear, torsion and compression	Remember/ Understand/ Analyse/Apply
CO2	Perform the design of special RC elements	Remember/ Understand/ Analyse/Apply
CO3	Learn the design of flat slabs and grid floors	Remember/ Understand/ Analyse/Apply
CO4	Analyze the inelastic behavior of RC beams	Remember/ Understand/ Analyse/Apply
CO5	Draw the reinforcement detailing of structural elements	Remember/ Understand/ Analyse/Apply

## Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	2
CO2	3	3	3	3	2	2
CO3	3	3	3	3	2	2
CO4	3	3	2	3	2	2
CO5	3	2	3	2	2	2
3- Strong;2-Medium;1-Some						

#### **Assessment Pattern**

	ContinuousAsse	End SemExamination		
Bloom'sCategory	1	2	(Marks)	
Remember(Re)	05	10	10	
Understand(Un)	05	10	20	
Apply (Ap)	30	20	40	
Analyse (An)	20	20	30	
Create (Cr)	-	-	-	

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				Fechnology-A			2	
	60 PS	SE 202 - A	UVANCE	ED CONCRET	ESIRUCT	URES		
		M.E. S	TRUCTU		ERING			
Semester	Hours	/Week		Total hrs	Credit	1	Maximum M	larks
Gemester	L	Т	Р	Totarms	С	CA	ES	Total
11	3	0	0	45	3	40	60	100
Design of Be	eams and Columr	าร						[9]
	mit state of collaps							
	idthDesign of be						and torsio	n.
<u> </u>	ams curved in plan		idrel bear	ns - Design of	slender coli	umns		
Design of Sp	pecial RC Elemen	ts						[9]
Design of DC	C walle Sheer wa		action on	d Daaign prin	vinlaa Daai	an of roo	tongular or	. d
	C walls- Shear wa				spiesDesi	gn or rec	langular ar	ia
	r walls- Design of <b>at Slab and Grid I</b>		Jesign of	Deep beams				[9]
Design of the	at Slab allu Gliu i	10015						[9]
Yield line the	ory of slabs – Hille	rbera's m	ethod of c	lesion of slab -	- Design of	flat Slab	-shear in fl	at
	imate analysis and				Deelgirei	nat olab		at
	haviour of RC Bea		i gria nee					[9]
Inelastic beh	aviour of concret	e beams	- Mome	nt Rotation cu	ırves – Mo	ment red	distribution	_
Baker's meth	od of analysis and	design –	Design of	f cast in situ joi	nts in frame	9		
Detailing Re	quirements							[9]
Design and o	detailing of structu	iral memb	ers - Rei	nforcement de	tailing as p	er SP: 3	4 & IS:552	5 -
Earthquake F	Resistant Design –	Detailing	requirem	ents for Ductilit	y as per IS:	13920		
							Total Hou	
							TOTAL HOLL	rs 45

Tex	xtbook(s):
1.	Varghese, P.C. "Advanced Reinforced Concrete Design", PHI Learning Pvt. Ltd.,2015.
2.	Krishna Raju N and Pranesh RN., "Design of Reinforced Concrete Structures", New Age International Publishers, New Delhi,2018.
Re	ference(s):
1.	Unnikrishna Pillai S, Devdas Menon, "Reinforced Concrete Design", McGraw-Hill Education, India, New Delhi, 2021
2.	Ramamrutham S, Design of Reinforced Concrete Structures, Dhanpat Rai Publications, New Delhi, 2016
3.	SP 34 – Handbook on Concrete reinforcement and detailing – Fifth reprint, 1999
4.	IS 13920 :2016 – Ductile detailing of Reinforced Concrete structures subjected to seismic forces – Code of Practice

A W Ros Chairman CHAIRMAN Bock Studies Faculty of Civile Studies Faculty of Civile of Tachnology K.S.Rangasamy College of Tachnology TIRUCHENGODE - 637 215

#### **Course Contents and Lecture Schedule**

S.No	Торіс	No.of Hours
1	Design of Beams and Columns	
1.1	Design for Limit state of collapse& serviceability	1
1.2	Calculation of deflection and crack width	1
1.3	Design of beams for combined effect of shear, bending moment and torsion.	1
1.4	Design of beams curved in plan	2
1.5	Design of Spandrel beams	2
1.6	Design of slender columns	1
2	Design of Special RC Elements	
2.1	Design of RC walls	1
2.2	Shear walls Classification and Design principles	1
2.3	Design of rectangular and flanged Shear walls	2
2.4	Design of Corbels	2
2.5	Design of Deep beams	2
3	Design of Flat Slab and Grid Floors	
3.1	Yield line theory of slabs	1
3.2	Hillerberg's method of design of slab	2
3.3	Design of flat Slab	2
3.4	Shear in flat slab Approximate analysis	1
3.5	Design of grid floors	2
4	Inelastic Behaviour of RC Beams	
4.1	Inelastic behaviour of concrete beams	1
4.2	Moment Rotation curves	2
4.3	Moment redistribution	2
4.4	Baker's method of analysis and design	3
4.5	Design of cast in situ joints in frame	2
5	Detailing Requirements	
5.1	Design and detailing of structural members	2
5.2	Reinforcement detailing as per SP : 34	2
5.3	Reinforcement detailing as per IS:5525	2
5.4	Earthquake Resistant Design	2
5.5	Detailing requirements for Ductility as per IS:13920	2
	Total	45

# **Course Designer**

1. Mr.K.ANGU SENTHIL - angusenthil@ksrct.ac.in

ANT

RoS Chairman CHAIRMAN BOCHAIRMAN BOCHAIC OF Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

60 PSE 203FINITE ELEMENT ANALYSIS IN STRUCTURAL ENGINEERINGPC3204		Category	L	Т	Ρ	Credit
	60 PSE 203	PC	3	2	0	4

- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To know the procedure and to solve two dimensional problems
- To appreciate the use of FEM to a range of Engineering Problems.
- To learn the concept of material and geometric Non-linearity
- To know the realistic engineering problem through computational simulations.

### Prerequisite

Fundamentals of Mathematics, knowledge of forces and resolution and equilibrium concepts. **Course Outcomes** 

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

-		
	Construct and solve the element equation for one dimensional structural element.	Remember, Understand, Apply
CO2	Describe the concept of two dimensional elements.	Remember, Understand, Analyze
	Analyze the 2D problems using isoparametric quadrilateral elements and Implement the Gaussian Quadrature expression for numerical integration.	Remember, Understand, Apply, Analyze
CO4	Identify the concepts of Non-linear Analysis of the structures.	Understand and Analyze
CO5	Apply the knowledge on application of Finite Element method	Remember, Understand

#### Mapping with Programme Outcomes

COs	P01	PO2	PO3	PO4	PO5	PO6		
CO1	3	2	3		2			
CO2	3	2	3	3	2	3		
CO3	2	3	3	2	3	2		
CO4	3	2	3	2	3			
CO5	3	3	3	3	2	2		
	3- Strong;2-Medium;1-Some							

#### AssessmentPattern

Bloom'sCategory		Assessment Tests Marks)	End Sem Examination
	1	2	(Marks)
Remember	5	5	10
Understand	5	5	10
Apply	35	35	30
Analyse	15	15	50
Evaluate	-	-	-
Create	-	-	-



60 PSE 203- FINITE ELEMENT ANALYSIS IN STRUCTURAL ENGINEERING										
M.E. STRUCTURAL ENGINEERING										
Hours / Week Credit Maxim							ximum N	/larks		
Semest	er L	Т	Р	Total Hours	С	CA	ES	Tota		
II	II 3 2 0 60 A			4	40	60	100			
ntroductior /ariational unctions- E Finite Elen Basic boun equation-we soparame Natural co- Numerical i Non-Linea Definition –	formulation of boun Bar, Beam and Truss ment Analysis of 2D adary value problem eak formulation-Line tric Formulation ordinate systems-La ntegration- one and r Analysis geometric and mate	f finite eleme dary value pr s Elements. <b>) Problems</b> n in 2 Dimense ar strain triar agrangian inte two point pro erial nonlinea	oblem Finite e sions – Triang gular element erpolation poly blems.	teps in finite element a lement modeling - Eleme gular, quadrilateral, highe s. nomials-Isoperimetric ele placement – stress- strai	ent equation-L er order elem ment formula	inear and ents-Pois ition-axisy	d quadrat son and /mmetry	tic shap [9] Laplac [9]		
<b>Practical A</b> Modeling a	, .	e Element Ar	e for inelastic l I <b>alysis</b>					[9] ondition: [9]		
<b>Practical A</b> Modeling a	pplication of Finite	e Element Ar	e for inelastic l I <b>alysis</b>	behaviour.	ial properties		ndary co	onditions [9]		
Practical A	<b>Application of Finite</b> and analysis using s ation.	e Element Ar	e for inelastic l I <b>alysis</b>	behaviour.	ial properties	and bou	ndary co	onditions [9]		
Practical A Modeling a Error evalua Text book	(s) : drupatla and Belegu , 4 <sup>th</sup> Edition, 2015.	e Element Ar software pack	e for inelastic alysis ages-types of ction to Finite I	behaviour. analysis-meshing-mater Elements in Engineering"	ial properties <b>Total H</b> Prentice Hal	and bou ours 45+ <sup>,</sup>	ndary co 15 (Tuto	onditions [9] rial) = 6		
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Practical A Modeling a Error evalua Text book 1 Chan Delhi 2 P.Ses Reference	(s) : where the second state of the second st	e Element Ar software pack undu "Introduc Analysis", Pr	e for inelastic alysis ages-types of ction to Finite I entice Hall of I	behaviour. analysis-meshing-mater Elements in Engineering"	ial properties <b>Total H</b> Prentice Hal , 2009.	and bou ours 45+ I of India	ndary co <b>15 (Tuto</b> r Pvt. Ltd.	onditions [9] rial) = 6		
Charactical A       Modeling a       Error evaluation       Text book       1     Chan       2     P.Ses       Reference       1     Madh       1     India.       2     Redd	(s): (s): (s): (s): (s): (s): (c):	e Element Ar software pack undu "Introduc Analysis", Pr Abdul Hamid	e for inelastic alysis ages-types of ction to Finite f entice Hall of f Sheikh., Matri ata McGraw F	behaviour. analysis-meshing-mater Elements in Engineering" ndia Pvt. Ltd., New Delhi x and Finite element Ana fill publishing Co Ltd, New	ial properties <b>Total He</b> , Prentice Hal , 2009. Iyses of Struc v Delhi, 3 <sup>rd</sup> Ed	and bou ours 45+ I of India ctures. An	ndary co 15 (Tutor Pvt. Ltd. e Books 6.	nditions [9] rial) = 6 New		
Practical A       Modeling a       Error evaluation       Text book       1     Chan       2     P.Ses       Reference       1     Madh       1     India.       2     Redd	(s): (s):	e Element Ar software pack undu "Introduc Analysis", Pr Abdul Hamid	e for inelastic alysis ages-types of ction to Finite f entice Hall of f Sheikh., Matri ata McGraw F	behaviour. analysis-meshing-mater Elements in Engineering", ndia Pvt. Ltd., New Delhi x and Finite element Ana	ial properties <b>Total He</b> , Prentice Hal , 2009. Iyses of Struc v Delhi, 3 <sup>rd</sup> Ed	and bou ours 45+ I of India ctures. An	ndary co 15 (Tutor Pvt. Ltd. e Books 6.	nditions [9] rial) = 6 New		

ourse	Contents	and Lecture	Schedule
ourse	Contento		ooncaute

S.No	Торіс	No.of Hours
1	Introduction to Finite Element Analysis	
1.1	Basic Concepts of Finite element analysis	1
1.2	Steps in finite element analysis	1
1.3	Weighted Residual methods and Weak formulation	1
1.4	Variational formulation of boundary value problem	1
1.5	Finite element modeling	1
1.6	Tutorial- Rayleigh Ritz method	2
1.7	Element equation-Linear and quadratic	2
1.8	Shape functions- Bar and Beam Elements	2
1.9	Shape functions- Truss Elements	2



2	Finite Element Analysis of 2D Problems	
2.1	Basic boundary value problem in 2 Dimensions	1
2.2	Element stiffness matrix for Triangular element. quadrilateral, higher order elements	2
2.3	Constant strain triangle – Isoparametric representation	2
2.4	Potential energy approach – Element stiffness matrix, force terms and stress calculations	2
2.5	Element stiffness matrix for quadrilateral and higher order elements	2
2.6	Poisson equation	1
2.7	Laplace equation	1
2.8	Tutorial-Problems in two dimensional stress field	2
2.9	Linear strain triangular elements	1
3	Isoparametric Formulation	
3.1	Natural co-ordinate systems	2
3.2	Four node quadrilateral elements	2
3.3	Lagrangian interpolation functions	2
3.4	Isoperimetric element formulation	2
3.5	Axisymmetry element	2
3.6	Numerical Integration - One point formula and two point formula	2
3.7	Tutorial-Problems in numerical integration using Gauss quadrature formula	2
4	Non-Linear Analysis	
4.1	Basic Concepts of Non-Linear Analysis	1
4.2	Geometric and Material nonlinearity	1
4.3	Strain displacement	1
4.4	Stress- Strain behavior of Non-linear analysis	1
4.5	Finite element format for non-linear analysis	1
4.6	Software usage for large deflection	1
4.8	Software for inelastic behaviour	1
4.9	Iteration methods and iterative methods, Newtons Raphson Method	1
4.10	Tutorials on Non-linear analysis problems	2
5	Practical Application of Finite Element Analysis	
5.1	Convergence and requirements	1
5.2	Modeling and analysis using software packages	2
5.3	Types of analysis	1
5.4	Types of meshing- III conditioned elements	1
5.5	Properties and boundary conditions	1
5.6	Discretisation errors	1
5.7	Error evaluation	1
5.8	Auto and Adaptive Mesh Generation Techniques	1
	Total	60

# **Course Designers**

Dr.J.Abdul Bari- abdulbari@ksrct.ac.in

A. Wor مو<sup>رو</sup> المراجع

RoS Chairman CHAIRMAN BOCHAIRMAN BOCHAIC OF Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

60 PSE 2P1		Category	L	Т	Ρ	Credit
	ADVANCED STRUCTURAL ENGINEERING LABORATORY	PC	0	0	4	2

- To explain about the behavior of beams and slabs in flexure and shear
- To understand the concepts of Strain recording instruments
- To know about the measurement of vibration.
- To illustrate about the Dynamic testing of cantilever beams
- To identify the Static cyclic testing of single bay two storied frames

#### Prerequisite

Strength of Materials, Structural Analysis, Design of Reinforced Concrete design, Design of Steel Structures, Experimental Methods and Model Analysis.

#### Course Outcomes

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

CO1	Construct the concrete beam and absorb the behavior of flexural member for different loading conditions.	Apply
CO2	Demonstrate the testing for strength and deflection behavior of steel sections.	Analyze
CO3	Illustrates the behavior of column under axial load and compute the direct and bending stresses.	Apply
CO4	Familiarize the behavior of cantilever beam under dynamic loading and evaluate the mode shapes.	Apply
CO5	Employ the static cyclic testing on frames and predict the stiffness and energy dissipation of the frame.	Evaluate

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6		
CO1	3	1	1	1	1	2		
CO2	3	1	1	1	1	2		
CO3	3	2	2	1	1	2		
CO4	3	2	3	2	2	2		
CO5	3	2	3	2	2	2		
	3- Strong;2-Medium;1-Some							



Ros Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

				Technology–A				
	60 PSE 2P1 -AI					ABORA	FORY	
<b>.</b> .			TRUCTU	RAL ENGINE		-		
Semester	Hours	/Week	r	Total hrs	Credit	-	MaximumMa	arks
	L	Т	Р		С	CA	ES	Total
	0	0	4	45	2	60	40	100
3. Fab ecc 4. Dyr a. b. 5. Sta a. b.	ting of simply suppo prication, casting and entric loading. To determine the d To evaluate the mo tic cyclic testing of s Drift of the frame Stiffness of the frame sipation capacity of	d testing o tilever bea amping co ode shapes single bay	f reinforce ms. efficients s. two storie	ed concrete co	lumn subjec ations.		ncentric and	d
							TotalHour	s 45
Textbook	· /							
1. Sadh	u Singh, " Experime	ental Stres	s Analysi	s", Khanna Pul	olications, N	lew Delhi	, 2000.	
Reference	e(s):							
1. Dallee	y J W, and Riley W	F, "Experi	mental St	tress Analysis"	, McGraw-H	lill, Inc. N	ew York, 19	91.
	n L.S, Raghavan M Analysis", Tata Mc(						ndra K, "Ex	perimer

# **Course Designer**

1. Dr.R.JAGADEESAN -jagadeesan@ksrct.ac.in

R1/ w.e.f. 12.07.2023 Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

4.16-

Ros Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		Category	L	Т	Ρ	Credit
60 PSE 2P2	COMPUTER AIDED ANALYSIS AND DESIGN LABORATORY	PC	0	0	4	2
	DESIGN LABORATORT					

- To learn the principles of computer graphics and application packages, optimization and artificial intelligence.
- To expose students to computer aided drafting.
- To familiarize students with 2D objects in drawing and enable them to prepare plan, elevation and sectional drawings.
- To expose students to 3D modelling.

#### Prerequisite

Basic knowledge in computer operation and Civil Engineering design software's.

#### Course Outcomes

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

CO1	To work on spreadsheets and worksheets.	Understand
CO2	To understand regression and matrix inversion concepts.	Understand
CO3	To arrive at C programs to solve problems using numerical techniques.	Apply
CO4	To use computer methods of structural analysis to solve structural problems.	Apply
CO5	To work on finite element programming to solve real time problems.	Apply

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	3	2	3
CO2	3	3	3	2	2	2
CO3	3	3	2	3	2	2
CO4	3	3	2	2	2	2
CO5	3	3	2	3	3	3
	3- 3	Strong;2	2-Mediu	m;1-Sor	ne	

#### Assessment Pattern

Bloom's Category		Assessment Tests Marks)	End Sem Examination
Bloom 5 Oalegory	1	2	(Marks)
Understand (U)	-	-	20
Apply (Ap)	-	-	50
Analyse (An)	-	-	30
Create (Cr)	-	-	0

4. Wor RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		K.S.Rang	asamy Co	llege of	Technology–A	Autonomou	IS R2022		
		60 PSE 2P2	-COMPU	TER AID	ED ANALYSIS	6 AND DES	IGN LAB	ORATOR	Y
			M.E. S	TRUCTU	RAL ENGINE	ERING			
Sem	ester	Hours	/Week		Total hrs	Credit	Ν	/laximum	Marks
		L	Т	Р		С	CA	ES	Total
		0	0	4	45	2	60	40	100
					XPERIMENTS				
		Analysis, design and	-				-		,
• •		ng and analysis - a			ncepts of strue	ctural comp	onents, o	codal prov	visions for
		limensioning, analy							
• •	-	using software or m			•				
• •	-	/ detailing using	commercia	al CAD s	oftware. (Diffe	rent groups	s may be	assigned	different
	•	ructures).				D			
		Programming for st				• •	-		-
		Exercises include				-			
		Gauss-Jordan me		ar Regre		itting by Po	Jiynomiai	Regressi	on, ⊏igen
		ction by power meth Finite Element sof		damental	s modelling	analveie a	nd nostru	ocessing	of simple
		and shell models -			-	•	• •	-	•
•	tbook(		Introducti				intento, u		,po oto.
1.	•	aman, V., Compute	r Oriented	Numeric	al Methods. Pr	entice – Ha	ll of India	2004.	
Ref	erence	•						,	
1.		namoorthy C. S ar	d Raieev	S., "Con	nputer Aided F	Design". Na	rosa Put	lishina Ha	ouse. New
		1991.		0., 001		, 110 see see see see see see see see see se		, ising th	
2.	Hintor	n E. and Owen D. F	R. J., Finite	Element	Programming	, Academic	Press, 19	977.	
	-	antonto and Lootu	<b>•</b> • •						

Course Contents and Lecture Schedule

S.No	Торіс	No.of Hours
1	Model - I	
1.1	Drafting – 2D & 3D	4
1.2	Design of Buildings	6
1.3	Analysis of loads on Buildings	6
2	Model - II	
2.1	Programming – Basic	4
2.2	Programming with MATLAB	6
2.3	Programming with MATLAB	6
3	Model - III	
3.1	Finite Element Analysis - Introduction	4
3.2	Finite Element Analysis – Software Application	4
3.3	Finite Element Analysis – Software Application	5

# **Course Designers**

Mr.S.GUNASEKAR -gunasekar@ksrct.ac.in

A Women RoS Chairman CHAIRMAN BOCHAIRMAN BOCHAIC OF Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

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

(An Autonomous Institution affiliated to Anna University)

#### M.E. / M.Tech. Degree Programme SCHEME OF EXAMINATIONS (For the candidates admitted from 2022-2023 onwards) THIRD SEMESTER

S.No.	Course	Name of the	Duration of Internal	Weighta	ige of Marks	6	Minimum for Pass i Semes Exan	n End ter
	Code	Course	Exam	Continuous Assessment *	End Semester Exam	Max. Marks	End Semester Exam	Total
			тн	EORY				
1	60 PSE E4*	Professional Elective IV	2	40	60	100	45	100
2	60 PSE E5*	Professional Elective V	2	40	60	100	45	100
			PRA	CTICAL				
7	60 PSE3P1	Project Work - Phase I	3	100	-	100	-	100
8	60 PSE3P2	Inplant Training	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 wills 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 award of terminal examination marks.

R1/ w.e.f. 12.07.2023 Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

4. Wr

Ros Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

	К	.S.Rangasam	y College of	Technology – A	utonomou	us R202	2		
		60 PS	SE 3P1 PROJ	ECT WORK PH	ASE I				
		M.E	E. STRUCTUR	RAL ENGINEER	ING				
Comostor		Hours / Week		Total has	Credit	Μ	laximum	Marks	
Semester	L T P Total hrs C CA ES Total								
111	0	0	16	60	08	100	0	100	
Objective(s)	<ul> <li>To provide an exposure to the students to refer, read and review the research article journals and conference proceedings relevant to their project work.</li> <li>To learn about new product development</li> <li>To learn how to apply theoretical knowledge in the field.</li> </ul>								
Course Outcomes	1. S ca 2. U 3. D	urvey the relev ontact resource lse different ex	vant literature e persons for perimental teo elop an exper	s will be able to such as books, the selected topi chniques/differer imental set up/ e	ic of resear nt software/ equipment/t	ch. ′ computa œst rig.	ational/ana	alytical tools	

The Project Work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Seminar should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of M.E/M. Tech. The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report. The work has to be presented in front of the examiners panel set by Head and PG coordinator. The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student.

4. Wo

Ro Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRVCHENGODE - 637 215

M.E. STRUCTURAL ENGINEERING           Semester         Hours / Week         Total hrs         Credit         Maximum Marks           III         0         0         0         2         100         0         100           Objective(s)         Make exposer for the students to actual working environment and enhance thei knowledge         • Make exposer for the students to actual working environment and enhance thei knowledge         • Provide students the opportunity to test their interest in a particular career before permanent commitments are made         • To develop skills in the application of theory to practical work situations         • Enhance the ability to improve student's creativity skills and sharing ideas           • To cultivate student's leadership ability and responsibility to perform or execute the giver task         • To cultivate student's leadership ability and responsibility to perform or execute the giver task           Course Outcomes         At the end of the course, the students will be able to         1. Understand the psychology of the workers, their habits, attitudes and approach to problems along with relevant aspects of industry management         3. Understand the scope, functions and job responsibilities in various departments of ar organization           4. Interpreting the theoretical knowledge with real time site conditions while executing projects         5. Develop detailed report of the complete project during the training.			60	) PSE 3P2 IN-I	PLANT TRAINI	NG			
Semester         L         T         P         Total hrs         C         CA         ES         Total           III         0         0         0         0         2         100         0         100           • Make exposer for the students to actual working environment and enhance thei knowledge         • Make exposer for the students to actual working environment and enhance thei knowledge         • Provide students the opportunity to test their interest in a particular career before permanent commitments are made           • To develop skills in the application of theory to practical work situations         • Enhance the ability to improve student's creativity skills and sharing ideas           • To cultivate student's leadership ability and responsibility to perform or execute the giver task         • To cultivate student's leadership ability and responsibility to perform or execute the giver task           Course Outcomes         • Teamiliarized with various Design, Manufacturing, Analysis, Automation and their applications along with relevant aspects of industry management         3. Understand the scope, functions and job responsibilities in various departments of ar organization           • Interpreting the theoretical knowledge with real time site conditions while executing projects         • Interpreting the theoretical knowledge with real time site conditions while executing projects			<b>M</b> .	E. STRUCTUR	AL ENGINEER	ING			
LTPCCAESTotalIII000021000100• Make exposer for the students to actual working environment and enhance thei knowledge• Provide students the opportunity to test their interest in a particular career before permanent commitments are made• Provide students the opportunity to test their interest in a particular career before permanent commitments are made• To develop skills in the application of theory to practical work situations • Enhance the ability to improve student's creativity skills and sharing ideas • To cultivate student's leadership ability and responsibility to perform or execute the given taskCourse OutcomesAt the end of the course, the students will be able to 1. Understand the psychology of the workers, their habits, attitudes and approach to problems along with the practices followed either at factory or at site 2. Familiarized with various Design, Manufacturing, Analysis, Automation and their applications along with relevant aspects of industry management 3. Understand the scope, functions and job responsibilities in various departments of ar organization4. Interpreting the theoretical knowledge with real time site conditions while executing projects	Somostor		Hours / Wee	ek 🛛	Total bro	Credit	M	laximum l	Marks
Objective(s)       • Make exposer for the students to actual working environment and enhance their knowledge         • Provide students the opportunity to test their interest in a particular career before permanent commitments are made         • To develop skills in the application of theory to practical work situations         • Enhance the ability to improve student's creativity skills and sharing ideas         • To cultivate student's leadership ability and responsibility to perform or execute the giver task         At the end of the course, the students will be able to         1. Understand the psychology of the workers, their habits, attitudes and approach to problems along with the practices followed either at factory or at site         2. Familiarized with various Design, Manufacturing, Analysis, Automation and their applications along with relevant aspects of industry management         3. Understand the scope, functions and job responsibilities in various departments of ar organization         4. Interpreting the theoretical knowledge with real time site conditions while executing projects	Semester	L	Т	Р	Total III's	С	CA	ES	Total
Objective(s)       knowledge         • Provide students the opportunity to test their interest in a particular career before permanent commitments are made         • To develop skills in the application of theory to practical work situations         • Enhance the ability to improve student's creativity skills and sharing ideas         • To cultivate student's leadership ability and responsibility to perform or execute the giver task         At the end of the course, the students will be able to         1. Understand the psychology of the workers, their habits, attitudes and approach to problems along with the practices followed either at factory or at site         2. Familiarized with various Design, Manufacturing, Analysis, Automation and their applications along with relevant aspects of industry management         3. Understand the scope, functions and job responsibilities in various departments of ar organization         4. Interpreting the theoretical knowledge with real time site conditions while executing projects	III	0	0	0	0	2	100	0	100
Course Outcomes1. Understand the psychology of the workers, their habits, attitudes and approach to problems along with the practices followed either at factory or at site2. Familiarized with various Design, Manufacturing, Analysis, Automation and their apple cations along with relevant aspects of industry management3. Understand the scope, functions and job responsibilities in various departments of ar organization4. Interpreting the theoretical knowledge with real time site conditions while executing projects	Objective(s)	know • Provi perm • To de • Enha • To cu	rledge de students t anent commitn evelop skills in ince the ability	he opportunity nents are made the application to improve stud	to test their of theory to pra dent's creativity	interest in ctical work skills and s	a partic situation	cular care s eas	eer before
5. Develop detailed report of the complete project during the training.		t 2. F 3. U 4. I	o problems alo Familiarized wit cations along w Understand the organization nterpreting the projects	ng with the pra h various Desi ith relevant as scope, functio theoretical kn	ctices followed gn, Manufacturi pects of industry ns and job resp owledge with re	either at fa ng, Analys / managen onsibilities eal time sit	ictory or a is, Autom nent in variou te conditio	it site ation and s departm ons while	their appli nents of an

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RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

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

(An Autonomous Institution affiliated to Anna University)

#### M.E. / M.Tech. Degree Programme SCHEME OF EXAMINATIONS (For the candidates admitted from 2022-2023 onwards) FOURTH SEMESTER

S.No.	Course	Name of the	Duration of Internal	Weighta	ge of Marks	6	Minimum for Pass i Semes Exan	n End ter
	Code	Course	Exam	Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
			PRA	CTICAL				
1	60 PSE4P1	Project Work - Phase II	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 wills 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 award of terminal examination marks.

4. 16 RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		M.E.	STRUCT	URAL ENG	INEERING					
Semester	Hours	s / Week		Total	Credit	Ma	Maximum Ma	irks		
Semester	L	Т	Р	hrs	С	СА	ES	Total		
IV	0	0	32	60	16	60	40	100		
Objective(s)	<ul> <li>To retrieve the hazards by adopting suitable assessment methodologies an staring it to global.</li> <li>To strengthens the students to carry out the problems on their own</li> <li>To improve the leadership skills and work in a group</li> <li>To solve complex problems and obtaining solution for them</li> </ul>									
Course Outcomes       At the end of the course, the students will be able to         1. Develop attitude of lifelong learning and will develop interpersonal skills to people working in diversified field will.         2. Write technical reports and research papers to publish at national and in level.         3. Develop strong communication skills to defend their work in front of qualified audience.         4. Learn about Patent filing and IPR         5. Gain knowledge about new business ideas and product development						internationa				

department. The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion. The report must bring out the conclusions of the work and future scope for the study. . The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner and a guide, co-guide etc. as decided by the Head and PG coordinator. The candidate has to be in regular contact with his guide.

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4. Wr

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		Category	L	Т	Ρ	Credit
60PSE E11	THEORY OF STRUCTURAL STABILITY	PE	3	0	0	3

- To Learn behaviour of structural elements under compressive loads, •
- To understand the stability of columns, beams and plates under various load conditions. •
- To analyse beam column behaviour along with frames. •
- To know the basic theory for buckling of beams for various applications.
- To Introduce numerical techniques

#### Prerequisite

knowledge of Structural Analysis, Strength of Materials & Mathematical Logic.

#### Course Outcomes

On the	e successful completion of the course, students will be able to	
CO1	Obtain the concept of structural stability of structures	Apply
CO2	Compare the method and analysis of structures	Apply
CO3	Design a beam column behaviour with the portal frame	Analyze
CO4	Explain the torsional buckling in beam	Apply
CO5	Interpret the use of energy methods with numerical techniques	Analyze

#### Mapping with Programme Outcomes

COs	P01	PO2	PO3	PO4	PO5	PO6
CO1		3	2	3	2	2
CO2	3	3	3	2	2	2
CO3	2		2	3	2	1
CO4	3	3	2	2	2	3
CO5	3	3		2	3	
	3- 5	Strong;2	2-Mediu	m;1-Sor	ne	

#### Assessment Pattern

Bloom'sCategory		Assessment Tests Marks)	End Sem Examination
	1	2	(Marks)
Remember (Re)	10	10	10
Apply (Ap)	40	40	60
Analyse (An)	10	10	30
Create (Cr)	0	0	0



	K.S.Rar	igasamy Colle	ge of Techno	ology - Auton	omous R2	022		
	60	PSE E11- THE	ORY OF STR	UCTURAL ST	ABILITY			
		M.E. STR	UCTURAL E	NGINEERING	ì			
Comostar		Hours / Week	Σ.	Total Hours	Credit	Max	aximum Marks	
Semester	L	Т	Р	Total Hours	С	СА	ES	Total
Ι	3	0	0	45	3	40	60	100
Stability of Colur Concepts of Elast Elastic Buckling o up columns- ortho Methods of Analy Approximate meth Element - analysis Derivation of Colu Double modulus T	ic Structural s f columns- Eq gonality of buc <b>/sis and in El</b> nods – Raylei s of columns - mn design for	uilibrium - Ener ckling modes- E <b>astic Buckling</b> gh and Galerki - Experimental	gy and Imper ffect of shear n methods – study of colu	fection approa on buckling lo numerical mo mn behaviour	aches – No oad - Large ethods – F – South w	on-prisma deflectio Finite diffo vell plot -	tic colu n theor erence Colum	mns- Built y. [9] and finite n curves -
Beam Columns a Beam column be foundation – Buck stiffness methods Buckling of Beam Lateral buckling of supported and C buckling – Uniform and energy approx Buckling of Thin Isotropic rectangu methods – Plates	haviour- stan kling of frame – Approximate ns of beams – El antilever bear n and non uni ach. <b>Plates</b> lar plates - Go	es – Single stor e evaluation of o nergy method- ms - Narrow re form Torsion of overning Differen	rey portal fra critical loads i Application t ectangular cr n open cross ntial equation	mes with and n multistoried to Symmetric toss sections- section - Flex	without s frames – U and unsyn – Numeri kural torsio	ide sway Ise of Wo nmetric I ical solut nal buckl	– Clas od's ch beams ions – ing – E – Use	ssical and harts. [9] s – simply Torsional Equilibrium [9] of Energy [9]
							Total	Hours: 45
Text book (s) :								
	•	ructures Stabilit			-	).		
	ar, "Stability of	Structures", All	lied Publisher	s Ltd, New De	lhi, 2008.			
Reference(s) :								
		Stability of Colu						, 2016
2 Timoshenko,	S.P, and Ger	e, J.M. "Theory	of Elastic sta	ability", McGrav	w-Hill Com	pany, 20 <i>°</i>	10	
3 Gambhir, "St	ability Analysis	s and Design of	Structures",	Springer, New	York, 2004	4.		
					<b>-</b> 1	1 0000		

4 Simitser.G.J and Hodges D.H, "Fundamentals of Structural Stability", Elsevier Ltd., 2006.

#### **Course Contents and Lecture Schedule**

S.No	Торіс	No.of Hours
1	Stability of Columns	
1.1	Concepts of Elastic Structural stability	1
1.2	Analytical approaches to stability	1
1.3	characteristics of stability analysis	1
1.4	Elastic Buckling of columns- Equilibrium	1
1.5	Energy and Imperfection approaches	1
1.6	Non-prismatic columns	1

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	Total	45
5.6	Numerical Techniques	1
5.5	Plates with stiffeners	2
5.4	Use of Energy methods	2
5.3	Simply Supported on all edges	1
5.2	Governing Differential equations	2
5.1	Isotropic rectangular plates	1
5	Buckling of Thin Plates	
4.8	Equilibrium and energy approach	1
4.7	Flexural torsional buckling	1
4.6	Uniform and non uniform Torsion on open cross section	1
4.5	Torsional buckling	1
4.4	Narrow rectangular cross sections – Numerical solutions	2
4.3	simply supported and Cantilever beams	1
4.2	Energy method- Application to Symmetric and unsymmetric I beams	1
4.1	Lateral buckling of beams	1
4	Buckling of Beams	
3.8	Use of Wood's charts	2
3.7	Approximate evaluation of critical loads in multistoried frames	1
3.6	Classical and stiffness methods	1
3.5	Single storey portal frames with and without side sway	1
3.4	Buckling of frames	1
3.3	Column on elastic foundation	1
3.2	standard cases- Continuous columns and beam columns	1
3.1	Beam column behaviour	1
3	Beam Columns and Frames	
2.9	Tangent modulus and Double modulus Theory.	1
2.8	Inelastic behaviour	1
2.7	Effective length of Columns	1
2.6	Derivation of Column design formula	1
2.5	South well plot - Column curves	2
2.4	Experimental study of column behaviour	1
2.3	Finite difference and finite Element - analysis of columns	1
2.2	Rayleigh and Galerkin methods – numerical methods	2
2.1	Approximate methods	1
2	Methods of Analysis and in Elastic Buckling	
1.9	Large deflection theory	1
1.8	Effect of shear on buckling load	1

Course Designers

1. Dr.D.SIVAKUMAR

- sivakumard@ksrct.ac.in

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		Category	L	Т	Ρ	Credit
60PSE E12	THEORY OF PLATES AND SHELLS	PE	3	0	0	3

- To study the behavior of the plates and shells with different geometry under various types of loads
- To illustrate design of several of plates.
- To enable the student analyze and design thin shell structures including domes, hyperbolic, parabolic, elliptic and cylindrical shells.
- To knowledge about thin and thick shells.
- To understand design of cylindrical shells.

#### Prerequisite

Fundamentals of Mathematics, knowledge of strength of materials and its mechanics and theory of elasticity and plasticity.

# Course Outcomes

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

CO1	Analyse bending of long rectangular plates using thin plate theory	Evaluate
CO2	Analyse circular plates with various loading conditions	Evaluate
CO3	Analyse rectangular plates using classical approach and methods	Evaluate
CO4	Analyse bending of Anisotropic plates	Evaluate
CO5	Design of R. C. Cylindrical shells and long shells.	Apply

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	3	2	2	1
CO2			3		2	1
CO3	2	2	3	2	2	1
CO4			3		2	1
CO5	1	1	3	2	3	1
	3- 3	Strong;2	2-Mediu	m;1-Sor	ne	

#### Assessment Pattern

	Continuous Ass	End SemExamination	
Bloom'sCategory	1	2	(Marks)
Remember	10	10	10
Understand	10	10	10
Apply	10	10	20
Analyse	10	10	20
Evaluate	10	10	10
Create	10	10	30



	11.0.11			Cechnology-A				
				RAL ENGINE		_0		
<b>.</b>	H	lours/Week	Nurs/M/ook		Credit	Maximum Ma		arks
Seme	L	Т	Р	Total hrs	С	CA	ES	Total
I	3	0	0	45	3	40	60	100
Thin	rally Loaded Plates Plates with small c us boundary condition	defection, Late	erally load	ed thin plates	, governing	different	ial equatior	<b>[09</b> ]
Recta Recta elem	<b>angular Plates</b> angular plates. Simp angular plates with ent methods							e
	<b>ular Plates</b> metrical bending of c	circular plates,	plates on	elastic foundat	tion.			[09]
Struc	ory of Shells stural behavior of th				Franslationa	I and rot	ational rule	d [09]
Jund	ce, Design of the for	lowing shells:	spherical,	conical, parab	oloid and el			-
<b>Desi</b> g	gn of Cylindrical SI gn of R.C cylindrical s – Design of shells	<b>hells</b> I shell with ed	lge beams	using theory		lipsoid. ells – De	sign for lon	g [09]
<b>Desi</b> Desi shells	gn of Cylindrical SI gn of R.C cylindrical s – Design of shells	<b>hells</b> I shell with ed	lge beams	using theory		lipsoid. ells – De		g [09]
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Desig Desig shells Textl 1. 2. Refe	gn of Cylindrical SI gn of R.C cylindrical s – Design of shells book(s): Reddy J N, "Theory Timoshenko,S and Company, Newyork rence(s): Iyengar, N.G.R, "Str	hells I shell with ed with ASCE ma and Analysis Woinowsky .1990. ructural Stabil	lge beams anual coeff of Elastic F – Kreiger ity of Colu	using theory icients Plates and She ,"Theory of p mns and Plate	for long sho ells", Second plates and es" East We	lipsoid. ells – De d edition, shells".N est Press	sign for lon Total Hour CRC press Ic Graw- Pvt Ltd, N	g [09] s 45 2006. Hill boo
Designed Shells	gn of Cylindrical SI gn of R.C cylindrical s – Design of shells book(s): Reddy J N, "Theory Timoshenko,S and Company, Newyork. rence(s): Iyengar, N.G.R, "Str 2016	hells I shell with ed with ASCE ma and Analysis Woinowsky .1990. ructural Stabil nd Gere, J.M.	lge beams anual coeff of Elastic F – Kreiger ity of Colu	using theory icients Plates and She ,"Theory of p mns and Plate	for long sho ells", Second plates and es" East We	lipsoid. ells – De d edition, shells".N est Press r-Hill Com	sign for lon <b>Total Hour</b> CRC press, Ac Graw- Pvt Ltd, No apany, 2010	g [09] s 45 2006. Hill boo
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S.No	Торіс	No.of Hours
1	Laterally Loaded Plates	
1.1	Cylindrical bending of long rectangular plates - Differential equation	1
1.2	Plates with simply supported edges	1
1.3	Plates with built-in edges	1
1.4	Slope and curvature of slightly bent plates	2
1.5	Relation between bending moment and curvature	2
1.6	Various boundary conditions.	2
2	Rectangular Plates	
2.1	Small deflections of laterally loaded plates – Differential equation	1

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2.2	Simply supported rectangular plates under sinusoidal loading	1
2.3	Introduction to Navier's solution	1
2.4	Simply supported rectangular plates under uniform loading	1
2.5	Simply supported rectangular plates under hydrostatic pressure	1
2.6	Simply supported rectangular plates under concentrated load	1
2.7	Simply supported rectangular plates under uniform loading over an area of a rectangle	1
2.8	Introduction to Levy's method	1
2.9	Simply supported rectangular plates under uniform loading	1
3	Circular Plates	
3.1	Symmetrical bending of laterally loaded circular plates – Differential equation	2
3.2	Circular plates with uniform loading	2
3.3	Circular plate with triangular loading	1
3.4	Circular plate with circular hole subjected to moment at the inner edge	1
3.5	Circular plate with concentrated load	1
3.6	Circular plate loaded at the centre	1
3.7	Circular plates with moments at the edges	1
4	Theory of Shells	
4.1	Simply supported rectangular plates under hydrostatic pressure	2
4.2	Bending of laterally loaded thin plates – Differential equation	1
4.3	Simply supported and fixed square and rectangular plates under uniform loading	1
4.4	Simply supported and fixed square and rectangular plates under partial loading	1
4.5	Simply supported and fixed square and rectangular plates under triangular loading	1
4.6	Simply supported and fixed square and rectangular plates under trapezoidal loading	1
4.8	Energy methods - Principle of virtual work- Principle of minimum potential energy	1
5	Design of Cylindrical Shells	
5.1	Bending of Anisotropic plates – Differential equation	2
5.2	Bending of rectangular plates	1
5.3	Bending of circular and elliptic plates	1
5.4	Classification of shells	1
5.5	Case Study – Shell Structures	1
5.6	Design of R.C cylindrical shell with edge beams using theory for long shells	1
5.7	Design for long shells	1
5.8	Design of shells with ASCE manual coefficients	1
L	Total	45

# **Course Designers**

1. Dr.K.VIJAYA SUNDRAVEL

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H.W. فتصري RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		Category	L	т	Ρ	Credit
60PSE E13	DESIGN OF TALL BUILDINGS	PE	3	0	0	3

- The design criteria of the tall buildings, materials used, modern concepts
- The different types of loads to be considered in designing, behaviour of structural systems, analysis.
- The design of tall structures using different methods.
- The stability analysis of the tall buildings.
- Design against wind loads as per BIS code of practice and special consideration in the design of tall structures.

#### Prerequisite

Fundamentals of Mathematics, knowledge of basic Science

#### Course Outcomes

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

CO1	Implement design philosophies for the development of high rise structures.	Create
CO2	Find out the design loads for high rise buildings.	Evaluate
CO3	Analyse the behaviour of tall building subjected to lateral loading.	Analyze
CO4	Perform computerized general three dimensional analysis for high rise building.	Analyze
CO5	Perform stability analysis using various methods for tall buildings.	Apply

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6		
CO1	2	2	3	2	2	2		
CO2			3		2			
CO3	2	2	3	2	2	2		
CO4			3		2			
CO5	1	1	3	2	3	2		
	3- Strong;2-Medium;1-Some							

#### **Assessment Pattern**

Bloom'sCategory		sessment Tests arks)	End Sem Examination
Dioonin Soutegory	1	2	(Marks)
Remember	10	10	10
Understand	10	10	10
Apply	10	10	20
Analyse	10	10	20
Evaluate	10	10	10
Create	10	10	30

4. Wr K.S.Rangasamy College - 637 215

I         3         0         0         45         3         40         60           Design Criteria         Image: Second Secon						
BemesterCreditMaximumMarkLTPTotalhrsCreditMaximumMarkI3004534060Design Criteria						
L         T         P         Totains         C         CA         ES           I         3         0         0         45         3         40         60           Design Criteria						
L         T         P         C         CA         ES           I         3         0         0         45         3         40         60           Design Criteria         C         CA         ES         C         CA         ES         C	S					
Design Criteria	Total					
	100					
Design Philosophy, Materials – Modern concepts – High Performance Concrete, Fibre Reinforced Concrete, Light weight concrete, Self Compacting Concrete.	[09]					
<b>Loading</b> Gravity Loading – Dead load, Live load, Impact load, Construction load, Sequential loading. Wind Loading – Static and Dynamic Approach, Analytical method, Wind Tunnel Experimental methods. Earthquake Loading – Equivalent lateral Load analysis, Response Spectrum Method, Combination of Loads	[09]					
<b>Behaviour of Structural Systems</b> Factors affecting the growth, height and structural form, Behaviour of Braced frames, Rigid Frames, In filled frames, Shear walls, Coupled Shear walls, Wall – Frames, Tubular, Outrigger braced, Hybrid systems.	[09					
Analysis and Design Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of structures as an integral unit, Analysis for member forces, drift and twist. Computerized 3D analysis. Design for differential movement, Creep and Shrinkage effects, Temperature Effects and Fire Resistance.	[09					
<b>Stability Analysis</b> Overall buckling analysis of frames, wall – frames, Approximate methods, Second order effect of gravity loading, P – Delta Effects, Simultaneous first order and P-Delta analysis, Translational instability, Torsional Instability, Out of plumb effects, Effect of stiffness of members and foundation rotation in stability of structures.	[09					
TotalHours	45					
Textbook(s):						
1. Bryan Stafford Smith and Alexcoull, "Tall Building Structures - Analysis and Design", John Wil Sons, Inc. Wiley India Pvt.Ltd. New Delhi., 2011.	ley ar					
2. Taranath B.S, "Structural Analysis and Design of Tall Buildings", McGraw-Hill, 1988.						
Reference(s):						
1. Harry G Poulos, "Tall Building Foundation Design", Taylor & Francis., 2017.						
2. Mark P Sarkisian, "Designing Tall Buildings Structure As Architecture", Taylor & Francis., 201	5.					
3. Coull, A. and Smith, Stafford, B. "Tall Buildings", Pergamon Press, London, 2003.						
4. Lynn S.Beedle, "Advances in Tall Buildings", CBS Publishers and Distributors, Delhi, 1996.						
Course Contents and Lecture Schedule						

S.No	Торіс	No.of Hours
1	Design Criteria	
1.1	Design Philosophy, Materials	1
1.2	Modern concepts	1
1.3	High Performance Concrete	1
1.4	Fibre Reinforced Concrete	2

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	Total	45
5.8	Effect of stiffness of members and foundation rotation in stability of structures	1
5.7	Out of plumb effects	1
5.6	Torsional Instability	1
5.5	Translational instability	1
5.4	P – Delta Effects, Simultaneous first order and P-Delta analysis	1
5.3	Second order effect of gravity loading – Approximate method	1
5.2	Overall buckling analysis of wall frames	1
5.1	Overall buckling analysis of frames	2
5	Stability Analysis	
4.8	Creep and Shrinkage effects, Temperature Effects and Fire Resistance.	1
4.6	Design for differential movement	1
4.5	Computerized 3D analysis	1
4.4	Analysis for member forces, drift and twist	1
4.3	Analysis of structures as an integral unit	1
4.2	Accurate analysis and reduction techniques	1
4.1	Modeling for approximate analysis	2
4	Analysis and Design	
3.7	Outrigger braced, Hybrid systems	1
3.6	Tubular Systems	1
3.5	Shear walls, Coupled Shear walls, Wall	1
3.4	Behaviour of In filled frames	1
3.3	Behaviour of Rigid Frames	1
3.2	Behaviour of Braced frames	2
3.1	Factors affecting the growth, height and structural form	2
3	Behaviour of Structural Systems	
2.9	Combination of Loads	1
2.8	Response Spectrum Method	1
2.7	Equivalent lateral Load analysis	1
2.6	Experimental methods. Earthquake Loading	1
2.5	Static and Dynamic Approach, Analytical method, Wind Tunnel	1
2.4	Wind Loading	1
2.3	Construction load, Sequential loading	1
2.2	Dead load, Live load, Impact load	1
2.1	Gravity Loading	1
2	Loading	
1.6	Self Compacting Concrete.	2

# Course Designers

1. Dr.K.VIJAYA SUNDRAVEL

- vijayasundravel@ksrct.ac.in

**R1/ w.e.f. 12.07.2023** Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

A.W. ملكة أيوار . حالية أيوار

RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		Category	L	Т	Ρ	Credit
60PSE E14	DESIGN OF STRUCTURES FOR DYNAMIC LOADS	PE	3	0	0	3

- To Design factors, behaviour of structures in cyclic loads,
- To recap of structural dynamics with reference of different systems,
- To understand ductility, earth quake design of structures,
- To design of structures against blast and impact
- To Design against wind loads as per BIS code of practice and special consideration in the design of structures.

#### Prerequisite

Basic knowledge of Earthquake, RCC Structures & Soil Mechanics.

#### **Course Outcomes**

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

CO1	Explain the behavior of structures under dynamic loads	Apply
CO2	Design structures for earthquake, blast and impact loads	Analyze
CO3	Perform ductile detailing	Understand
CO4	Design against wind load as per BIS Code	Apply
CO5	Ductility Detailing should be considering for vibrations structures	Analyze

#### Mapping with Programme Outcomes

COs	P01	PO2	PO3	PO4	PO5	PO6
CO1	2	3	2	3	2	2
CO2	3	3	2	2	2	3
CO3	2	3	2	3	2	2
CO4	3	3	2	2	2	2
CO5	3	3	1	3	3	3
	3- 3	Strong;2	2-Mediu	m;1-Sor	ne	•

#### Assessment Pattern

Ploom's Cotogony	ContinuousAsse	ssmentTests (Marks)	End SemExamination
Bloom'sCategory	1	2	(Marks)
Remember (Re)	10	10	10
Apply (Ap)	40	40	60
Analyse (An)	10	10	30
Create (Cr)	0	0	0

4. Wr **BoS Chairman** CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

	K.S.Rang	asamy Colleg	e of Technolo	ogy - Autonomo	ous R2022					
	60PSE E14			ES FOR DYNAM	IIC LOAD	S				
M.E. STRUCTURAL ENGINEERING Hours / Week` Credit Maximum Marks										
Semester		lours / Week`		Total Hours		Max	imum N	larks		
	L	Т	Р		С	CA	ES	Total		
I	3	0	0	45	3	40 60 1				
and cyclic load Ductility and its Design Again Earthquake ch estimating load practice - Duct Design Again Displacement and space fran Design Again Characteristics effects - Design chimneys. Special Consi Energy absorp	st Earthquakes laracterization - R ls - Response of fr lity based design st Blast And Impa method for three di nes st Wind of wind - Basic ar gn as per BIS coo derations tion capacity - Duo	ctural dynamic esponse spec amed, braced ct mensional Stru d Design wind de of practice ctility of the m	cs with referer etra - seismic frames and sh ucture - Coordi I speeds - Pres including Gus aterial and the	nce to SDOF, M co-efficient and near wall buildin nate transforma ssure coefficient st Factor appro	IDOF and [9 I response gs - Desig tions - Ana : - Aero ela ach - tall [9]	continuu ] e spectra n as per alysis of [9] astic and building:	um syst a metho BIS co [9] space ti Aerody s, stack	ems – ods of odes of russes /namic (s and		
active control of	of vibrations - New a	and favorable r	naterials				9]			
Text book (s)	:					10	otal Hou	115.45		
1 Paulay, . John Wile	T. and Priestly, .M ey and Sons, 2011.		-				•	•		
<sup>2</sup> Damodarasamy S.R,"Basics of Structural Dynamics and Aseismic Design", PHI Learning Pvt Ltd, New Delhi, 2009.										
Reference(s)										
1 Bela Goschy, "Design of Building to withstand abnormal loads ", Butterworths, 2010.										
-										
•	, .V., "Wind effects	0	0	es ", Elsevier, 20	)14.					
4 R.R. Crai	g - Structural Dyna	mics, John Wil	e 2003							

#### **Course Contents and Lecture Schedule**

S.No	Торіс	No.of Hours
1	Introduction	
1.1	Factors affecting design against dynamic loads	1
1.2	Behaviour of concrete, steel, masonry	2
1.3	Behaviour of soil under impact and cyclic loads	2
1.4	Recap of Structural dynamics with reference to SDOF	1

#### R1/ w.e.f. 12.07.2023

Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

AW RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

	Total	45
5.5	New and favorable materials	2
5.4	Passive and active control of vibrations -	2
5.3	Detailing for ductility	1
5.2	Ductility of the material and the structure	2
ວ 5.1	Energy absorption capacity	2
5	Special Considerations	
4.8	chimneys	1
4.7	stacks	1
4.6	tall buildings,	1
4.5	Design as per BIS code of practice including Gust Factor approach	1
4.4	Aero elastic and Aerodynamic effects	2
4.3	Pressure coefficient	1
4.2	Basic and Design wind speeds	1
4.1	Characteristics of wind	1
4	Design Against Wind	
3.5	Analysis of space frames	2
3.4	Analysis of space trusses	2
3.3	Coordinate transformations	2
3.2	Displacement method for three dimensional Structure	2
3.1	Displacement method for Structure	1
3	Design Against Blast And Impact	
2.9	Ductility based design	1
2.8	Design as per BIS codes of practice	1
2.7	shear wall buildings	1
2.6	Response of framed, braced frames and	1
2.5	loads	1
2.4	response spectra methods of estimating	1
2.3	seismic co-efficient	1
2.2	Response spectra	1
2.1	Earthquake characterization	1
2	Design Against Earthquakes	
1.7	Ductility and its importance	1
1.6	Recap of Structural dynamics with reference to continuum systems	1

**Course Designers** 

1. Dr.D.SIVAKUMAR - sivakumard@ksrct.ac.in

ANT RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		Category	L	Т	Ρ	Credit
60PSE E15	FRACTURE MECHANICS OF CONCRETE STRUCTURES	PE	3	0	0	3

- To give an outline of the total field of fracture mechanics
- To familiarize students with problems that can be solved with fracture mechanics concepts.
- To impart knowledge on the mechanisms of failure and non linear fracture mechanics.
- To study crack criteria by using Griffith's Criteria, Stress Intensity Factors, R curves.
- To apply crack concepts & numerical modelling to high strength concrete & fibre reinforced concrete.

#### Prerequisite

Fundamentals of Mathematics, knowledge of basic strength of material.

#### Course Outcomes

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

CO1	Evaluate the fracture failure parameters	Evaluate
CO2	Evaluate the linear elastic fracture mechanics problems	Evaluate
CO3	Explain the concept of elastic plastic fracture mechanics	Understand
CO4	Estimate the residual life of fatigue Crack Growth in structure.	Analyze
CO5	Evaluate the fracture parameters using direct and indirect methods	Evaluate

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6			
CO1	2	2	3		2				
CO2	2	2	3		2				
CO3	1	2		3	2	3			
CO4	2	2	3	3	2	3			
CO5	2	2	3	2	3	2			
	3- Strong;2-Medium;1-Some								

#### Assessment Pattern

Assessment rattern							
ContinuousAsse	ssmentTests (Marks)	End SemExamination					
1	2	(Marks)					
10	10	10					
10	10	10					
10	10	20					
10	10	20					
10	10	10					
10	10	30					
	1 10 10 10 10 10 10	10         10           10         10           10         10           10         10           10         10           10         10					

4. W **BoS Chairman** CHAIRMAN Baculty of Civil Engineering Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

Courses of failures of structures – case studies Fracture Mechanics Approach to Design: Energy Criterion – Stress intensity approach – Time dependent crack growth – Effect of Material Properties on Fracture LINEAR ELASTIC FRACTURE MECHANICS: An atomic view of fracture – Stress concentration Effect of Flows – The Griffith Energy Balance – Comparison with the Critical Stress Criterion – Modified Griffith equation – The Energy Release rate – Instability and the R Curve – Stress analysis of cracks – Crack tip plasticity – Plane strain fracture –Mixed mode fracture. ELASTIC – PLASTIC FRACTURE MECHANICS: Crack –tip- opening displacement – J contour integral – Crack growth resistance curves – J controlled fracture – Crack tip constraint under large –scale yielding – Sealing model for clearage fracture DYNAMIC AND TIME – DEPENDENT FRACTURE: Dynamic fracture and crack arrest – Creep crack growth – Viscoelastic fracture mechanics. Material Behaviour: Fracture mechanisms in metals, plastics, ceramics, ceramic composites and concrete						Fechnology–				
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<ul> <li>An atomic view of fracture – Stress concentration Effect of Flows – The Griffith Energy Balance – Comparison with the Critical Stress Criterion – Modified Griffith equation – The Energy Release rate – Instability and the R Curve – Stress analysis of cracks – Crack tip plasticity – Plane strain fracture –Mixed mode fracture.</li> <li>[09] ELASTIC – PLASTIC FRACTURE MECHANICS: Crack –tip- opening displacement – J contour integral – Crack growth resistance curves – J controlled fracture – Crack tip constraint under large –scale yielding – Sealing model for clearage fracture</li> <li>[09] DYNAMIC AND TIME – DEPENDENT FRACTURE: Dynamic fracture and crack arrest – Creep crack growth – Viscoelastic fracture mechanics. Material Behaviour: Fracture mechanisms in metals, plastics, ceramics, ceramic composites and concrete APPLICATION TO STRUCTURES : Linear Elastic Fracture Mechanics – Elastic plastic J – integral analysis – Failure Assessment Diagrams- Application to welded structures – Primary VS secondary stresses in the FAD Method – Ductile –Tearing analysis with FAD – Probabilistic Fracture Mechanics – Fatigue crack propagation – Environmentally assisted cracking in metals.</li> <li>Textbook(s):</li> <li>1. Anderson, T.L. "Fracture Mechanics Fundamentals and Applications", Taylor &amp; Francis Group, 2015</li> <li>2. David Broek , Sijthoff&amp;Noordhoff ., "Elementary engineering fracture mechanics", Alphen aan den Rijn. Netherlands, 2012</li> <li>2. Fracture mechanics of concrete structures – Theory and applications – Rilem Report – Edited by L-Chapman and Hall – 1989.</li> <li>3. Fracture mechanics – applications to concrete – Edited by Victor, C. Li, &amp; Z.P. Bazant – ACI SI 118.</li> </ul>										
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4. Valliappan S. "Continuum Mechanics Fundamentals" (1982), Oxford IBH, N D. New Delhi.	3.		ure mechanics – a	applications	s to concr	ete – Edited b	by Victor, C	. Li, & Z.	P. Bazant	– ACI SF

# Course Contents and Lecture Schedule

S.No	Торіс	No.of Hours
1	INTRODUCTION	
1.1	Review of Engineering Failure Analysis	
1.2	Brittle fracture-Ductile fracture	
1.3	Modes of fracture failure	1
1.4	The Griffith energy Balance Approach	2

AW RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

1.5	Crack tip Plasticity	2
1.6	Fracture toughness	2
2	LINEAR ELASTIC FRACTURE MECHANICS	
2.1	Elastic crack tip stress field	1
2.2	Stress and displacement fields in isotropic elastic materials	1
2.3	Westergaard's approach (opening mode)	1
2.4	Plane Strain Fracture toughness (KIC) testing	1
2.5	Feddersen approach	1
2.6	Determination of R curve.	1
2.7	Energy released rate for DCB specimen	1
2.8	Anelastic deformation at crack tip	1
2.9	Test techniques, Various test specimens	1
3	ELASTIC – PLASTIC FRACTURE MECHANICS:	
3.1	Critical energy release rate	2
3.2	limitation of K approach	2
3.3	Approximate shape and size of the plastic zone	1
3.4	Effective crack length	1
3.5	Effect of plate thickness	1
3.6	Elastic plastic fracture concept	1
3.7	Crack tip opening displacement	1
4	DYNAMIC AND TIME – DEPENDENT FRACTURE:	
4.1	Fatigue crack growth to sharpen the tip	2
4.2	Load displacement test	2
4.3	Test methods to determine J1c	1
4.4	Mechanism of Fatigue ,Fatigue crack propagation	1
4.5	Paris law	1
4.6	Crack closure mechanism	1
4.7	Residual stresses at crack tip	1
5	APPLICATION TO STRUCTURES :	
5.1	Principles of crack arrest, crack arrest in practice	2
5.2	K-R Curves, Crack resistance curve	1
5.3	Numerical Methods and Approaches in Fracture Mechanics	1
5.4	Direct methods to determine fracture parameters	1
5.5	Indirect methods to determine fracture parameters	1
5.6	variable amplitude service loading, Interaction effects.	1
5.7	Fatigue crack growth test, stress intensity factor, factors affecting stress intensity factor	1
5.8	Retardation effect	1
_	Total	45

# CourseDesigners

1. Dr.K.VIJAYA SUNDRAVEL

- vijayasundravel@ksrct.ac.in

G.Wr هيمن RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		Category	L	Т	Р	Credit
60PSE E16	ADVANCED GROUNDWATER HYDROLOGY	PE	3	0	0	3

- The basic knowledge of groundwater hydrogeology, hydrometeorology, aquifers and it parameter.
- Understand various theories and equations related to groundwater hydraulics.
- Locating the hydro geological boundaries through conducting pumping tests and analysis.
- Understanding the concepts well design criteria.
- Acquire knowledge about problem identification and also providing suitable remedy in terms of maintaining the local groundwater table.

#### Pre requisite

Basic knowledge of Environmental Engineering courses

#### **Course Outcomes**

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

CO1	Study the ground water hydrologic cycle and types of acquifiers.	Remember/
		Analyse/
		Apply
CO2	Understand the ground water movement and principles of ground water flow and equation.	Remember / Analyse/ Apply
CO3	Analyze the aquifer parameters and well characteristics.	Remember / Analyse/ Apply
CO4	Discuss the construction of wells and design of wells.	Remember / Analyse/ Apply
CO5	Explain the methods of ground water recharge and assessment	Remember / Analyse/ Apply

#### Mapping with Programme Outcomes

COs	P01	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	3	3
CO2	3	2	2	3	3	2
CO3	2	3			3	2
CO4	3	2		2	3	1
CO5	3	2	3	3	2	2

#### AssessmentPattern

	ContinuousAsse	End SemExamination			
Bloom'sCategory	1 2		(Marks)		
Remember (Re)	20	20	30		
Apply (Ap)	30	20	50		
Analyse (An)	10	20	20		
Create (Cr)		-	-		

R1/ w.e.f. 12.07.2023

Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

4. Wr Ros Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

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1.2

1.3

**R1/ w.e.f. 12.07.2023** Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

Occurrence of groundwater

Hydrogeology and Hydrometeorology

ANT RoS Chairman CHAIRMAN Board Of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

1

2

1.4	Soil sample analysis and Water bearing materials	2
1.5	Types of aquifers and parameters of Aquifers	2
1.6	Determination of specific yield and permeability	1
2	Groundwater Hydraulics	
2.1	Groundwater Movement and Darcy's law and its limitations	1
2.2	Stream lines and flow net analysis	1
2.3	Discharge and draw down for various condition of groundwater flow	2
2.4	Principles of groundwater flow and its equation	2
2.5	Evaluation of well loss parameters and Partial penetration of wells, Interference of wells	1
2.6	Collector wells and Infiltration galleries	2
3	Pumping Test Analysis	
3.1	Determining aquifer parameters for unconfined, leaky and non-leaky aquifers	3
3.2	Steady and Transient conditions and Slug test	2
3.3	Locating hydro geological boundaries	2
3.4	Determination of well characteristics and specific capacity of wells	1
3.5	Well characteristics of large diameter wells.	1
4	Well Design and Construction	
4.1	Well design criteria	1
4.2	Construction of wells and Well drilling methods	2
4.3	Filter design – Artificial and natural packing	2
4.4	Well castings and screens	1
4.5	Production test	1
4.6	Maintenance of production wells.	2
5	Special Topics	
5.1	Methods of artificial groundwater recharge	2
5.2	Groundwater assessment and balancing	2
5.3	Seawater intrusion in coastal aquifers	1
5.4	Land Subsidence	2
5.5	Wells in hard rock areas	2
	Total	45

**Course Designers** 

1. Dr. S.Ramesh

- rameshs@ksrct.ac.in

**R1/ w.e.f. 12.07.2023** Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

4.10-

RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

GROUNDWATER MO	ELING AND Category	L	Т	Р	Credit	
60PSE E17	PE	3	0	0	3	

- Understand the groundwater exploration techniques both surface and subsurface by remote sensing and geophysical methods.
- Acquire preliminary idea about different methods of groundwater modeling techniques.
- Understand the different equations and model formulation methods.
- Acquire knowledge about data required for design and run the model.
- Understand about the influence of modeling for attaining the effective groundwater management.

#### Pre requisite

Basic knowledge of Environmental Engineering courses

### **Course Outcomes**

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

CO1	Acquired knowledge on ground water exploration through various geophysical methods by surface and substance investigation.	Remember/ Analyse/ Apply
CO2	Understand about the term model and it's types.	Remember / Apply
CO3	Gain knowledge about different equations related to ground water modeling.	Remember / Analyse/ Apply
CO4	Acquired knowledge on groundwater model design and development	Remember / Analyse/ Apply
CO5	Familiar to create the need based model and its development.	Remember / Analyse/ Apply

#### Mapping with Programme Outcomes

COs	P01	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	3	3
CO2	3	2	2	3	3	2
CO3	2	3			3	2
CO4	3	2		2	3	1
CO5	3	2	3	3	2	2

#### Assessment Pattern

	ContinuousAsse	End SemExamination	
Bloom'sCategory	1	2	(Marks)
Remember (Re)	20	20	30
Apply (Ap)	30	20	50
Analyse (An)	10	20	20
Create (Cr)		-	-

4. W Ros Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

	60PSE E17			ofTechnology R MODELING			Т	
		M.E. S	TRUCTU	RAL ENGINE				
Semester Hours/Week Totalhrs Credit MaximumMarks								
	I	_	Р		С			Total
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Groundwa	ater Prospecting							[09]
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	Seismic method -							
	of remote sensing te			igenerit ie	51 J			9
1.1	<b>.......</b> .							
roundwa	ater Flow Model							[09]
hysical m	odels – Analog mod	els – Mat	hematical	modeling - L	Insaturated	flow mod	els Numer	
	of groundwater flov							
	e over Relaxation, A							
	ethods -Direct metho						•	
	ant Transport Mode							[09]
	nt transport theory		tion, dispe	ersion equation	on – Longit	udinal ar	nd transve	
	/ – Hydrodynamic 🤇							
ransport -	- Solution methods -	Sorption	model -	Subsurface n	nass transpo	ort throug	h the vad	ose
	sity driven flow - Hea					Ū		
lodel Dev	velopment							[09
Data regu	irements – Conce	ممع امنيام						
σαιά τοφι		plual mo	del desig	gn : Concep	otualization	of aquife	er system	
	s, Input-output stress							1 – <sup>-</sup>
Parameter		ses, Initial	and Bou	ndary condition	ons - Model	design ar	nd execution	n on :
Parameter Grid desigi	s, Input-output stress	ses, Initial s, Time dis	and Boui scretizatio	ndary condition	ons - Model ent simulatio	design ar on – Mode	nd executional execution	n on : on :
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AW RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

#### Course Contents and Lecture Schedule

S.No	Торіс	No.o Hour
1	Groundwater Prospecting	
1.1	Investigation and evaluation	1
1.2	Geophysical methods	1
1.3	Electrical Resistivity methods	2
1.4	Interpretation of data	2
1.5	Seismic method and Subsurface investigation	2
1.6	Application of remote sensing techniques	1
2	Groundwater Flow Model	
2.1	Physical models, Analog models and Mathematical modeling	1
2.2	Unsaturated flow models and Numerical modeling of groundwater flow	1
2.3	Finite Differential equations and Finite difference solution	2
2.4	Alternating direction implicit procedure	2
2.5	Crank Nicolson equation, Iterative methods and Direct methods	1
2.6	Finite element method	2
3	Contaminant Transport Model	
3.1	Contaminant transport theory, Advection, dispersion equation	3
3.2	Longitudinal and transverse dispersivity	2
3.3	Hydrodynamic dispersion and Analytical models	2
3.4	Solution methods - Sorption model, Subsurface mass transport through the vadose zone	1
3.5	Density driven flow - Heat transport.	1
4	Model Development	
4.1	Conceptual model design	1
4.2	Conceptualization of aquifer system its Parameters, Input-output stresses, Initial and Boundary conditions	2
4.3	Model design and execution	2
4.4	Time discretization and Transient simulation	1
4.5	Sensitivity analysis	1
4.6	Model validation and prediction	2
5	Groundwater Management Model	
5.1	Optimal groundwater development	2
5.2	Modeling multilayer groundwater flow system	2
5.3	Artificial recharge feasibility through modeling	1
5.4	Simulation of movements of solutes in unsaturated zone	2
5.5	Stochastic modeling of groundwater flow	2
	Total	45

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**R1/ w.e.f. 12.07.2023** Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

4.10-

RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		Category	L	Т	Ρ	Credit
60PSE E21	STRUCTURAL HEALTH MONITORING	PE	3	0	0	3

- To learn the concept of structural health monitoring •
- To acquire knowledge on structural audit
- To understand the static field testing procedures
- To learn the dynamic field testing procedures •
- To apply various repair techniques in structures •

## Prerequisite

Courses - Construction Materials & Practices, Concrete Technology and Basic Sciences Course Outcomes

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

CO1	Understand the concept and measures of structural health monitoring	Remember/			
		Understand/			
		Analyse/Apply			
CO2	Investigate the health of structure using SHM procedures	Remember/			
		Understand/			
		Analyse/Apply			
CO3	Examine the health of structure using static field test	Remember/			
		Understand/			
		Analyse/Apply			
CO4	Assess the health of structure using dynamic field test	Remember/			
		Understand/			
		Analyse/Apply			
CO5	Apply suitable repair and rehabilitation techniques	Remember/			
		Understand/			
		Analyse/Apply			
Mapping with Programme Outcomes					

#### mapping with Progra

COs	P01	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	3	3	2
CO2	3	3	3	3	3	2
CO3	3	3	3	3	3	2
CO4	3	3	3	3	3	2
CO5	3	3	3	3	3	3
	3- Strong;2-Medium;1-Some					

#### Assessment Pattern

Bloom'sCategory	ContinuousAsse	End SemExamination	
Biooni scalegory	1	2	(Marks)
Remember(Re)	05	05	10
Understand(Un)	05	05	20
Apply (Ap)	25	30	50
Analyse (An)	25	20	20
Create (Cr)	-	-	-

4. Ng K.S.Rangasamy College - 637 215

					Technology–A				
	60PSE E21 - STRUCTURAL HEALTH MONITORING								
M.E -STRUCTURAL ENGINEERING           Semester         Hours/Week         Total hrs         Credit         Maximum Marks									
Semes	ster		-		Total hrs	Credit	Maximum Marl		
		L	Т	P		С	CA	ES	Total
		3	0	0	45	3	40	60	100
<b>Structural Health</b> Factors affecting Health of Structures, Causes of Distress, Regular Maintenance and monitoring structural monitoring - Concepts, Various Measures, Structural Safety in Alteration.							g [09]		
Proced	sment dures	of Health of Struc	ture, Colla	ipse and	Investigation,	Investigatio	n Manag	ement, SHI	<b>[09]</b> Л
Types	of Sta	<b>Testing</b> atic Tests - Behav nsor systems and							•
Dynamic Field Testing         [09]           Types of Dynamic Field Test - Stress History Test, Dynamic Response Methods, Ambient         Vibration test, Pull-back test, Hardware for Remote Data Acquisition Systems, Remote Structural           Health Monitoring.         East Acquisition Systems, Remote Structural									
Repairs and Rehabilitations of Structures         [09]           Case Studies (Site Visits), Piezo - electric materials and other smart materials, Electro–mechanical impedance (EMI) technique, Adaptations of EMI technique.									
								TotalHour	s 45
	oook(	•							
1. Daniel Balageas, Claus_PeterFritzen, Alfredo Güemes, Structural Health Monitoring, JohnWiley and Sons, 2006									
2. Douglas E Adams, "Health Monitoring of Structural Materials and Components - Methods with Applications", John Wiley and Sons, 2007									
Refer	rence	(s):							
	Daniel Balageas, Claus-Peter Fritzen, Alfredo Güemes, Structural Health Monitoring, Wiley, ISTE, 2006								
2. <sub>V</sub>	/ictor Giurgiutiu, "Structural Health Monitoring" Academic Press, 2014								
<sup>3.</sup> Н	landbo	ook on Repair & Re	ehabilitation	n of R.C.(	C. Buildings, C	PWD, Govt	of India,	2011	
In	nternat	ral Health Monitori ional Conference ihenzhen, China							

### **Course Contents and Lecture Schedule**

S.No	Торіс	No.of Hours
1	Structural Health	
1.1	Introduction to Structural health monitoring	1
1.2	Factors affecting Health of Structures	1
1.3	Causes of Distress	1
1.4	Regular Maintenance and monitoring	2

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1.5	Concepts in Structural monitoring	1
1.6	Various measures in structural monitoring	2
1.7	Structural Safety in Alteration.	1
2	Structural Audit	
2.1	Structural Audit – Introduction & Importance	1
2.2	Need for Assessment of Structure and Damage identification	1
2.3	Assessment of Health of Structure	1
2.4	Collapse and Investigation	2
2.5	Investigation Management	1
2.6	SHM Procedures	2
2.7	Role of sensors in SHM	1
3	Static Field Testing	
3.1	Static field testing - Concept and types	1
3.2	Behavior test - Procedure& Applications	1
3.3	Diagnostic test - Procedure& Applications	1
3.4	Proof load test - Procedure& Applications	1
3.5	Simulation and loading methods for SHM	2
3.6	Sensor Systems & Hardware requirements	2
3.7	Static response measurement	1
4	Dynamic Field Testing	
4.1	Dynamic field testing - Concept and types	1
4.2	Stress history test	1
4.3	Dynamic Load Allowance test	2
4.4	Ambient Vibration test	1
4.5	Pull-back test	1
4.6	Hardware for Remote Data Acquisition Systems	1
4.7	Remote Structural Health Monitoring.	2
5	Repairs and Rehabilitations of Structures	
5.1	Introduction to Repairs and Rehabilitations of Structures	1
5.2	Case Studies	2
5.3	Piezo - electric materials	2
5.4	Smart materials	2
5.5	Electro–mechanical impedance (EMI) technique,	1
5.6	Adaptations of EMI technique	1
	Total	45

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4.10-RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		Category	L	Т	Ρ	Credit
60PSE E22	DESIGN OF SUB STRUCTURES	PE	3	0	0	3

- To impart knowledge in the selection of sites for investigate and procedure of sub surface • exploration
- To determine the soil condition and provide the suitable foundation.
- To design the pile foundation based on capacity of super structure.
- To understand different types of foundations and their designing methods.
- Laying foundation for other miscellaneous structures like towers and different types of machine foundations and their design.

#### Prerequisite

Basic knowledge of Soil Mechanics, Geology & Mathematical

#### CourseOutcomes

On th	On the successful completion of the course, students will be able to				
CO1	State the knowledge on soil exploration	Apply			
CO2	Analysis the concepts of safe bearing capacity of shallow foundation	Apply, Analyze			
CO3	Explain pile foundation and their types	Understand			
CO4	Estimation the well foundations and sheet pile wall	Apply			
CO5	Identify the general analysis of machine foundation and soil dynamics	Analyze			
Mapp	ing with Programme Outcomes				

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	3	2	3
CO2	3	2	3	2	3	2
CO3	3	3	2	3	2	3
CO4	2	2	2	2	2	2
CO5	3	3	2	3	2	3
	3- 9	Strong ??	-Mediu	m·1-Sor	ne	•

Strong,∠

#### Assessment Pattern

Bloom's Category		Assessment Tests Marks)	End Sem Examination		
	1	2	(Marks)		
Knowledge (Kn)	10	10	10		
Apply (Ap)	40	40	60		
Analyse (An)	10	10	30		
Create (Cr)	0	0	0		

R1/ w.e.f. 12.07.2023

Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

4. 45 RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

K.S.Rangasamy College of Technology - Autonomous R2022 60PSE E22 -DESIGN OF SUB STRUCTURES											
M.E. STRUCTURAL ENGINEERING											
Hours / Week Credit Maximum Marks											
Semes	Semester L T P Total Hours C CA ES Total										
	3	0	0	45	3	40	60	100			
Sub Surface Exploration       [9]         Purpose - Programme and Procedures – Sampling- Exploration- soil data and Bore-hole log reports.       [9]         Shallow Foundations       Types of foundations and their specific applications – depth of foundation – bearing capacity and settlement estimates (Plate load) – structural design of isolated footings, strip, rectangular and trapezoidal combined footings – strap – raft foundation – Approximate flexible method of raft design.       [9]         Deep Foundations       [9]         Types of Piles and their applications - Pile capacity – Settlement of piles – Pile group – Structural design of piles and pile caps.       [9]         Foundations for Other Miscellaneous Structures       [9]         Design of Caissons and Well foundations - Foundations for towers –Sheet Pile wall-Coffer dams.       [9]         Machine Foundations       [9]         Types - General requirements and design criteria - General analysis of machine foundations-Soil Dynamics – Vibration isolation - Guide lines for design of reciprocating engines, impact type machines, rotary type											
Design of ( <b>Machine F</b> Types - G Vibration	Caissons and Well fo Foundations eneral requirements	undations - Fo and design cri	oundations fo iteria - Gene	ral analysis of	machine for	undations	ns. -Soil Dy	[9] namics -			
Design of <b>Machine F</b> Types - G Vibration machines,	Caissons and Well fo Foundations eneral requirements isolation - Guide lin framed foundations.	undations - Fo and design cri	oundations fo iteria - Gene	ral analysis of	machine for	undations	ns. -Soil Dyi ines, rot	[9] namics – ary_type			
Design of Machine F Types - G Vibration machines, Text book	Caissons and Well fo Foundations eneral requirements isolation - Guide lin framed foundations.	undations - Fo and design cri les for desigr	oundations fo iteria - Gene n of reciproc	ral analysis of cating engines	machine for , impact ty	undations pe mach	ns. -Soil Dyr ines, rof <b>Total I</b>	[9] namics – ary type [9] <b>Hours 45</b>			
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Design of Machine F Types - G Vibration machines, Text book 1 Swa Delh	Caissons and Well fo Foundations eneral requirements isolation - Guide lin framed foundations.	undations - Fo and design cri les for design s and Design	oundations fo iteria - Gene of reciproc	ral analysis of cating engines ures", Oxford a	machine for , impact ty and IBH Put	undations pe mach	ns. -Soil Dy ines, rot <b>Total I</b> Co., Pvt.L	[9] namics – ary type [9] <b>Hours 45</b>			
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Design of Machine F Types - G Vibration machines, Text book 1 Swa 2 Ven 2 Ven Reference 1 Tho	Caissons and Well fo Foundations eneral requirements isolation - Guide lin framed foundations. (s): my Saran , "Analysis i,2018. katramaiah.C, "Geote e(s): mlinson, M.J. and Bo	undations - Fo and design cri les for design s and Design echnical Engine orman. R. "Fo	oundations fo iteria - Gene of reciproc of Substructu eering", New undation Des	ral analysis of cating engines ures", Oxford a Age Internatio	machine for , impact ty and IBH Put nal Ltd., Nev	undations pe mach blishing C w Delhi, 2 S Longm	ns. -Soil Dyn ines, rof <b>Total I</b> Co., Pvt.L 2016. an VI, 20	[9] namics – ary type [9] <b>Hours 45</b> .td., New			
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S.No	Торіс	No.of Hours
1	Sub Surface Exploration	
1.1	Purpose	1
1.2	Programme and Procedures	2
1.3	Sampling	1
1.4	Exploration	2
1.5	soil data	1
1.6	Bore-hole log reports	2

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2	Shallow Foundations	
2.1	Types of foundations and their specific applications	1
2.2	depth of foundation	1
2.3	bearing capacity and settlement estimates (Plate load)	1
2.4	structural design of isolated footings,	1
2.5	structural design of strip, rectangular and trapezoidal combined footings	2
2.6	structural design of strap – raft foundation	2
2.7	Approximate flexible method of raft design.	1
3	Deep Foundations	
3.1	Types of Piles	1
3.2	Pile applications	1
3.3	Pile capacity	1
3.4	Settlement of piles	2
3.5	Pile group	2
3.6	Structural design of piles	1
3.7	pile caps	1
4	Foundations for Other Miscellaneous Structures	
4.1	Design of Caissons	2
4.2	Design of Well foundations	2
4.3	Foundations for towers	2
4.4	Sheet Pile wall	2
4.5	Coffer dams	1
5	Machine Foundations	
5.1	Types	1
5.2	General requirements and design criteria -	1
5.3	General analysis of machine foundations	1
5.4	Soil Dynamics	2
5.5	Vibration isolation	1
5.6	Guide lines for design of reciprocating engines,	1
5.7	impact type machines,	1
5.8	rotary type machines,	1
5.9	framed foundations	1
		2
	Total	45

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ANG فتصري RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		Category	L	Т	Ρ	Credit	
60PSE E23	STRUCTRUAL OPTIMIZATION	PE	3	0	0	3	

- To explain basics concepts of optimizing in structural design.
- To develop optimization techniques, and application of algorithms.
- To understand linear Programming methods for plastic design of frames.
- To apply Optimization theorems and using several methods.
- To evaluate different types of non traditional optimization techniques.

#### Prerequisite

Basic knowledge of Soil Mechanics, Geology & Mathematical **Course Outcomes** 

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

CO1	Apply the knowledge on the recent advances in optimization.	Remember, Understand, Apply
CO2	Write algorithm for Geometric and Dynamic programming.	Remember, Understand, Analyze
CO3	To know the basis of univariate and multivariate minimization.	Remember, Understand, Apply, Analyze
CO4	Understand the concepts of optimization structural theorems.	Analyze
CO5	Understand the concepts of optimization problems in the Structural Engineering	Understand and Apply

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	3	2	3
CO2	3	2	3	2	3	2
CO3	3	3	2	3	2	3
CO4	2	2	2	2	2	2
CO5	3	3	2	3	2	3
	3- \$	Strong;2	2-Mediu	m;1-Sor	ne	

#### Assessment Pattern

Bloom's Category	Continuous A (N	End Sem Examination	
Bloom S Gategory	1	2	(Marks)
Remember	10	10	10
Understand	10	10	10
Apply	20	10	30
Analyse	20	30	50
Evaluate	-	-	-
Create	-	-	-

R1/ w.e.f. 12.07.2023

Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

K.S.Rangasamy College - 637 215

		n.o.ndi	•	-	nology – Autonom JAL OPTIMIZATIC		4		
				Electiv					
Sam	ootor		Hours / We	ek	Total Hours	Credit	Ма	aximum	Marks
Sem	ester	L	Т	Р	Total Hours	C	CA	ES	Tota
	II	3	0	0	45	3	40	60	100
Linear p	rogrammir	ng, Integer			rogramming. Dyna nents.	amic Progra	amming	g and g	eometrio [9]
Minimiza <b>Optimiz</b> a	tion ation Theo	orems	·	-	es. Computer sear d Heyman's Theo				[9]
	U			optimality criter	ion methods.				[9]
			Techniques			K	<b>-</b>		11-0
		e problems.	olution – Ge	enetic Algorithr	n – simulated anı	nealing -	russ p	problem	- Hand [9]
onnalatio								Total H	
Text boo	ok (s) :								
1 Sp	oillers, Will	iam R., Mac	Bain, Keith N	I, "Structural O	ptimization", 2006.				
2 R	ao., S.S., "	Optimizatio	n theory and	Applications",	Wiley Eastern Lim	ited, New D	elhi, 19	995.	
Reference	:e(s) :								
1 CI	nristensen	, Peter, Klar	bring, Anders	s, "An Introduct	ion to Structural O	ptimization"	, 2009,	Springe	er.
2 P		ntimization	Theory and /	Applications" \M	liov Eastorn Ltd		1070		

2 Rao, S.S., Optimization Theory and Applications" Wiley Eastern Ltd., New Delhi, 1978.

3 Majid, K.I., "Optimum Design of Structures" Newnes-Butter Worths, London, 1974.

4 Gallegher, R.H. and Zienkiewiez, O.C., John Wiley and Sons, "Optimum Structural Design, Theory and Applications", New York, 1973.

#### Course Contents and Lecture Schedule

S.No	Торіс	No.of Hours
1	Introduction	
1.1	Basic concepts of minimum weight	1
1.2	Basic concepts of minimum cost design	2
1.3	Objective of Cost design	1
1.4	Functions	2
1.5	constraints	1
1.6	Classical methods	2
2	Optimization Techniques And Algorithms	
2.1	Basics of Optimization Techniques	1

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2.2	Linear programming methods for optimal design of structural elements	1
2.3	Integer Programming methods for optimal design of structural elements	1
2.4	Quadratic Programming methods for optimal design of structural elements	2
2.5	Dynamic Programming, methods for optimal design of structural elements	2
2.6	Geometric Programming methods for optimal design of structural elements	2
3	Computer Search Methods	
3.1	Linear Programming methods for plastic design of frames	1
3.2	Concepts of Plastic design of frames	1
3.3	Computer search for univariate Minimization	1
3.4	Computer search for multivariate Minimization	2
3.5	Problems in Univariate Minimization	2
3.6	Problems in mutitivariate minimization	2
4	Optimization Theorems	
4.1	Optimization by structural theorems	2
4.2	Maxwell Theorems for trusses and frames	1
4.3	Mitchell Theorems for trusses and frames	1
4.4	Heyman's Theorems for trusses and frames	1
4.5	Fully stressed design with deflection constraints	2
4.6	optimality criterion methods	2
5	Non-Traditional Optimization Techniques	
5.1	Methods on national evolution	1
5.2	Genetic Algorithm	1
5.3	Simulated annealing	1
5.4	Truss problem	2
5.5	Hand simulation for simple problems	2
5.6	Simple problems in Non-traditional optimization techniques	2
	Total	45

1. Dr. J.Abdul Bari- abdulbari@ksrct.ac.in

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		Category	L	Т	Ρ	Credit
60PSE E24	BRIDGE ENGINEERING	PE	3	0	0	3

- To identify the Classification of bridges
- To understand the roads on bridges, design of solid slab, bridges, R.C. girder bridges, long span girder bridge and plate girder bridges.
- To Design of prestressed concrete bridges.
- To learn bearing, sub structures and footings for bridges.
- To discuss about construction and maintenance of bridges.

#### Prerequisite

Basic knowledge of RCC, Steel Structures and Prestressed Concrete & Concrete Technology. **CourseOutcomes** 

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

CO1	List out the components and classification of a bridge.	Apply,
		Analyze
CO2	Design a deep foundation and well foundation.	Analyze
CO3	List out the different forms of reinforced bridges.	Understand
CO4	List out the different forms of steel bridges.	Apply
CO5	Show the rehabilitation for bridges.	Analyze

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2							3
CO2	2	3	3	2	2							1
CO3	3	3		3	2							2
CO4	3	3	2	2	2							2
CO5	3	3	2	1	3							2
3- Stro	ng;2-Me	dium;1-	Some				•		•	•	•	•

### Assessment Pattern

Plaam's Catagany	ContinuousAsse	End SemExamination	
Bloom'sCategory	1	2	(Marks)
Knowledge (Kn)	10	10	10
Apply (Ap)	40	40	60
Analyse (An)	10	10	30
Create (Cr)	0	0	0

S. W. **BoS Chairman** CHAIRMAN CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

	r	igusuniy oon	eye ol lec	hnology – Auto	nomous	VZVZZ		
		60PSE E	24 -BRIDO	GE ENGINEERIN	NG			
			RUCTURA	L ENGINEERIN				
Semester		lours / Week		Total Hours	Credit	1	aximum I	
	L	Т	Р		С	CA	ES	Total
Introduction	3	0	0	45	3	40	60	100
bridge – preli	d components of a minary data collect ghway and railway Substructure	tion – choice a	and type of					
Analysis and well foundation	design of foundation on – caisson found concrete rocker and	lation – piers a	and abutme	ents – bridge bea				er bearings
A	Superstructure							[9
types – slab l Pigeaud's the method – infl	oncrete and prestr hollow and voided eory – skew slab o luence lines –bala – Pre-stressed cor	slab – beam deck – RC tee inced Cantilev	– slab box e beam an er bridge -	– reinforced cor d slab bridge – – rigid frame bri	ncrete slat continuou dge – box	o bridge s beam k girder	– load dis bridge – t bridge – l	stribution - fixed poin bow string
Plate girder b members – si	oridge – box girder uspension bridge –	- cable stayed						
Construction	n <b>And Maintenanc</b> methods – short s and maintenance –	span – long sp		work for concre	te hridaes	– constr	uction ma	
			ridge – reh				d testing c	
			ridge – reh				-	of bridges.
Text book (s	):		ridge – reh				-	of bridges. [9
Text book (s)	<b>) :</b> vamy, S., "Bridge E	Engineering", T		abilitation of a b	ridge failur	es – load	-	of bridges. [9
1 Ponnusv	vamy, S., "Bridge E .W., Thomson, S.I		ata McGra	abilitation of a b	ridge failur New Delh	res – load	Total	of bridges. [9 <b>Hours: 4</b>
1 Ponnusv 2 Taylor, F Newyork	vamy, S., "Bridge E F.W., Thomson, S.I a, 2005.		ata McGra	abilitation of a b	ridge failur New Delh	res – load	Total	of bridges. [9 <b>Hours: 4</b>
1 Ponnusv 2 Taylor, F Newyork Reference(s)	vamy, S., "Bridge E .W., Thomson, S.I , 2005. : Victor, D., "Esse	E., and Smulsk	ata McGra ki, E., "Rein	abilitation of a b aw –Hill Pub co., nforced Concrete	ridge failur New Delh Bridges",	i, 2010. John Wi	Total	of bridges. [9 <b>Hours: 4</b> ons,
1     Ponnusv       2     Taylor, F       Newyork       Reference(s)       1     Jhnson       New Del	vamy, S., "Bridge E .W., Thomson, S.I , 2005. : Victor, D., "Esse	E., and Smulsk entials of Bri	Tata McGra ki, E., "Rein dge Engir	abilitation of a b aw –Hill Pub co., forced Concrete neering", Oxforc	New Delh Bridges",	res – Ioad i, 2010. John Wi Publish	Total	of bridges. [9 <b>Hours: 4</b> ons,
1Ponnusy2Taylor, FNewyorkReference(s)1Jhnson1New Del2Krishna3Bakht B	vamy, S., "Bridge E .W., Thomson, S.I , 2005. ) : Victor, D., "Esse hi, 2009.	E., and Smulsk entials of Bri of Bridge", Oxfo	Tata McGra ki, E., "Rein dge Engir	abilitation of a b aw –Hill Pub co., nforced Concrete neering", Oxforc	New Delh Bridges", & IBH New Delh	res – Ioad i, 2010. John Wi Publish ni, 2008.	Total	of bridges. [9 Hours: 4 ons, Pvt. Ltd.



### **Course Contents and Lecture Schedule**

S.No	Торіс	No.of Hours
1	Introduction	
1.1	Definition and components of a bridge	1
1.2	layout and planning of a bridge	1
1.3	classification	1
1.4	investigation of a bridge	1
1.5	preliminary data collection	1
1.6	choice and type of a bridge	1
1.7	hydraulic design of a bridge	1
1.8	traffic design	1
1.9	loading – highway and railway loading – specification	1
2	Analysis of Substructure	
2.1	Analysis and design of foundation	1
2.2	shallow foundation – open foundation	1
2.3	deep foundation – pile foundation	1
2.4	well foundation – caisson foundation.	1
2.5	piers and abutments – bridge bearing	2
2.6	steel rocker and roller bearings	1
2.7	reinforced concrete rocker and roller bearings	1
2.8	elastomeric bearings	1
3	Analysis of Superstructure	
3.1	Reinforced concrete and prestressed concrete bridge:	1
3.2	Straight and curved bridge decks - decks of various types	1
3.3	slab hollow and voided slab – beam – slab box	1
3.4	Reinforced concrete slab bridge – load distribution – Pigeaud's theory – skew slab deck	1
3.5	RC tee beam and slab bridge – continuous beam bridge – fixed point method	1
3.6	influence lines –balanced Cantilever bridge – rigid frame bridge –	1
3.7	box girder bridge – bow string girder bridge	1
3.8	Pre-stressed concrete bridge – analysis and design for static, moving and dynamic loading	2
4	Steel Bridge	
4.1	Plate girder bridge	2
	box girder bridge – composite beam bridge	1
4.2	ber gilder blidge beilipeelle bedit blidge	

AW RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

	Total	45
5.8	load testing of bridges	1
5.7	rehabilitation of a bridge failures	1
5.6	lesson from bridge	1
5.5	inspection and maintenance	1
5.4	construction management	2
5.3	false work for concrete bridges	1
5.2	short span – long span	1
5.1	Construction methods	1
5	Construction And Maintenance	
4.7	moving and dynamic loading	1
4.6	analysis for static,	1
4.5	cable stayed bridge	1
4.4	suspension bridge	1

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		Category	L	Т	Ρ	Credit
60PSE E25	NON LINEAR ANALYSIS OF STRUCTURES	PE	3	0	0	3

- Analyze the bar system considering the material and geometric nonlinearity.
- Perform inelastic analysis of flexural members.
- Perform vibration analysis of flexural members.
- Perform elastic and inelastic analysis of Plates.
- Perform nonlinear and instability analysis of elastically supported beams.

#### Prerequisite

Basic knowledge of Soil Mechanics, Geology & Mathematical **CourseOutcomes** 

000130		
On the	successful completion of the course, students will be able to	
CO1	Describe the concept of Non-Linear Analysis of the structures	Remember, Understand, Apply
CO2	Analyse the members subjected to deformations and analysis of bars with and without restraints	Remember, Understand, Analyze
CO3	Apply the knowledge of vibration theory on flexural members and identify its behaviour under cyclic loading	Remember, Understand, Apply, Analyze
CO4	Identify the Non-linear behaviour of plates.	Analyze
CO5	Solve the elemental equation of beams Non linear vibrations	Understand and Apply
Manain	an with Dramonome Outcomes	

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	3	2	3
CO2	3	2	3	2	3	2
CO3	3	3	2	3	2	3
CO4	2	2	2	2	2	2
CO5	3	3	2	3	2	3
	3- 8	Strong;2	-Mediu	m;1-Sor	ne	

#### Assessment Pattern

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

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4. Wy Ros Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College 1 technology TIRUCHENGODE - 637 215

	60	PSE E25 -NC	N LINEAR A	NALYSIS OF STR	RUCTURE	S		
		M.E.	STRUCTUR	AL ENGINEERING	3			
			Elec	tive II				
Somootor	Hours / Week				Credit	Maximum Marks		
Semester	L	Т	Р	Total Hours	С	СА	ES	Tota
11	3	0	0	45	3	40	60	100

determinate and statically indeterminate bar systems of uniform and variable thickness. [9] INELASTIC ANALYSIS OF FLEXURAL MEMBERS : Inelastic analysis of uniform and variable thickness members subjected to small deformations; inelastic analysis of bars of uniform and variable stiffness members with and without axial restraints [9]

VIBRATION THEORY AND ANALYSIS OF FLEXURAL MEMBERS : Vibration theory and analysis of flexural members; hysteretic models and analysis of uniform and variable stiffness members under cyclic loading [9] ELASTIC AND INELASTIC ANALYSIS OF PLATES : Elastic and inelastic analysis of uniform and variable thickness plates [9]

NONLINEAR VIBRATION AND INSTABILITY: Nonlinear vibration and Instabilities of elastically supported beams. [9]

	Total Hours: 45
Text	book (s) :
1	Gang Li, Kevin Wong ,"Theory of Nonlinear Structural Analysis: The Force Analogy Method for Earthquake Engineering", Wiley,1st edition (23 June 2014).
2	Fertis, D.G, Non-linear Mechanics, CRC Press, 1999.
Refe	rence(s) :
1	Sathyamoorthy.M, Nonlinear Analysis of Structures, CRC Press, 2010.
2	Reddy.J.N, Non-linear Finite Element Analysis, Oxford University Press, 2008.
3	F.C. Filippou and G.L. Fenves, "Methods of Analysis for Earthquake-Resistant Structures" from "Earthquake Engineering, From Engineering Seismology to Performance-Based Engineering", CRC Press, 2004.
4	McGuire, William; Gallagher, Richard H.; and Ziemian, Ronald D., "Matrix Structural Analysis, 2nd Edition" 2000.

#### Course Contents and Lecture Schedule

S.No	Торіс	No.of Hours
1	INTRODUCTION TO NONLINEAR ANALYSIS	
1.1	Material nonlinearity	1
1.2	Geometric nonInearity	1
1.3	Statically determinate bar systems of uniform thickness	1
1.4	Statically indeterminate bar systems of uniform thickness	2
1.5	Statically determinate bar systems of variable thickness	2
1.6	Statically indeterminate bar systems of variable thickness	2

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2	INELASTIC ANALYSIS OF FLEXURAL MEMBERS	
2.1	Inelastic analysis of uniform thickness members subjected to small deformations	1
2.2	Inelastic analysis of variable thickness members subjected to small deformations	1
2.3	inelastic analysis of bars of uniform stiffness members with axial restraints	1
2.4	inelastic analysis of bars of variable stiffness members with axial restraints	2
2.5	inelastic analysis of bars of uniform stiffness members without axial restraints	2
2.6	inelastic analysis of bars of variable stiffness members without axial restraints	2
3	VIBRATION THEORY AND ANALYSIS OF FLEXURAL MEMBERS	
3.1	Vibration theory – Basic introductions	1
3.2	Analysis of Flexural Members	1
3.3	Hysteretic Models	1
3.4	Analysis of uniform stiffness members under cyclic loading	2
3.5	Analysis of variable stiffness members under cyclic loading	2
3.6	Problems related to cyclic loading	2
4	ELASTIC AND INELASTIC ANALYSIS OF PLATES	
4.1	Elastic analysis of uniform plates	2
4.2	In Elastic analysis of uniform plates	2
4.3	Elastic analysis of variable thickness plates	2
4.4	In Elastic analysis of variable thickness plates	2
4.5	Simple Problems	1
5	NONLINEAR VIBRATION AND INSTABILITY	
5.1	Nonlinear vibration	3
5.2	Instabilities of elastically supported beams	3
5.3	Problems related to nonlinear vibrations	3
	Total	45

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4.10-

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	ENVIRONMENTAL MONITORING	Category	L	Т	Ρ	Credit
60PSE E26	INSTRUMENTS	PE	3	0	0	3

- To understand the chemical analysis of water
- To know the analysis of pollutants.
- To find the methods for toxic organics estimation.
- To learn the non-destructive methods of analysis.
- To provide knowledge about monitoring analyzers.

## Pre requisite

Basic knowledge of Environmental Engineering courses

#### **Course Outcomes**

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

CO1	Able to select appropriate instrumental method for chemical analysis.	Knowledge/ Analyse/ Apply
CO2	Explore spectroscopic methods of analysis of pollutants	Knowledge/ Analyse/ Apply
CO3	Select the correct method for toxic organics estimation using chromatography methods	Knowledge/ Analyse/ Apply
CO4	Understand electro and nondestructive methods of analysis	Knowledge/ Analyse/ Apply
CO5	Identify the continuous monitoring instruments	Knowledge/ Analyse/ Apply

### Mapping with Programme Outcomes

COs	P01	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	3	3
CO2	3	2	2	3	3	2
CO3	2	3			3	2
CO4	3	2		2	3	1
CO5	3	2	3	3	2	2

#### Assessment Pattern

	ContinuousAsse	ssmentTests (Marks)	End SemExamination
Bloom'sCategory	1	2	(Marks)
Knowledge (Kn)	20	20	30
Apply (Ap)	30	20	50
Analyse (An)	10	20	20
Create (Cr)		-	-

4. Ng Ros Chairman CHAIRMAN Board of Staties Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

				echnology–A NTAL MONIT			_	
		MES	TRUCTU	RAL ENGINE	FRING			
Semes	ter Hours	Week		Total hrs	Credit		Maximum	Marks
comee	L	T	Р	rotarmo	C	CA	ES	Total
	3	0	0	45	3	40	60	100
	nentals	-	-		-			[09
Vet ch and acc	emistry methods and th curacy, error in measurin ation and analyte isolatio	ng signals <sup>,</sup>						ision
Principl urbidim jenerat	oscopic Methods es, techniques and a netry, Atomic Absorptio tion), Atomic Emission (ICP) – TOC Analyzer	n Spectro	metry (Fla	ame, graphite	furnace, co	old vapou	ir and hyd	dride
Principl HPLC)	atrographic Methods es, techniques and ap and lon Chromatograp s) analysis, ICP-MS							
Electro	o and Radio Analytical es, techniques and a							[08
Analyze	er. amperometry, pola	rography,	electro-c	apillary analy	sis, Neutro			AOX
Analyze (NAA), <b>Contin</b> Principl NOx, fl	er. amperometry, pola X-ray Fluorescence (XF uous Monitoring Instru- es, techniques and app uorescent analyzer for	rography, RF) and X- uments blications of	electro-c ray Diffrac of NDIR a	apillary analy ction (XRD) me nalyzer for CC	sis, Neutro thods. ), chemilun	n Activa	ation Ana	AOX alysis for
Analyze NAA), Contin Principl NOx, fl	er. amperometry, pola X-ray Fluorescence (XF uous Monitoring Instru- es, techniques and app	rography, RF) and X- uments blications of	electro-c ray Diffrac of NDIR a	apillary analy ction (XRD) me nalyzer for CC	sis, Neutro thods. ), chemilun	n Activa	ation Ana	AOX alysis for sing
Analyze NAA), Contin Principl NOx, fl low inje	er. amperometry, pola X-ray Fluorescence (XF uous Monitoring Instru- es, techniques and app uorescent analyzer for	rography, RF) and X- uments blications of	electro-c ray Diffrac of NDIR a	apillary analy ction (XRD) me nalyzer for CC	sis, Neutro thods. ), chemilun	n Activa	ation Ana analyzer quality us	AOX alysis for sing
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Course	<b>Contents</b> and	l Lecture	Schedule
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S.No	Торіс	No.of Hours
1	Fundamentals	
1.1	Wet chemistry methods	1
1.2	instrumental methods	2
1.3	error in measuring signals	2
1.4	quality control & assurance	2
1.5	sample preparation and analyte isolation	2
2	Spectroscopic Methods	
2.1	techniques and applications of spectrophotometry	2
2.2	fluorimetry, nephelometry and turbidimetry	2
2.3	Atomic Absorption Spectrometry	2
2.4	Atomic Emission Spectrometry	2
2.5	flame photometry and Inducted Coupled Plasma (ICP)	2
2.6	TOC Analyzer	2
3	Chromatrographic Methods	
3.1	Principles, techniques and applications of GC,	2
3.2	high performance liquid chromatography	2
3.3	Ion Chromatography	2
3.4	hyphenated techniques for environmental contaminant analysis	2
4	Electro and Radio Analytical Methods	
4.1	Introduction to Electro and Radio Analytical Methods	1
4.2	Principles, techniques and applications of conductometry, potentiometry, coulometry,	2
4.3	AOX Analyzer. amperometry, polarography	2
4.4	electro-capillary analysis	1
4.5	Neutron Activation Analysis	1
4.6	X-ray Fluorescence (XRF) and X-ray Diffraction (XRD) methods.	1
5	Continuous Monitoring Instruments	
5.1	Principles, techniques and applications of NDIR analyzer for CO	2
5.2	chemiluminescent analyzer for NOx	2
5.3	fluorescent analyzer for SO2	1
5.4	particulates analysis	1
5.5	auto analyzer for water quality using flow injection analysis	2
	Total	45

1. Dr. S.Ramesh

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A.W. هيماني RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		Category	L	Т	Ρ	Credit
60PSE E27	MUNICIPAL SOLID WASTE MANAGEMENT	PE	3	0	0	3

- To know the types, sources, generation of municipal solid waste ٠
- To understand the Storage, collection, transport, of municipal solid waste. •
- To learn the design and operation aspects of sanitary landfills. •
- To acquire knowledge on waste processing
- To study the source reduction and onsite storage methods. •

#### Pre requisite

Basic knowledge of properties learnt in waste management courses Course Outcomes

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

CO1	. Identify the sources, types and characteristics of solid wastes.	Knowledge/ Analyse/ Apply
CO2	Describe the health, environmental effects and solid waste management strategies	Knowledge/ Analyse/ Apply
CO3	Choose the on-site storage methods and segregation of municipal solid wastes	Knowledge/ Analyse/ Apply
CO4	Summaries the methods of collection and operating, maintenance of transfer station	Knowledge/ Analyse/ Apply
CO5	Explain the off-site processing techniques and equipments.	Knowledge/ Analyse/ Apply

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	2	2	2
CO2	3	3	2	2	2	2
CO3	3	3			2	1
CO4	2	2		3	3	1
CO5	3	2	2	3	3	1

#### Assessment Pattern

Bloom'sCategory -		Assessment Tests Marks)	End Sem Examination
Dicom Sourcegory	1	2	(Marks)
Knowledge (Kn)	20	20	30
Apply (Ap)	30	20	50
Analyse (An)	10	20	20
Create (Cr)		-	-

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<u>4</u>. No RAS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College 1 technology TIRUCHENGODE - 637 215

				Technology-/					
	60PS			L SOLID WAS		GEMENT			
M.E – Structural Engineering           Semester         Hours/Week         Total hrs         Credit         MaximumMarks									
Semester				Total firs					
	L 3	T 0	P 0	45	C 3	CA 40	ES 60	Total 100	
	Ŧ	0	0	45	3	40	00		
Sources an	d types of municipa	al solid wa	stes-Was	ste generation	rates-facto	rs affectir	na aeneratio	[ <b>09]</b>	
	ics-methods of sa								
	lic health and envir								
	(M&H) rules- Integr								
Role of NG	* -								
	duction and On-Si							[09]	
	uction of waste- Re								
	aterials used for co								
	open storage – was and Transfer	te segrega	tion and s	storage – case	studies und	der Indian	conditions	_	
	Residential and c	ommorcial	l wasta c	olloction C		hieles	Mannawar		
	routes – Analysis								
	maintenance; optic							',	
	of Wastes				probleme	oorring.		[09]	
	of waste processi	ng – Phys	sical Proc	cessing techni	ques and	Equipmer	nts; Resour		
ecovery fr	om solid waste co	mposting	and bion	nethanation; T	hermal pro	cessing	options- ca	se	
	ler Indian conditions	S.			-	_	-		
Disposal								[09]	
	sal of solid waste;								
	andfill liners - Mana	gement of	leach ate	e and landfill g	as – Land fi	ill Bioread	ctorDumps	ite	
Rehabilitati	on								
							TotalHour	s 45	
Textbook	(s):								
1. T.V Ra	amachandra, "Mana	gement of	Municipa	I solid waste"	TERI Press	, 2010			
2. Georg	e Tchobanoglous a	nd Frank K	(reith, "Ha	andbook of Sol	id waste Ma	anagemer	nt", Mc Grav	v Hill,	
	ork, 2002.								
Reference	e(s):								
1. Handb	ook of Solid Waste	Managem	ent (McG	raw-Hill Handt	books), 2002	2			
2. Paul T	Williams, "Waste T	reatment a	and Dispo	sal", John Wil	ey and Sons	s, 2000.			
	al on Municipal Solic nment of India, New			nt, CPHEEO, I	Ministry of L	Jrban Dev	/elopment,		
	er A.G.R and Keelin			ndhook of Dro		Doovolin			
	s", Lewis Publisher				cessing and	кесусии	ig of Munici	bai solid	

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#### Course Contents and Lecture Schedule

S.No	Торіс	No.of Hours
1	Sources and Types	
1.1	Sources and types of municipal solid wastes	1
1.2	Waste generation rates	1
1.3	factors affecting generation	1
1.4	methods of sampling	1
1.5	Effects of improper disposal of solid wastes	1
1.6	Public health and environmental effects	1
1.7	Elements of solid waste management	1
1.8	Municipal solid waste (M&H) rules	1
1.9	Public awareness; Role of NGO's	1
2	Source Reduction and On-Site Storage	
2.1	Source reduction of waste	1
2.2	Reuse and Recycling	1
2.3	On-site storage methods-	2
2.4	Effect of storage on material	1
2.5	materials used for containers	1
2.6	segregation of solid wastes	1
2.7	Public health and economic aspects of open storage	1
2.8	waste segregation and storage	1
3	Collection and Transfer	
	vehicles – Manpower –Collection routes – Analysis of collection systems; Transfer stations – Selection of location, operation & maintenance; options under Indian conditions – Field problems – solving. Me	
3.1	Methods of Residential and commercial waste collection	1
3.2	Collection vehicles	2
3.3	Collection routes	1
3.4	Analysis of collection systems	2
3.5	Transfer stations	1
3.6	Selection of location for transfer stations	1
3.7	operation & maintenance transfer stations	1
4	Processing of Wastes	
4.1	Objectives of waste processing	1
4.2	Physical Processing techniques and Equipments	2
4.3	Resource recovery from solid waste	2
4.4	composting and biomethanation	1

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4.5	biomethanation	1
4.6	Thermal processing options	1
4.7	case Studies	1
5	Disposal	
5.1	Land disposal of solid waste	1
5.2	Sanitary landfills site selection	1
5.3	design and operation of sanitary landfills	2
5.4	Landfill liners	1
5.5	Management of leach ate and landfill gas	2
5.6	Land fill Bioreactor	1
5.7	Dumpsite Rehabilitation	1
	Total	45

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		Category	L	Т	Ρ	Credit
60PSE E31	SOIL STRUCTURE INTERACTION	PE	3	0	0	3

- To know Soil foundation interaction problems, behaviors and models.
- To understand the elastic foundation soil models and plate on elastic medium
- To design plate types, numerical analysis of finite plates,
- To develop elastic analysis of single pile and group of piles based on settlement.
- Interaction analysis of piles and about the analysis of laterally loaded piles.

#### Prerequisite

Basic knowledge of Soil Mechanics, Foundation Design & Geology.

#### CourseOutcomes

On the	On the successful completion of the course, students will be able to				
CO1	Generate concepts of soil structure Interaction	Apply			
CO2	Assess the soil models as isotropic elastic half-space	Apply			
CO3	Formulate winkler foundation model for elastic continum	Understand			
CO4	Calculate elastic medium for rectangular and circular plates	Apply			
CO5	Estimate the load distribution in pile.	Analyze			

#### Mapping with Programme Outcomes

COs	P01	PO2	PO3	PO4	PO5	PO6		
CO1	3	3	2	3	2	3		
CO2	3	3	3	2	2	2		
CO3	3	3	2	3	2	2		
CO4	3	3	2	2	2	2		
CO5	3	3	2	3	3	3		
	3- Strong;2-Medium;1-Some							

#### Assessment Pattern

Bloom's Category	ContinuousAsse	End SemExamination	
Bloom'sCategory	1	2	(Marks)
Knowledge (Kn)	10	10	10
Apply (Ap)	40	40	60
Analyse (An)	10	10	30
Create (Cr)	0	0	0

4. W K.S.Rangasamy College - 637 215

		K.S.Ra	angasamy C	ollege of Te	chnology – Autonom	ous R2022			
			60PSE E31	-SOIL STR		ON			
			M.E.	STRUCTUR	RAL ENGINEERING				
Elective III									
Som	nester Total Hours							timum	Marks
Ucili	03101	L	Т	Р	Total Hours	С	CA	ES	Total
	II	3	0	0	45	3	40	60	100
paramet Beam o Infinite be <b>Plate or</b> Infinite p rectangu Elastic a Interacti Laterall Load de	er elastic n Elastic beam, two ams in rela- blate, Winh ular and ci Analysis on analysis on analysis y Loaded eflection	models, Elas Foundation parameters ation to their Medium kler, Two par rcular plates of Pile single pile, is, Load distr Pile prediction fo	stic plastic be - Soil Model , Isotropic ela stiffness. rameters, Iso , Numerical a Theoretical s ibution in pile	haviour, Tin <b>s</b> astic half-sp tropic elastic analysis of fi olutions for e. aded piles,	alysis, Soil response ne dependent behaviou ace, Analysis of beam c medium, Thin and thic nite plates, Simple solu settlement and load dis Sub grade reaction tharts.	ır. s of finite lei ck plates, Ar tions. stributions, <i>A</i>	ngth, Cl nalysis c Analysis analys	assific of finite of pile is, Int	[9] ation of [9] plates, [9] group, [9]
Text bo	ok (s) :						10		ours: 45
		A.P.S., "Elas	stic Analysis	of Soil Foun	dation Interaction", Else	evier, 2009			
	oulos, H.G	., and Davis	, E.H., "Pile F	oundation A	Analysis and Design", J	ohn Wiley, 2	2001		
Referen	ce(s) :								
1 So	cott, R.F.,	"Foundation	Analysis", Pr	entice Hall,	2011				
2 St	ructure-So	oil Interaction	n – State of A	rt Report", I	nstitution of Structural I	Engineers, 2	018		
3 C	oncrete In	stitute, Delhi	, 2011	U U	ocedures for combine	U			
	akash, S. ork, 1990.	, and Sharn	na, H. D., "P	ile Foundat	ions in Engineering Pr	actice."John	Wiley	& Sor	ns, New

#### **Course Contents and Lecture Schedule**

S.No	Торіс	No.of Hours
1	Soil-Foundation Interaction	
1.1	Introduction to soil	1
1.2	foundation interaction problems	1
1.3	Soil behaviour, Foundation behaviour	1
1.4	Interface behaviour	2
1.5	Scope of soil foundation interaction analysis	1
1.6	Soil response models	1

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1.9 <b>2</b>	Time dependent behaviour Beam on Elastic Foundation- Soil Models	1
2.1	Infinite beam,	1
2.2	two parameters,	2
2.3	Isotropic elastic half-space,	2
2.4	Analysis of beams of finite length,	
2.5	Classification of finite beams	2
2.6	Classification of finite beams in relation to their stiffness	1
3	Plate on Elastic Medium	
3.1	Infinite plate, Winkler	1
3.2	Two parameters	1
3.3	Isotropic elastic medium,	1
3.4	Thin and thick plates,	1
3.5	Analysis of finite plates,	1
3.6	rectangular and circular plates,	1
3.7	Numerical analysis of finite plates, Simple solutions	1
3.8	Simple solutions	2
4	Elastic Analysis of Pile	
4.1	Elastic analysis of single pile,	2
4.2	Theoretical solutions for settlement	2
4.3	Theoretical solutions for settlement and load distributions,	2
4.4	Analysis of pile group	1
4.5	Interaction analysis,	1
4.6	Load distribution in pile.	1
5	Laterally Loaded Pile	
5.1	Load deflection prediction for laterally loaded piles,	2
5.2	Sub grade reaction and	2
5.3	elastic analysis,	1
5.4 5.5	Interaction analysis, Pile raft system, ,	2
5.5 5.6	Solutions through influence charts	1
5.0		
	Total	45
se Des		

1. Dr.D.SIVAKUMAR - sivakumard@ksrct.ac.in

		Category	L	Т	Ρ	Credit
60PSE E32	DESIGN OF SHELL STRUCTURES	PE	3	0	0	3

A. W. Ros Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

- Classification of shells, membrane theory of shells, and design of folded plate structures
- Design philosophy of space frame, optimization techniques and structural theorems
- Study the behaviour and design of shells, folded plates, space frames and application of FORMIAN software.
- To expose the students the principles of design of folded plates.
- Students will be introduced to general principles of design Philosophy and behaviour.

#### Prerequisite

Fundamentals of Mathematics, knowledge of strength of materials and its mechanics and

theory of elasticity and plasticity.

### Course Outcomes

Onthesuccessful completion of the course, students will be able to

CO1	Analyze various types of shells and using membrane theory.	Evaluate
CO2	Analyze various shapes of plates using various methods.	Evaluate
CO3	Principles and design philosophy of space frames.	Evaluate
CO4	Analyze and design space frames.	Evaluate
CO5	Analyze various optimization structural members.	Apply

### MappingwithProgrammeOutcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	1	3	1	1
CO2	3	3	1	3	1	1
CO3	3	3	1	3	1	1
CO4	3	3	1	3	1	1
CO5	3	3	1	3	1	1
	3_0	Strong		m·1_Sor	mo	

3- Strong;2-Medium;1-Some

#### AssessmentPattern

	ContinuousAsse	End SemExamination	
Bloom'sCategory	1 2		(Marks)
Remember	10	10	10
Understand	10	10	10
Apply	10	10	20
Analyse	10	10	20
Evaluate	10	10	10
Create	10	10	30

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4. Wr **BoS Chairman** 

RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		60			OF SHELL S		_0		
				TRUCTU	RAL ENGINE	ERING			
Semest							larks		
		L	Т	Р		С	CA	ES	Total
		3	0	0	45	3	40	60	100
Classif	fication	eory of Shells of shells – Typ shells of transla						– Shells	of <b>[09</b>
	d Plate s	<b>ded Plates</b> tructures – struc	ctural beha	aviour – T	ypes – Design	by ACI – A	SCE Tasl	k Committe	e [09
	frames	- Design Philos – configuratior		of nodes	s – general p	rinciples of	design F	hilosophy	- [09
Analys	sis of S	p <b>ace Frames</b> ace frames – Fo	rmex Alge	bra, Forn	nian – Detaileo	l design of S	Space frai	nes	[09
Optim	ization								1 1/1/4
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Shell surfaces 1.1 1 1.2 Classification of shell surfaces 1 1.3 Surfaces of revolution 1 1.4  $\Delta$ -forms of surfaces 2 1.5 Folded plates 2 1.6 Characteristics of shell surfaces. 2 2 **Design of Folded Plates** 

A.Wr فتصري RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

2.1	Surfaces and its related aspects	1
2.2	Curvatures of a surface	1
2.3	Curves and related aspects	1
2.4	Structural behaviour of shell	1
2.5	Stress-strain relationships	1
2.6	Equilibrium equations	1
2.7	Equilibrium equations for thin shell elements in membrane state	1
2.8	Curvilinear coordinate system	1
2.9	Shells of revolution	1
3	Space Frame - Design Philosophy	
3.1	Analysis of shells	2
3.2	Membrane analysis	2
3.3	Axisymmetric loading	1
3.4	Concentrated load – Self weight	1
3.5	Uniform loading – Pressure loading	1
3.6	Hydrostatic loading	1
3.7	Non-axisymmetric loading – Wind load	1
4	Analysis of Space Frames	
4.1	Spherical domes under concentrated load and under self-weight	2
4.2	Bending analysis	1
4.3	Axisymmetric case – Equilibrium equations for thin shells of revolution in bending	1
4.4	Equilibrium equations in orthogonal curvilinear coordinate system	1
4.5	Bending equation of spherical lattice domes	1
4.6	Cylindrical shells – Equilibrium equations – DKJ theory	1
4.8	Cylindrical shells – Equilibrium equations – Jenkin's theory	1
5	Optimization	
5.1	Beam method of analysis	2
5.2	Merits and demerits – Case studies for simply supported cylindrical shells – without and with edge beams	1
5.3	Design of shells based on membrane theory - Shells having semicircular directrix	1
5.4	Design of shells based on membrane theory - Shells with circular directrix	1
5.5	Design of shells based on beam theory	1
5.6	Design aspects of paraboloid, hyperboloid and hyperbolic paraboloid shells	1
5.7	Analysis and structural behaviour of folded plates and its various types	1
5.8	Design of folded plates by ACI-ASCE Task Committee method	1
	Total	45

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AW هيماني RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		Category	L	Т	Ρ	Credit
60PSE E33	OFF SHORE STRUCTURES	PE	3	0	0	3

- To understand the demand for coastal and offshore structures, overview of different types of ocean structures.
- To get exposed to structural geometry, analysis methods, design techniques, construction practice, different types of material, guidelines associated with selection of materials for marine environment.
- To learn various types of structural systems/forms, brief overview of various environmental loads.
- To be familiar with the problems associated with the material behavior in marine environment and various protection methods.
- To understand the inspection and testing methods, repair and rehabilitation processes.

#### Prerequisite

Fundamentals of Mathematics, knowledge of Mechanics of Materials, Statics, Concrete Technology and Concrete Design

#### CourseOutcomes

Onthesuccessful completion of the course, students will beable to

CO1	Understand the functions and behaviour of offshore structures	Understand
CO2	Identify the different types of loads acting on the structures	Understand
CO3	Understand the behaviour of waves and its effects on structures	Understand
CO4	Evaluate the behaviour of structures for its dynamic loads	Evaluate
CO5	Design of offshore structures with failure probability	Create

#### MappingwithProgrammeOutcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	3		2	2
CO2	2	2	3		2	2
CO3	1	2	1	3	2	
CO4	2	2	3	3	2	2
CO5	2	2	3	2	3	
	3- 8	Strong;2	2-Mediu	m;1-Sor	ne	

#### AssessmentPattern

Plaam's Catagony	ContinuousAsse	End SemExamination	
Bloom'sCategory	1 2		(Marks)
Remember	10	10	10
Understand	10	10	10
Apply	10	10	20
Analyse	10	10	20
Evaluate	10	10	10
Create	10	10	30

4. 16 **BoS Chairman** CHAIRMAN Baculty of Civil Engineering Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

	K.S.Rang			Technology–A		us R2022		
				SHORE STRU				
	Llauma	<u>M.E. S</u> /Week	TRUCTU				/aximum Ma	aulta
Semester	.      .	1		Total hrs	Credit	_		
	L 3	<u>Т</u>	P	45	C 3	CA	ES	Total
II VAVE THE	Ũ	0	0	45	3	40	60	100
	ration process, sma	ll, finite an	nplitude a	nd nonlinear w	ave theorie	S.		[09]
	<b>F OFFSHORE STR</b> s, wave forces on sn		-	e bodies - curr	ent forces -	Morison	equation.	[09]
Different ty nodeling.	E SOIL AND STRUE pes of offshore s	structures,	foundat	-	fixed jacl	ket platfo	orm structur	[ <b>09]</b> al
Static meth	OF OFFSHORE ST od of analysis, found	dation ana	lysis and	dynamics of o	ffshore stru	ctures.		[09]
	F OFFSHORE STR latforms, helipads, .			is and design	of mooring	cables an		[09]
Tauthaal	(-)-						TotalHours	s 45
Textbook					<u></u>			
	ly. D. V and Swamic		-					
1987		odynamics	of Offsho	ore Structures'	', Computat	tional me	chanics Pub	lications
Reference	e(s):							
	P 2A-WSD, Planning gn – API Publishing			onstructing Fix	ed Offshore	Platform	s – Working	Stress
	F. Wilson, Dynami			tures, John W	iley and So	ns, Inc, 20	003.	
	dy, D. V. and Arocki any,1991	asamy, M.	, Offshore	e Structures, V	ol. 1 and V	ol. 2, Krie	ger Publishi	ng
	ut Sarpkaya, Wave I	Forces on	Offshore	Structures, Ca	ımbridge Ur	niversity F	Press, 2010.	
Course C	ontents and Lectu	re Schedu	ıle					

S.No	Торіс	No.of Hours
1	WAVE THEORIES	
1.1	Types of offshore structures and conceptual development	1
1.2	Analytical models for jacket structures	1
1.3	Materials and their behaviour under static and dynamic loads	1
1.4	Statutory regulations	2
1.5	Allowable stresses	2
1.6	Various design methods and Code Provisions	2
2	FORCES OF OFFSHORE STRUCTURES	
2.1	Design specification of API, DNV, Lloyd's and other classification societies	1

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	Total	45
5.8	Behavior of steel at elevated temperature	1
5.7	Fire Rating for Hydrocarbon fire	1
5.6	Design of structures for high temperature	1
5.5	Blast Mitigation	1
5.4	Blast walls; Platform survival capacity and Plastic design methods.	1
5.3	Palmgren-Miner cumulative damage rule	1
5.2	Fatigue behaviour	1
5.1	Fatigue of tubular joints	2
5	DESIGN OF OFFSHORE STRUCTURES	
4.7	External hydrostatic pressure	1
4.6	Stiffened tubes	1
4.5	Chord collapse and ring stiffener spacing	1
4.4	Stress concentration	1
4.3	Overlapping braces	1
4.2	Punching shear Stress	2
4.1	Elastic stress distribution	2
4	ANALYSIS OF OFFSHORE STRUCTURES	
3.7	Kuang's formulae	1
3.6	Parameters of in-plane tubular joints	1
3.5	In plane and multi plane connections	1
3.4	Cylindrical and rectangular structural members	1
3.3	Eccentric connections and offset connections	1
3.2	Possible modes of failure	2
3.1	Introduction to tubular joints	2
3	OFFSHORE SOIL AND STRUCTURE MODELLING	
2.9	Design of structural elements	1
2.8	Use of approximate methods	1
2.7	Principles of Static and dynamic analyses of fixed platforms	1
2.6	Concept of Return waves	1
2.5	Maximum wave force on offshore structure	1
2.4	Morison's Equation	1
2.3	Environmental loads due to wind, wave, current and buoyancy	1
2.2	Construction of jacket and gravity platforms 28102 Module II Loads on offshore structures	1

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		Category	L	Т	Ρ	Credit
60PSE E34	EXPERIMENTAL TECHNIQUES AND INSTRUMENTATION	PE	3	0	0	3
Objective						
<ul> <li>To learn th</li> <li>To unders</li> <li>To acquire</li> <li>To learn p</li> </ul>	ne basics in measurements, strain gauge types, tand various devices for vibration measurement e knowledge in data acquisition systems hoto elasticity and its applications nnondestructive testing methods in structures		ons			
Prerequisite	U U					
Courses - Enginee	ering Mathematics and Basic Science					
CourseOutcomes						
Onthesuccessful of	completion ofthecourse, students will beable to					
CO1 Demonstr	ate the strain measuring equipment					Rememl Understa Analyse/A
CO2 Understand	d various vibration measuring equipment					Rememl Understa Analyse/A
CO3 Choose v	arious data indicating and recording instrument.					Rememl Understa Analyse/A
CO4 Outline the	e concept of photoelasticity					Rememl Understa Analyse/A
CO5 Apply suit	able non-destructive testing methods.					Rememl Understa

# COs PO1 PO2 PO3 PO4 PO5 PO6

	CO1	3	2	2	2	2	2
	CO2	3	2	2	3	3	2
ſ	CO3	3	2	3	3	2	2
	CO4	3	2	2	2	2	2
ľ	CO5	3	2	2	3	3	3
		3- 8	Strong;2	2-Mediu	m;1-Sor	ne	

# Assessment Pattern

Bloom'sCategory		Assessment Tests Marks)	End SemExamination
	1	2	(Marks)
Remember(Re)	10	05	15
Understand(Un)	10	15	15
Apply (Ap)	30	20	50
Analyse (An)	10	20	20
Create (Cr)	-	-	-

R1/ w.e.f. 12.07.2023

Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

AW مر موزور ا RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

	K.S.Ranga								
	60PSE E34 -E)					IMENTAT	ION		
Someete		<u>M.E - S</u> /Week	TRUCTU			N.	1 avina um	Morke	
Semeste	Hours,			Total hrs	Credit		Maximum Mark		
	L3	Т0	P 0	45	C 3	40	ES 60		otal 00
	-	Ŧ	0	40	3	40	60		
Basic Co (Mechani	nd Strain Measuremen oncept – Measurement ical, Electrical, Acoust Rosette analysis. Hydr	ts of displa tical etc) -	- Strain g	gauge circuits	- potentior				[11]
<b>Vibratior</b> Linear V	n Measurements /ariable Differential T ments. Vibration meter	ransducers	s (LVDT			ocity and	l acceler	ation	[07]
<b>Data Acc</b> Indicating processir	<b>quisition Systems</b> g and recording devid ng systems – Cathod on systems.	ces – Sta	atic and						[09]
Photoela	<b>asticity</b> sticity – Optics of phot	oelasticity	– Polaris	scope – Isoclin	ics and Isoc	chromatics	s– Metho	ds of	[07]
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Ultrasoni structural	tructive Testing Meth c testing principles an l testing – Advanced l es, GECOR, Ground p	d applicat NDT meth	ods – Uli	trasonic pulse			impulse i	radar	[11]
Jltrasoni structural	c testing principles an I testing – Advanced I es, GECOR, Ground p	d applicat NDT meth	ods – Uli	trasonic pulse				radar	
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1.3 Various strain gauges – Mechanical Strain gauges - Principle & 1 Working Electrical Strain gauges - Principle & Working 1.4 1 Acoustical Strain gauges - Principle & Working 1 1.5 1.6 Working of potentiometer 1 Working of Wheat stone bridge 1.7 1

R1/ w.e.f. 12.07.2023

Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

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1.8	Rosette analysis concepts and formulas	1
1.9	Rosette analysis problems	2
1.10	Use of Hydraulic jack, load cell and proving ring	1
2	Vibration Measurements	
2.1	Introduction to transducers	1
2.2	Linear Variable Differential Transducers – Operation and use	1
2.3	Transducers for velocity measurements	1
2.4	Transducers for acceleration measurements	1
2.5	Vibration meter – Principle and working	1
2.6	Working principle of Seismographs	1
2.7	Seismogram and its inference	1
3	Data Acquisition Systems	
3.1	Introduction to data acquisition systems	1
3.2	Static data recording devices	2
3.3	Dynamic data recording devices	1
3.4	Data acquisition and processing systems	1
3.5	Cathode Ray Oscilloscope – Operation and use	1
3.6	XY Plotter – Principle & Construction	1
3.7	Chart plotter	1
3.8	Digital data acquisition systems	1
4	Photoelasticity	
4.1	Introduction to photoelasticity& Principles	1
4.2	Optics of photoelasticity	1
4.3	Plane Polariscope – Working principle	1
4.4	Circular Polariscope – Working principle	1
4.5	Isoclinics and isochromatics – Properties & importance	1
4.6	Methods of stress seperation	2
5	Non Destructive Testing Methods	
5.1	Introduction to NDT and its scope	1
5.2	Ultrasonic testing principles and application	1
5.3	Rebound hammer – Working Principle	1
5.4	Holography& its uses	1
5.5	Use of laser for structural testing	1
5.6	Advanced NDT methods- Ultrasonic pulse echo method	2
5.7	Impact echo method	1
5.8	Impulse radar techniques	1
5.9	GECOR	1
5.10	Ground penetrating radar (GPR).	1
	Total	45

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A.W. فالعاري RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		Category	L	Т	Ρ	Credit
60PSE E35	MATRIX METHOD OF STRUCTURAL ANALYSIS	PE	3	0	0	3

- To learn the basic concepts of structural analysis.
- To know about the matrix analysis of structures by using flexibility method.
- To understand about the matrix analysis of structures by using stiffness method.
- To learn about matrix analysis of axial elements.
- To learn about matrix analysis of beams and frames

#### Prerequisite

# Fundamentals of Mathematics, knowledge of basic Science CourseOutcomes

Onthesuccessful completion of the course, students will be able to

CO1	Understand the concepts of energy theorems	Remember,
		Understand,
		Apply
CO2	Formulation of stiffness and flexibility matrix for various co-ordinates	Remember,
		Understand,
		Analyze
CO3	To solve the beam using stiffness and flexibility methods	Remember,
		Understand,
		Apply,
		Analyze
CO4	To solve the frame using stiffness and flexibility methods	Analyze
CO5	To understand the concents of colving the truce using stiffness and flevibility	Understand
005	To understand the concepts of solving the truss using stiffness and flexibility	••••••
	methods	and Apply
	a with Dreaman of Outeeman	

#### Mapping with Programme Outcomes

COs	P01	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	3	
CO2	3	3	3	2	3	3
CO3	2	3	3	3	2	2
CO4	2	2	3	3	2	1
CO5	2	3	2	3	2	2
3- Strong 2-Medium 1-Some						

3- Strong;2-Medium;1-Some

Bloom'sCategory		Assessment Tests Marks)	End Sem Examination		
	1	2	(Marks)		
Remember	10	10	10		
Understand	10	10	10		
Apply	20	10	30		
Analyse	20	30	50		
Evaluate	-	-	-		
Create	-	-	-		

<u>4</u>. No K.S.Rangasamy College - 637 215

	K.S.Ranga							
	60PSE E3	5 -MAT	RIX METHO	D OF STRUCTUR	RAL ANALYSIS	6		
		M.E.	STRUCTUR	RAL ENGINEERIN	IG			
Semester	Hours / Week		k	- Total Hours	Credit	Maximum Marks		
Jemester	L	Т	Р	Total Hours	С	СА	ES	Total
П	3	0	0	45	3	40	60	100
Structure-Loads-Re Levels of structural Matrix Concepts a Matrix-matrix oper transformation mat Matrix Analysis of Introduction-axial s DOF)-analysis by flexibili Matrix Analysis of Conventional stiffr continuous beams analysis procedure Matrix Analysis of Conventional stiffn matrix and analysi	analysis-Energy and Matrix Analy ations-linear sim rix-stiffness and f f Structures With stiffness and flex lexibility method. f Beams less method for Flexibility metho f Plane Frames ess method for p	method vsis of S ultaneou lexibility n Axial I ibility m Analysi beams- d for co	s-Energy co <b>Structures</b> us equation matrix-Equi <b>Elements</b> atrix-analysi is by conver beams elem ntinuous bea ame-elemen	ncepts based on d s-Eigen values a valent joint loads-s is by conventional ntional stiffness me nent stiffness (4 I ams-force transfor t stiffness matrix(6	isplacement ar nd Eigen vect stiffness and fle I stiffness metl ethod for plane DOF)-generatio mation matrix- 6DOF)-generati	nd force f tors-coor xibility m hod for truss el on of stil element ion of st	field. odinate nethods. axial ele ement ( ffness r flexibilit ructural	[9] systems [9] ement (2 4 DOF) [9] natrix fo y matrix [9] stiffness
matrix and analysis	procedure.						Tatall	[9]   <b>ours: 4</b>
Text book (s) :							TOTAL	
								iours. 4
	on, "Advanced St	ructural <i>i</i>	Analvsis". Na	rosa Publishing Ho	use.New Delhi.2	2010.		
	n.R and Peruma		-	rosa Publishing Ho e structural Analy			axmi Pu	
2 Vaidyanadha New Delhi, 2	n.R and Peruma		-	-			axmi Pu	
2 Vaidyanadha New Delhi, 2 Reference(s) : 1 Madhujit Muł India,2009.	n.R and Peruma 016. hopadhyay,Abdul	al.P, "Co Hamid	omprehensiv Sheikh,"Matr	e structural Analy	sis – Vol.1 & ` nent Analyses c	Vol2", La	ıres", .A	iblication
2     Vaidyanadha       New Delhi, 2       Reference(s) :       1     Madhujit Muł       1     India,2009.       2     Rajesekaran       2     Ltd, New Dell	n.R and Peruma 016. hopadhyay,Abdul S. and Sankara S ni, 2011.	al.P, "Co Hamid Subrama	omprehensiv Sheikh,"Matr nian G. "Cor	e structural Analy rix and Finite Elem nputational Structu	sis – Vol.1 & ` nent Analyses c ral Mechanics",	Vol2", La of Structu Prentice	ires", .A Hall of	iblication
2     Vaidyanadha       New Delhi, 2       Reference(s) :       1     Madhujit Muł       India,2009.       2     Rajesekaran       Ltd, New Delli       3     Manickaselva	n.R and Peruma 016. hopadhyay,Abdul S. and Sankara S ni, 2011. m M.K.," Elements 04.	Al.P, "Co Hamid Subrama s of Matr	Sheikh,"Matr nian G. "Cor	e structural Analy	sis – Vol.1 & ` ent Analyses c ral Mechanics", ctures", Khanna	Vol2", La of Structu Prentice Publishe	ires", .A Hall of	iblicatior ne book

## Course Contents and Lecture Schedule

S.No	Торіс	No.of Hours
1	Concepts In Structural Analysis	
1.1	Introduction – Forces and Displacement Measurements	1
1.2	Equilibrium of Force	1
1.3	Compatibility of Displacements	1
1.4	Types of Structures, load and response	1
1.5	Force- Displacement relation	1
1.6	Levels of structural analysis	1

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4.45-

RoS Chairman CHAIRMAN BOCHAIRMAN BOCHAIRMAN BOCHAIRMAN Faculty of College of Technology K.S.Rangasamy College 0 17 cms TIRUCHENGODE - 637 cms

1.7	Energy methods	1
1.8	Energy concepts based on displacement field	1
1.9	Energy concepts based on force field	1
2	Matrix Concepts and Matrix Analysis of Structures	
2.1	Matrix Operations	1
2.2	Linear Simultaneous Equations	1
2.3	Eigen values	1
2.4	Eigen vectors	1
2.5	Coordinate Systems	1
2.6	Transformation Matrix	1
2.7	Stiffness And Flexibility Matrix	1
2.8	Equivalent joint loads	1
2.9	Stiffness And Flexibility Methods simple problems	1
3	Matrix Analysis of Structures With Axial Elements	
3.1	Introduction on axial elements	1
3.2	Axial Stiffness and Flexibility Matrix	1
3.3	Analysis By Conventional Stiffness Method For Axial Element (2 DOF)	2
3.4	Analysis By Flexibility Method	2
3.5	Analysis by conventional stiffness method for plane truss element (4 DOF)	2
3.6	Analysis By Flexibility Method	1
4	Matrix Analysis of Beams	
4.1	Conventional stiffness method for beams	1
4.2	Beams element stiffness (4 DOF)	1
4.3	Generation of stiffness matrix for continuous beams	1
4.4	Flexibility method for continuous beams	1
4.5	Force Transformation Matrix	1
4.6	Element Flexibility Matrix	1
4.8	Analysis for the flexibility matrix	1
4.9	Problems in Flexibility matrix	1
5	Matrix Analysis of Plane Frames	
5.1	Conventional stiffness method for plane frame	1
5.2	Element stiffness matrix(6DOF)	1
5.3	Generation of structural stiffness matrix	1
5.4	Analysis Procedure for structural stiffness matrix	2
5.5	Flexibility method for plane frames	2
5.6	Force transformation matrix	1
5.7	Element flexibility matrix and analysis procedure	1
	Total	45

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AW

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- · Process analysis and kinetics of secondary treatment
- To understand the process kinetics
- Suspended and attached growth treatment of wastewater
- To study the digestion process
- To find the attached growth treatment process.

#### Prerequisite

# Fundamentals of Mathematics, knowledge of properties of construction materials and its mechanics and concrete technology.

#### **Course Outcomes**

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

CO1	Identify the biological treatment process and analysis	Create
CO2	Evaluate the bio kinetic coefficients	Apply
CO3	Personation the common physical chemical and hielegical unit expertions	Understand
003	Recognize the common physical, chemical and biological unit operations encountered in treatment process	Understand
CO4	Characterize the treatment process	Understand
CO5	Formulate the application of the attached growth treatment process.	Apply

#### Mapping with Programme Outcomes

COs	P01	PO2	PO3	PO4	PO5	PO6	
CO1	1	1	3		1	3	
CO2	1	1	3		1	3	
CO3	1	2	3	2	1	3	
CO4	1	2	3	2	2	3	
CO5	1	2	3	1	2	3	
3- Strong;2-Medium;1-Some							

#### AssessmentPattern

	ContinuousAsse	End Sem. Examination		
Bloom'sCategory	1 2		(Marks)	
Remember	10	10	10	
Understand	10	10	10	
Apply	10	10	20	
Analyse	10	10	20	
Evaluate	10	10	10	
Create	10	10	30	



K.S.Rangasamy College of Technology - Autonomous R2022										
	60PSE E36- SECONDARY TREATMENT OF WASTEWATER									
M.E. STRUCTURAL ENGINEERING										
Elective III										
Semester	Hours / Week		Total Hours	Credit			Marks			
	L	T	P		C	CA	ES	Total		
	3	0	0	45	3	40	60	100		
Objective(s)	<ul> <li>Process analysis and kinetics of secondary treatment</li> <li>To understand the process kinetics</li> <li>Suspended and attached growth treatment of wastewater</li> <li>To study the digestion process</li> <li>To find the attached growth treatment process.</li> </ul>									
Course Outcomes	<ol> <li>Identif</li> <li>Evaluation</li> <li>Recognition</li> <li>treatment</li> <li>Chara</li> </ol>	fy the biolog ate the biok gnize the co nent proces acterize the	gical treatn inetic coel ommon ph s treatment	ysical, chemical and	alysis I biological unit op		encoui	ntered in		
required for ea	s given agai ach topic ba examinatior	inst each to ased on in ns shall not	pic are of nportance depend or	indicative. The fact and depth of cov n the number of hou	ulty have the freed erage required.	lom to de				
and non ideal f dispersion coef <b>Fundamentals</b> Role of microor ratio - Determi Description, Des <b>Suspended Gro</b> Treatment Proc constants – ap Modelling of Si – Modifications for transfer of of Stabilization po ponds – Faculta <b>Suspended Gro</b>	low reactors ficient. of Process ganisms – M nation of bio sign and ope owth Treatm ess Loading oplication o uspended C (only theor oxygen – Se onds – Clas ative ponds owth Treatm	<ul> <li>Kinetics</li> <li>Microbial grookinetic coerating para</li> <li>nent Proce</li> <li>g – Biolog</li> <li>f kinetics</li> <li>Growth Treading</li> <li>y) – Oxida</li> <li>condary classification –</li> <li>Anaerob</li> <li>nent Proce</li> </ul>	s in para owth kine pefficients meters – I ss - Activ ical & soli to Biologi atment Pr tion pond urifier - des - Applicatio ic ponds - ss - Diges	on – Process design – maturation ponds stion Process	dation process - suspended growth v reactors. <b>ss and Ponds</b> - F/M ratio – Deter uspended Growth FR - Design of Act s – Oxygen requir n, flow pattern an – Construction an	tests – loading - n treatme mination Treatm ivated S ements id analy id perforr	Estim [9] - MCR ent pro of Bi nent Pro sludge - arrai vsis of mance.	ation of T - F/ M bcess – 9] bo-kinetic ocess – Process ngement Aerobic [9]		
Sludge Digestio relationship – g sludge blanket p considerations <b>Attached Grow</b> Attached Grow Trickling Filter Rankine's and treatment proce	n – Sources gas producti process – de r <b>th Treatme</b> rth Treatme – Proces I Eckenfeld	s of sludge - on – desig esign consid ent <b>Process</b> ent Process s – Class der equatio	– Characte In conside derations. s – Subs sification n - Rotat	eristics – Quantities erations. Anaerobic Aerobic Digestion – strate Removal in - design based ing Biological co up flow expanded	treatment of liquid Kinetics – Oxygen Attached Growtl on popular desig ntactors – Anael	d wastes requirer h Treatr gn equat robic att	s – A ments - [9] ment P tions - ached	naerobic - Design Process - - NRC, growth		
(Only theory)						_	[9]			
						T	otal H	ours: 45		
Text book :	" <b>F</b>	ntal En ala				0.2				
1 Garg, S.K.	, Environme	ental Engine	ering" Vol	. II, Khanna Publish	ers, New Delhi, 20	03.				

A W

RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

2	Karia G L & Christian R A, "Wastewater Treatment", Prentice Hall of India, New Delhi, 2013.								
Refe	Reference(s) :								
1	Metcalf and Eddy, "Waste Water Engineering – Treatment and reuse", Tata McGraw-Hill, New Delhi, 2003.								
2	Arceivala S. J., "Waste Water Treatment and disposal, Marceldekker publishers, 1981.								
3	Larry D. Benefield and Clifford W. Randall, "Biological process design for Wastewater Treatment", 1980.								
4	Howard S. Peavy, Donald R. Rowe and George Techobanoglous, "Environmental Engineering", McGraw – Hill co., 1987.								

#### **Course Contents and Lecture Schedule**

S.No	Торіс	No.of Hours
1	Introduction, Process Analysis and Selection	
1.1	Biological treatment processes	1
1.2	Choice of treatment method	1
1.3	Environmental impact and other considerations in planning the treatment	1
1.4	Cost of Wastewater treatment	2
1.5	Reactors used for the treatment	2
1.6	Estimation of dispersion coefficient.	2
2	Fundamentals of Process Kinetics	
2.1	Role of microorganisms	1
2.2	Microbial growth kinetics	1
2.3	Biological oxidation process	2
2.4	Determination of biokinetic coefficients	1
2.5	Modelling of suspended growth treatment process	1
2.6	Design and operating parameters	1
2.7	Modelling of plug flow reactors.	1
2.8	Biological & solids retention time	1
2.9	Determination of Bio-kinetic constants	1
2.10	Determination of Bio-kinetic constants	1
3	Suspended Growth Treatment Process - Activated Sludge Process and Ponds	
3.1	Suspended Growth Treatment Process	2
3.2	Modelling of Suspended Growth Treatment Process	2
3.3	Design of Activated Sludge Process	1
3.4	Oxidation pond	1
3.5	Oxygen requirements	1
3.6	Arrangement For Transfer Of Oxygen	1
3.7	Secondary clarifier	1
4	Suspended Growth Treatment Process - Digestion Process	
4.1	Sludge Digestion	2
4.2	Sources of sludge	1

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	Total	45
5.8	Up flow packed bed	1
5.7	Anaerobic attached growth treatment processes	1
5.6	Rotating Biological contactors	1
5.5	NRC, Rankine's and Eckenfelder equation	1
5.4	Design based on popular design equations	1
5.3	Trickling Filter	1
5.2	Substrate Removal in Attached Growth Treatment Process	1
5.1	Attached Growth Treatment Process	2
5	Attached Growth Treatment Process	
4.8	Design considerations. Aerobic Digestion	1
4.6	Anaerobic sludge blanket process	1
4.5	Anaerobic treatment of liquid wastes	1
4.4	Kinetic relationship	1
4.3	Anaerobic digestion	1

# CourseDesigners

1. Dr.K.VIJAYA SUNDRAVEL

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AW

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		Category	L	Т	Ρ	Credit
60PSE E37	INDUSTRIAL WASTEWATER POLLUTION - PREVENTION AND CONTROL	PE	3	0	0	3

- To know the industrial wastewater and laws
- To identify techniques and approaches for minimizing the generation.
- To find the treatment of physic chemical and biological treatment methods.
- To identify an Application of physic chemical and biological treatment methods for recovery, reuse and disposal.
- To know the supported with case studies under Indian situations.

#### Prerequisite

Fundamentals of Mathematics, knowledge of properties of construction materials and its

mechanics and concrete technology.

#### **Course Outcomes**

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

CO1	Discuss about the source and environmental impact of industrial waste water	Create
CO2	Able to develop the methods for prevention and control of industrial pollution	Apply
CO3	Formulate the various methods for industrial waste water treatment	Understand
CO4	Know about the design of effluent treatment plant	Understand
CO5	Identify the various case studies associated in industrial wastewater treatment	Apply

#### Mapping with Programme Outcomes

COs	P01	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1		2	3
CO2	1	1	2		2	3
CO3	2	2	2	2	1	3
CO4	2	2	1	2	3	3
CO5	1	2	1	1	3	3

#### **Assessment Pattern**

	ContinuousAsse	End Sem. Examination		
Bloom'sCategory	1 2		(Marks)	
Remember	10	10	10	
Understand	10	10	10	
Apply	10	10	20	
Analyse	10	10	20	
Evaluate	10	10	10	
Create	10	10	30	



	K	.S.Rangasam	y College of	Technology - Autonom	ous R2022			
	60PSE E37- IN			R POLLUTION - PREVE	INTION AND CO	NTROL		
		M						
	1	Hours / Weel		ective III	Credit	Max		Marks
Semester	L	T	к Р	Total Hours	Credit		ES	Total
	3	0	<u>г</u>	45	3	40	60	100
	-	e industrial wa	, ,		0	40	00	100
Objective(s)	<ul> <li>To identify</li> <li>To find the</li> <li>To identify reuse and</li> </ul>	techniques an treatment of p an Applicatio disposal.	nd approaches ohysio chemic on of physio	s for minimizing the gene al and biological treatme chemical and biological ies under Indian situation	nt methods. I treatment metho	ods for I	recove	ery,
				s will be able to				
Course Outcomes	<ol> <li>Able to d</li> <li>Formulat</li> <li>Know ab</li> <li>Identify th</li> </ol>	evelop the me e the various r out the design ne various cas	thods for prev methods for ir of effluent tre se studies ass	ociated in industrial wast	ustrial pollution Itment ewater treatment			
				The faculty have the fre				
each topic based	l on importanc	e and depth o	of coverage re	equired. The marks allot	ted for questio	ns in the	e exam	inations
shall not depend	on the number	of nours indic	cated.					
requirements for sampling -genera on water quality r Industrial Pollut Prevention and C techniques – Po benefit analysis – Industrial Waste Equalisation - Ne biological treatm adsorption - Pho removal Treatal Wastewater Reu Individual and Co discharge system on water and la Thickening, diges Case Studies Attached Growt manufacturing pr	treatment of tion rates, cha nanagement ion Preventio Control of Indu llution Prevent payback perio water Treatm eutralisation – ent – Sequen bolity studies. Se And Residues ommon Effluer as - Quality red and – Residues tion, condition	industrial was racterization a strial Pollution tion of Assess od - Waste mir ent Oil separation icing batch re Wet Air Oxida lual Managem nt Treatment F quirements for als of industri ing, dewaterin Process – ion, wastewate	stewater – Ir and variables ment - Mate minization Circ n – Flotation - eactors – Hig ation – Evap Plants – Joint Wastewater ial wastewater g and disposa Substrate R er characteris	Industrial wastewater an idustrial waste survey – -Toxicity of industrial effli- nd Barriers – Waste ma rial balance - Evaluation cles - Precipitation – Heavy r h Rate reactors - Cher oration – Ion Exchange treatment of industrial a reuse – Industrial reuse er treatment – Quantific al of sludge – Manageme emoval in Attached G tics, source reduction op bil Refining – Pharmaceut	<ul> <li>Industrial wasternet uents and Bioass</li> <li>nagement Hierard</li> <li>n of Pollution present</li> <li>metal Removal – mical oxidation -</li> <li>Membrane Terminal domestic was</li> <li>Present status</li> <li>present status</li> <li>ant of RO rejects.</li> <li>Growth Treatmernet</li> </ul>	ewater n ay tests chy - So evention Aerobic - Ozona echnolog tewater and issu cteristics nt Proces reatment d Distille	nonitor – Majc urce re option and ar tion – ies – - Zero ies – S of S ss – li t flow s ries	ing and or issues [9] eduction s –Cost [9] naerobic carbon Nutrient [9] effluent Disposal ludge – [9] ndustrial
Text book :								
<sup>I</sup> Singapore	, 2000.			Practice", McGraw Hill Ir				ook Co.,
Reference(s) :		,			,	, .		
	onard Nemero			ol', Mc-Graw Hill, 2000. ent – contemporary prac	ctice and vision fo	or the fut	ture", I	Elsevier,
3 Frank Woo	odard, "Industri			ok", Butterworth Heinema Is and Practice', Mc-Grav				

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S.No	Торіс	No.of Hours
1	Introduction	
1.1	Industrial scenario in India	1
1.2	Industrial activity and Environment	1
1.3	Uses of Water by industry	1
1.4	Sources and types of industrial wastewater	2
1.5	Nature and Origin of Pollutants	2
1.6	Toxicity of industrial effluents and Bioassay tests	2
2	Industrial Pollution Prevention	
2.1	Prevention and Control of Industrial Pollution	1
2.2	Benefits and Barriers	1
2.3	Waste management Hierarchy	2
2.4	Source reduction techniques	1
2.5	Pollution Prevention of Assessment	1
2.6	Material balance	1
2.7	Evaluation of Pollution prevention options	1
2.8	Cost benefit analysis	1
2.9	Payback period	1
2.10	Waste minimization Circles	1
3	Industrial Wastewater Treatment	
3.1	Aerobic and anaerobic biological treatment	2
3.2	carbon adsorption	2
3.3	Wet Air Oxidation	1
3.4	Ion Exchange	1
3.5	Oxygen requirements	1
3.6	Membrane Technologies	1
3.7	Treatability studies.	1
4	Wastewater Reuse And Residual Management	
4.1	Joint treatment of industrial and domestic wastewater	2
4.2	Industrial reuse , Present status and issues	1
4.3	Disposal on water and land	1
4.4	Residuals of industrial wastewater treatment	1
4.5	Quantification and characteristics of Sludge	1
4.6	Thickening, digestion, conditioning, dewatering and disposal of sludge	1
4.8	Management of RO rejects.	1
5	Case Studies	
5.1	Attached Growth Treatment Process	2
5.2	Substrate Removal in Attached Growth Treatment Process	1

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5.3	Industrial manufacturing process description	1
5.4	wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles	1
5.5	Tanneries	1
5.6	Pulp and paper	1
5.7	Metal finishing	1
5.8	Sugar and Distilleries	1
	Total	45

# CourseDesigners

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		Category	L	т	Ρ	Credit
60PSE E41	CADD for Structures	PE	3	0	0	3



- To gain knowledge on Computer graphics and drafting software packages
- To analyze the structure using computer methods
- To acquire knowledge on computer aided designing and detailing
- To know Project scheduling using CPM and PERT
- To learn theartificial intelligence systems

#### Prerequisite

Courses –Structural Analysis, RCC and Steel Design **CourseOutcomes** 

Onthesuccessful completion of the course, students will beable to

CO1	Choose software packages for 2D drafting	Remember/
		Understand/
		Analyse/Apply
CO2	Perform structural analysis using software	Remember/
		Understand/
		Analyse/Apply
CO3	Design the structures with computer methodologies	Remember/
		Understand/
		Analyse/Apply
CO4	Optimize the structural design with the help of software	Remember/
		Understand/
		Analyse/Apply
CO5	Apply artificial intelligence in construction industry	Remember/
		Understand/
		Analyse/Apply

#### MappingwithProgrammeOutcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	2	3	2
CO2	3	3	3	3	3	2
CO3	3	3	3	3	3	2
CO4	3	2	3	2	3	2
CO5	3	3	3	3	3	3
	3- Strong;2-Medium;1-Some					

#### AssessmentPattern

Bloom'sCategory -	ContinuousAsse	essmentTests (Marks)	End SemExamination
BIOOTI SCategory	1	2	(Marks)
Remember(Re)	05	10	10
Understand(Un)	05	10	20
Apply (Ap)	30	20	40
Analyse (An)	20	20	30
Create (Cr)	-	-	-

4. Wr **BoS Chairman** CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

	K.S.Rang	asamy Co	llege of	Technology-/	Autonomou	s R2022		
		60P\$	SE E41 -	CADD FOR S	TRUCTURE	S		
		M.E S	TRUCTU	RAL ENGINE	ERING			
Semester	Hours	/Week		Total hrs	Credit	Ν	/laximum Ma	rks
	L	Т	Р		С	CA	ES	Total
	3	0	0	45	3	40	60	100
Computer G	raphics							[09]
Graphic prim	itives - Transform	ations - Ba	asics of 2	D drafting - M	odeling of a	urves an	d surfaces –	
Solid modelin	ng - Graphic standa	ards - Draf	ting softw	vare packages	and usage			
Structural A	nalysis							[09]
Computer m	ethods of structu	ral analys	sis - Fini	te Element p	rogramming	– Anal	ysis through	
application pa	ackages	-		-			-	
Structural Do	esign							[09]
Computer aid	led design of steel	and RC S	structural	elements - Det	tailed drawir	ng – Bill o	f materials	
Optimizatior	ו							[09]
Linear progra	mming - Simplex	algorithm -	Post-opt	imality analysi	s – Project s	schedulin	g - CPM and	
PERT applica	ations Genetic algo	prithm and	application	ons				
Artificial Inte	elligence							[09]
	Heuristic search ·				s - Architect	ure and a	applications of	of
KBES - Expe	rt system shells - I	Principles	of neural	network.				
							TotalHours	45

Тех	xtbook(s):
	Unnikrishna Pillai S, Devdas Menon, "Reinforced Concrete Design", McGraw-Hill Education, India, New Delhi, 2021
2.	Punmia B C and Jain,A.K, "Comprehensive Design of Steel Structures", Laxmi Publications, 2017
Ref	ference(s):
1.	Devdas Menon, Advanced Structural Analysis, Narosa publications, New Delhi, 2019
2.	Peter W, Christensen, Anders Klarbring "An Introduction to Structural Optimisation", Springer 2009.
	Meghre A S and Kadam K M, Finite Element Method in Structural Analysis, Khanna Publishers, New Delhi, 2014

4. KavehA, "Applications of Metaheuristic Optimization Algorithms in Civil Engineering", Springer, 2017

#### Cours<u>eContentsandLectureSchedule</u>

S.No	Торіс	No.of Hours
1	Computer Graphics	
1.1	Introduction to computer graphics	1
1.2	Graphic primitives	1
1.3	Transformations	1
1.4	Basics of 2D drafting	1
1.5	Modeling of curves and surfaces	1
1.6	Solid modeling	1
1.7	Graphic standards	1
1.8	Drafting software packages and usage	2

#### R1/ w.e.f. 12.07.2023

Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

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2	Structural Analysis				
2.1	Fundamentals of Structural Analysis	1			
2.2	Computer methods of structural analysis				
2.3	Various software used for Analysis	2			
2.4	FEM technique				
2.5	Finite Element programming	2			
2.6	Analysis through application packages	2			
3	Structural Design				
3.1	Fundamentals of RCC and Steel design	1			
3.2	Codal Provisions	1			
3.3	Computer aided design of steel structures	2			
3.4	Computer aided design of RCC structures	2			
3.5	Reinforcement detailing	1			
3.6	Structural Steel detailing	1			
3.7	Bill of materials	1			
4	Optimization				
4.1	Linear programming	2			
4.2	Simplex algorithm	1			
4.3	Post optimality analysis	1			
4.4	Project scheduling	1			
4.5	CPM technique	1			
4.6	PERT technique	1			
4.7	Genetic algorithm and applications	2			
5	Artificial Intelligence				
5.1	Introduction to Artificial intelligence	1			
5.2	Heuristic search	1			
5.3	Knowledge based expert systems	2			
5.4	Architecture and applications of KBES	2			
5.5	Expert system shells	1			
5.6	Principles of neural network	2			
	Total	45			

# CourseDesigner

1. Mr.K.ANGU SENTHIL - angusenthil@ksrct.ac.in

A.Wr فالمعارين RoS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

60PSE E42
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- Design of Steel Gantry Girders.
- Design of Steel Portal, Gable Frames.
- Design of Steel Bunkers and Silos.
- Design of Chimneys and Water Tanks.
- Design of Tubular Structures.

#### Prerequisite

#### Knowledge of portal frame analysis, structural steel design, foundation design

### Course Outcomes

Onthesuccessful completion of the course, students will be able to

CO1	Explain the planning and functional requirements of Industrial Structures	Apply
CO2	Design the Pre – Engineered structures and foundations	Create
CO3	Demonstrate the structural aspects of machine foundation and containment structures.	Apply
CO4	Design the Turbo generator foundations & conveyor systems.	Create
CO5	Design of offshore structures with failure probability	Create

# MappingwithProgrammeOutcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	3	2	3	2
CO2	3	2	3	2	3	2
CO3	1	2	3	2	3	2
CO4	3	2	3	2	3	2
CO5	2	2	3	2	3	2
	3- 3	Strong;2	2-Mediu	m;1-Sor	ne	

### AssessmentPattern

Plaam'a Catagony	ContinuousAss	End SemExamination	
Bloom'sCategory	1	2	(Marks)
Remember	10	10	10
Understand	10	10	10
Apply	10	10	20
Analyse	10	10	20
Evaluate	10	10	10
Create	10	10	30

4. Wr RAS Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College 1 technology TIRUCHENGODE - 637 215

				echnology–A ESIGN OF IND				
				RAL ENGINE		SINUCI	UNE	
Semest	ter Hours	Week		Total hrs	Credit	Ν	Maximum	Marks
	L	Т	Р		С	CA	ES	Total
	3	0	0	60	3	40	60	100
	antry Girders ction, loads acting on	aantry aire	ler nerm	issible stress	types of da	ntry airde	are and cr	[09
	ane data, maximum mo				types of ga	intry girde		lanc
Portal F	· · · · · · · · · · · · · · · · · · ·		errodito, v					[09
Design	of portal frame with hin ight Structures	ge base, c	lesign of	portal frame w	ith fixed bas	e – Gabl	e Structur	
	unkers and Silos							[09
Design	of square bunker - J	lansen's a	ndAiry's t	heories – IS	Code provis	sions – D	esign of	
	- Stiffeners – Hooper -							
girder –	stiffeners	-		-				_
Chimne								[09
ntroduc	tion, dimensions of s	teel stack	s, chimne	ey lining, bree	ech opening	is and a	ccess lad	lder,
oading	and load combinations	, design co	onsiderati	one stability a	oncidoration	doolan	of baco pl	
م مرمام م ا				ons, stability c	Unsideration	i, design	or base p	late,
	of foundation bolts, des	ign of foun		ons, stability c	Unsideration	i, design	or base p	
Water T	anks	0	dation.	· · ·			· ·	[09
Water T Design	anks of rectangular riveted	steel wate	idation. r tank – <sup>-</sup>	Tee covers –	Plates – Sta	ays – Loi	· ·	[09
Water T Design	anks	steel wate	idation. r tank – <sup>-</sup>	Tee covers –	Plates – Sta	ays – Loi	· ·	[09
Water T Design	anks of rectangular riveted	steel wate	idation. r tank – <sup>-</sup>	Tee covers –	Plates – Sta	ays – Loi	ngitudinal	and [09
Water T Design transver	ີ <b>anks</b> of rectangular riveted se beams –Design of s	steel wate	idation. r tank – <sup>-</sup>	Tee covers –	Plates – Sta	ays – Loi	· ·	and [09
Water T Design transver Textbo	anks of rectangular riveted se beams –Design of s ook(s):	steel wate staging – B	idation. r tank – <sup>-</sup> ase plate	Tee covers – s – Foundatior	Plates – Standar	ays – Lor r bolts	ngitudinal TotalHou	and [09
Water T Design transver Textbo 1. R	<b>Tanks</b> of rectangular riveted rse beams –Design of s <b>Dok(s):</b> am Chandra., "Design	steel wate staging – B	dation. r tank – <sup>-</sup> ase plate tructures",	Tee covers – s – Foundatior , 13th Ed., Sta	Plates – Stand ancho	ays – Lor r bolts shers, 207	ngitudinal TotalHou	and [09
Water T Design transver Textbo 1. R 2. K	<b>Tanks</b> of rectangular riveted rse beams –Design of s <b>Dok(s):</b> am Chandra., "Design oncz, J, "Manual of Pre	steel wate staging – B	dation. r tank – <sup>-</sup> ase plate tructures",	Tee covers – s – Foundatior , 13th Ed., Sta	Plates – Stand ancho	ays – Lor r bolts shers, 207	ngitudinal TotalHou	and [09
Water T Design transver Textbo 1. R 2. K	<b>Tanks</b> of rectangular riveted rse beams –Design of s <b>Dok(s):</b> am Chandra., "Design	steel wate staging – B	dation. r tank – <sup>-</sup> ase plate tructures",	Tee covers – s – Foundatior , 13th Ed., Sta	Plates – Stand ancho	ays – Lor r bolts shers, 207	ngitudinal TotalHou	and [09
Water T       Design       transver       Textbo       1.     R       2.     K       Referender       1.     P	<b>Tanks</b> of rectangular riveted rse beams –Design of s <b>Dok(s):</b> am Chandra., "Design oncz, J, "Manual of Pre	steel wate staging – B of Steel St ecast Cons	dation. r tank – <sup>-</sup> Base plate tructures"	Tee covers – s – Foundatior , 13th Ed., Stat /ol I & II" Bauve	Plates – Sta n and ancho ndard Publis erlay GMBH	ays – Lor r bolts shers, 207 , 1971.	ngitudinal <b>TotalHou</b> 11.	and [09 urs 45
Water T       Design       transver       Textbo       1.     R       2.     K       Reference       1.     P       2.     Su	Tanks of rectangular riveted rse beams –Design of s ook(s): am Chandra., "Design oncz, J, "Manual of Pre ence(s): unmia B. C., Jain	steel wate staging – B of Steel St ecast Cons Ashok K	dation. r tank – <sup>-</sup> ase plate tructures" truction V	Tee covers – s – Foundation , 13th Ed., Star (ol I & II" Bauve Arun Kr., "	Plates – Sta n and ancho ndard Publis erlay GMBH 'Design of	ays – Lor r bolts shers, 20 <sup>-</sup> , 1971.	ngitudinal TotalHou 11. Structure",	and [09
Textbo       1.     R       2.     K       Reference     P       2.     Su       1.     P       2.     Su	Tanks of rectangular riveted se beams –Design of s ook(s): am Chandra., "Design oncz, J, "Manual of Pre ence(s): unmia B. C., Jain ublishers, 2011. bramaniyam, N. "Desig	steel wate staging – B of Steel St ecast Cons Ashok k jn of Steel	dation. r tank – <sup>*</sup> ase plate tructures" truction V fr., Jain Structure	Tee covers – s – Foundation , 13th Ed., Star /ol I & II" Bauve Arun Kr., " s", (As per IS 8	Plates – Sta n and ancho ndard Publis erlay GMBH 'Design of 800-2007), C	ays – Lor r bolts shers, 20 , 1971. Steel S	ngitudinal TotalHou 11. Structure", niversity	and [09
Water T         Design         transver         Textbo         1.       R         2.       K         Refere         1.       P         2.       Su         9       2.         3.       Ha	Tanks of rectangular riveted se beams –Design of s ook(s): am Chandra., "Design oncz, J, "Manual of Pre ence(s): unmia B. C., Jain ublishers, 2011. bramaniyam, N. "Desig ress, 2014	steel wate staging – B of Steel St ecast Cons Ashok k yn of Steel Requireme	dation. r tank – <sup>-</sup> ase plate tructures", truction V fr., Jain Structure	Tee covers – s – Foundation , 13th Ed., Star /ol I & II" Bauve Arun Kr., " s", (As per IS 8	Plates – Sta n and ancho ndard Publis erlay GMBH 'Design of 800-2007), C	ays – Lor r bolts shers, 20 , 1971. Steel S	ngitudinal TotalHou 11. Structure", niversity	and [09 urs 45

# Course Contents and Lecture Schedule

S.No	Торіс	No.of Hours
1	Steel Gantry Girders	
1.1	Introduction	1
1.2	Loads acting on gantry girder	1
1.3	Permissible stress	1
1.4	Types of gantry girders and crane rails	2
1.5	Crane data, maximum moments	2
1.6	Shears, construction	2

R1/ w.e.f. 12.07.2023 Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

4.45-

2	Portal Frames	
2.1	Design of portal frame with hinge base	1
2.2	Design of portal frame with fixed base	1
2.3	Gable Structures	1
2.4	Lightweight Structures	1
2.5	Suspended roof structures analysis	1
2.6	Suspended roof structure design	1
2.7	Design of Foundations for industrial structures	1
2.8	Types of power plants	1
2.9	Design philosophy of Turbo generator foundation	1
3	Steel Bunkers and Silos	
3.1	Design of square bunker	2
3.2	Jansen's and Airy's theories	2
3.3	IS Code provisions	1
3.4	Design of side plates	1
3.5	Stiffeners	1
3.6	Hooper	1
3.7	Longitudinal beams Design of cylindrical silo	1
4	Chimneys	
4.1	Introduction	2
4.2	Dimensions of steel stacks	2
4.3	Chimney lining, breech openings and access ladder	1
4.4	Loading and load combinations	1
4.5	Design considerations & stability consideration	1
4.6	Design of base plate	1
4.7	Design of foundation bolts, design of foundation.	1
5	Water Tanks	
5.1	Design of rectangular riveted steel water tank	2
5.2	Tee covers	1
5.3	Plates – Stays	1
5.4	Longitudinal and transverse beams	1
5.5	Design of staging	1
5.6	Base plates	1
5.7	Foundation and anchor bolts	1
5.8	Case Study	1
	Total	45

# **Course Designers**

1. Dr.K.VIJAYA SUNDRAVEL

- vijayasundravel@ksrct.ac.in

AW

RoS Chairman CHAIRMAN BOCHAIRMAN BOCHAIC OF Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		Category	L	Т	Ρ	Credit
60PSE E43	DISASTER RESISTANT STRUCTURES	PE	3	0	0	3

- To analyses the behavior of life line structures during disasters.
- To study about the safety analysis of community structures.
- To assess the procedure for damaged structures, along with ground improvement techniques.
- To gain the knowledge of detailing of Structures and Components
- To understand the concept of designing structures to withstand disaster.

#### Prerequisite

Courses – Disaster Management

### **Course Outcomes**

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

CO1	Apply the design philosophy for resisting natural calamities.	Remember/
		Understand/
		Analyse/Apply
CO2	Evaluate the response of dams, bridges and identify strengthening techniques.	Remember/
		Understand/
		Analyse/Apply
CO3	Discuss the damage assessment and retrofitting.	Remember/
		Understand/
		Analyse/Apply
CO4	Describe the use of modern analysis, design and detailing for life line structures.	Remember/
		Understand/
		Analyse/Apply
CO5	Evaluate the techniques of damage assessment.	Remember/
		Understand/
		Analyse/Apply
Mappi	ng with Programme Outcomes	

#### **PO7** PO8 COs P01 PO2 PO3 PO4 PO5 PO6 **PO9** PO10 PO11 PO12 CO1 CO2 CO3 CO4 CO5 3- Strong;2-Medium;1-Some

#### Assessment Pattern

Bloom's Cotogony	ContinuousAsse	End SemExamination	
Bloom'sCategory	1	2	(Marks)
Remember(Re)	10	10	20
Understand(Un)	10	15	20
Apply (Ap)	35	30	50
Analyse (An)	05	05	10
Create (Cr)	-	-	-



	K.S.Ranga	asamy Co	llege of '	Technology–A	Autonomou	IS R2022		
	60PS	E E43- DI	SASTER	RESISTANT	STRUCTUF	RES		
		M.E. S	TRUCTU	RAL ENGINEI	ERING			
Semester	Hours	Week		Total hrs	Credit	Ν	Maximum Ma	arks
	L	Т	Р		С	CA	ES	Total
	3	0	0	45	3	40	60	100
Behaviour o	of Life-Line Struct	ures				•		[09]
Philosophy 1	for design to resist	earthquak	e, cyclon	e and flood, ts	unami, Nati	ional and	Internationa	al
codes of pra	ictice, By-Law of url	ban and se	emi-urbar	ı areas – Tradi	tional and n	nodern st	ructures.	
Community	Structures							[09]
Response c	of dams, bridges, b	, uildings	Strengthe	ning measure	s, Safety	analysis	and rating	-
Reliability as	ssessment							
	on and Retrofitting	0						[09]
•	l evaluation - Cla					f view –	methods of	of
	g for different disas			est – different	techniques			
	Structures and C							[09]
	ern materials and t				, Use of mo	odern ana	alysis, desig	n
	ction techniques op		tor pertor	mance.				
-	sessment of Struc					_		[09]
	veys - Maintenanc					ance - D	itterent type	s
of foundation	n and its impact on	satety - G	round imp	provement tech	nniques.			
							TotalHours	s 45

Тех	xtbook(s):
1.	D.J Dowrick, "Earthquake Resistant Designs", Wiley Ed Second, 2009.
2.	R.T Allen and S.C Edwards, "Repair of Concrete Structures", Blakie and Sons, 1993.
Ref	ference(s):
1.	R.N. Raiker, "Learning from failures - Deficiencies in Design, Construction and Service", R & D Center (SDCPL) RaikerBhavan, Bombay, 1987.
2.	A. M. Nevile, "Properties of Concrete", Pearson Ed Fifth, 2013.
3.	N. Subramanian, "Design of Reinforced Concrete Structures", Oxford University Press Ed Second, 2014.
4.	CPWD "Handbook on Repairs and Rehabilitation of RCC Buildings", 2002

#### Course Contents and Lecture Schedule

S.No	Торіс	No.of Hours
1	Behaviour of Life-Line Structures	
1.1	Philosophy for design to resist earthquake.	1
1.2	Cyclone and flood, tsunami.	1
1.3	National and International codes of practice.	1
1.4	By-Law of urban.	2
1.5	Semi-urban areas.	2
1.6	Traditional and modern structures.	2
2	Community Structures	

A.W. RoS Chairman CHAIRMAN Board Of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

2.1	Response of dams, bridges, buildings	1
2.2	Response of bridges.	1
2.3	Response of buildings.	1
2.4	Strengthening measures.	2
2.5	Safety analysis and rating.	2
2.6	Reliability assessment.	2
3	Rehabilitation and Retrofitting	
3.1	Testing and evaluation	1
3.2	Classification of structures for safety point of view	2
3.3	Methods of strengthening for different disasters	2
3.4	Qualification test	2
3.5	Different techniques	2
4	Detailing of Structures and Components	
4.1	Use of modern materials	2
4.2	Modern materials impact on disaster reduction	2
4.3	Use of modern analysis	1
4.4	Design techniques optimization for performance	2
4.5	Construction techniques optimization for performance	2
5	Damage Assessment of Structures	
5.1	Damage surveys	1
5.2	Maintenance to improve hazard resistance	1
5.3	Modifications to improve hazard resistance	1
5.4	Different types of foundation	2
5.5	Different types of foundationimpact on safety	2
5.6	Ground improvement techniques.	2
	Total	45

# **Course Designer**

1. Dr.M.VELUMANI - velumani@ksrct.ac.in

**R1/ w.e.f. 12.07.2023** Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

A.Wr عن العاريين

		Category	L	Т	Ρ	Credit
60PSE E44	INDUSTRIAL STEEL STRUCTURES	PE	3	0	0	3

- To learn guidelines for industrial structures ٠
- To acquire knowledge in design of roof and gantry girders
- To learn the design of special structures in industries
- To perform the design of tower structures •
- To learn the behavior and design of pre engineering buildings •

# Prerequisite

Courses -Strength of Materials, Design of Steel Structures

#### Course Outcomes

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

CO1	Classify the different types of industrial structures based on planning an functional	Remember/ Understand/
	requirements.	Analyse/Apply
CO2	Assess the general behavior of steel shell roofs and design of gantry girders an	Remember/
	gantry columns.	Understand/
		Analyse/Apply
CO3	Evaluate the various forces acting on Bunkers, silos, chimney's, cooling tower	Remember/
	steel storage tanks and design them.	Understand/
		Analyse/Apply
CO4	Calculate the different types of forces acting on towers and design the towe	Remember/
	foundations.	Understand/
		Analyse/Apply
CO5	Analysis and design of pre-engineered structures	Remember/
		Understand/
		Analyse/Apply
Mappi	ng with Programme Outcomes	

COs	PO1	PO2	PO3	PO4	PO5	PO6		
CO1	3	2	3	3	3	2		
CO2	3	3	3	3	3	3		
CO3	3	2	3	2	3	3		
CO4	3	2	3	3	2	2		
CO5	3	3	3	3	3	2		
	3- Strong;2-Medium;1-Some							

#### Assessment Pattern

Bloom's Category		Assessment Tests Marks)	End Sem Examination
0,1	1	2	(Marks)
Remember(Re)	10	10	20
Understand(Un)	10	15	20
Apply (Ap)	35	30	50
Analyse (An)	05	05	10
Create (Cr)	-	-	-

4. Wy Ros Chairman CHAIRMAN Board of Statics Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

	K.S.Rang	asamy Co	llege of	Technology-A	Autonomou	IS R2022		
	60PSE E44- INDUSTRIAL STEEL STRUCTURES							
M.E. STRUCTURAL ENGINEERING								
Semester Hours/Week Total hrs Credit Maximum Marks						arks		
	L	Т	Р		С	CA	ES	Total
III	3	0	0	45	3	40	60	100
Planning and Functional Requirements Classification of Industries and Industrial structures –planning for lay out Requirements regarding Lighting, Ventilation and Fire safety- Protection against noise and vibration- guide lines from factories Act. Industrial Building								
ndustrial A Bunkers and	dustrial Buildings- S <b>ppurtenances</b> d Silos - Chimney a			-				[09]
-	attice Towers towers - Transmis ers.	ssion Line	Towers	– pipe track	structures-	Tower Fo	oundations -	[09]
Introduction-	Pre Engineered Str -section specification -section details		of assem	ıblies –analysi	s and desi	gn of pre	e engineered	<b>[09]</b>
							TotalHours	s 45

Tex	ktbook(s):
1.	Santhakumar A.R., and Murthy S.S.,"Transmission Line structures", Tata Mc Graw- Hill, 1992.
2.	Subramaniam.N., "Design of Steel Structures ",(As per IS 800-2007)", Oxford university press, 2014.
Ref	ference(s):
1.	Shiyekar M.R., "Limit State Design in Structural Steel", PHI Learning Private Limited, New Delhi, 2013
2.	Rajagopalan K., "Storage Structures", Oxford IBH Publishing Company Ltd, 1989.
3.	IS 800 – 2007, "Code of Practice for General Construction in steel", BIS, New Delhi.
4.	Teaching Resources for Structural Steel Design, INSDAG, Kolkata, 2010.

#### **Course Contents and Lecture Schedule**

S.No	Торіс	No.of Hours
1	Planning and Functional Requirements	
1.1	Classification of Industries	1
1.2	Classification of Industrial structures	1
1.3	Planning for lay out Requirements regarding Lighting	2
1.4	Ventilation	1
1.5	Fire safety	1
1.6	Protection against noise and vibration	1
1.7	Guide lines from factories Act.	2
2	Industrial Building	



2.1	Roofs for Industrial Buildings	2
2.2	Steel shell roofs	2
2.3	Gantry Girders	2
2.4	Design of gantry columns	3
3	Industrial Appurtenances	
3.1	Bunkers	1
3.2	Silos	1
3.3	Chimney	2
3.4	Cooling Towers	2
3.5	Design of steel storage tanks	3
4	Design of Lattice Towers	
4.1	Micro wave towers	1
4.2	Transmission Line Towers	1
4.3	Pipe track structures	2
4.4	Tower Foundations	2
4.5	Testing towers	3
5	Design of Pre Engineered Structures	
5.1	Introduction-section specification	1
5.2	Types of assemblies	1
5.3	Analysis of pre-engineered structure	2
5.4	Design of pre-engineered structure	3
5.5	Connection details	2
	Total	45

# **Course Designer**

1. Dr.M.VELUMANI

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R1/ w.e.f. 12.07.2023 Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

ANT

RoS Chairman CHAIRMAN BOCHAIRMAN BOCHAIC OF Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		Category	L	Т	Ρ	Credit
60 PSE E45	CORROSION ENGINEERING	PE	3	0	0	3

- To rationalize the periodic properties such as corrosive environments •
- To recall the basics of Electrochemical and Polarization
- To endow with an overview of Corrosive concentration
- To enable the students with various concepts like corrosion testing •
- To implement the principles of corrosion prevention •

# Prerequisite

Courses -Strength of Materials, Design of Steel Structures, Concrete Technology Course Outcomes

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

CO1	Define the basic concepts on corrosion.	Remember/
		Understand/
		Analyse/Apply
CO2	Discuss the testing and evaluation of forms of corrosion	Remember/
		Understand/
		Analyse/Apply
CO3	Describes the different types of corrosive environments.	Remember/
		Understand/
		Analyse/Apply
CO4	Illustrate the concepts of corrosion testing.	Remember/
		Understand/
		Analyse/Apply
CO5	Apply the corrosion prevention.	Remember/
		Understand/
		Analyse/Apply
Mappi	ng with Programme Outcomes	

#### Mapping with Programme Outo

COs	P01	PO2	PO3	PO4	PO5	PO6		
CO1	3	2	3	3	2	2		
CO2	3	3	3	3	2	3		
CO3	3	2	3	2	3	2		
CO4	2	2	2	3	2	2		
CO5	3	3	3	3	3	2		
	3- Strong;2-Medium;1-Some							

#### Assessment Pattern

Bloom's Category		Assessment Tests Narks)	End Sem Examination
0,1	1	2	(Marks)
Remember(Re)	10	10	20
Understand(Un)	10	15	20
Apply (Ap)	35	30	50
Analyse (An)	05	05	10
Create (Cr)	-	-	-

S. Wr Ros Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		60 PSE E	45 - COR	ROSION ENG	INEERING			
				RAL ENGINE				
Semester	Hours/			Totalhrs	Credit		Maximum Ma	irks
Comocion	1	T	Р		_	C CA ES		Total
	3	0	0	45	3	40	60	100
	Ţ.	•		10	Ũ	10	00	[09
Cost of Cor Damage – Expressions Environmen	rosion – Corrosion I Classification of C a. Electrochemical A tal Effects: Effect of orrosive concentration	Corrosion. Aspects oxygen a	Corrosic Electroc and oxidiz	n Principles hemical Reac ers – Effect of	: Introductio ctions – Po Velocity – E	on – Co larisation Effect of t	rrosion Rate – passivity emperature -	1 2 ,
Galvanic Co Effect – Pre Corrosion – Evaluation Veld Decay Selective L Other Alloy Galvanic Effects – tir	<b>CORROSION</b> prrosion : EMF and evention. Crevice Co Filiform Corrosion. & Prevention of pit - Knife Line Attack eaching: Dezincifica systems. Erosion C ffect – Combating ne to cracking – E - corrosion Factors -	orrosion: E Pitting – S ting dam ation Cha Corrosion: Erosion c nvironme	Environme Solution c age. Inter aracteristic Surface corrosion. ntal & Me	ental Factors – omposition – granularcorros cs, Mechanisr Films – Veloc Stress corros etallurgical fac	- Mechanisr Velocity – M sion .Auster n, preventic ity – Turbuk sion: crack stors – Mec	n – Coml letallurgic ntic Stair on – Gra ence – Ir morpholo hanism -	bating Crevic cal Variables aless Steels aphitization - npingement ogy – Stress - methods o	:e  - - 
CORROSIV /lineral Acio Acid. Organ vater – soils Liquid me	<b>E ENVIRONMENTS</b> ds: Sulfuric Acid – iic Acids – Alkalies s – Aerospace – Bio atals and fused salts	<b>S</b> Nitric Aci – Atmosp logical co s – sewag	d – Hydro here Corr rrosion – ge and pl	ochloric Acid - rosion – Sea v Human body - ant – waste tr	– Hydrofluo water – Fres - Corrosion eatment – I	ric Acid - sh water of metals Dew poin	<ul> <li>Phosphorie</li> <li>High purity</li> <li>by halogensity</li> </ul>	6
CORROSIC ntroduction Measuring & Cleaning sp Galvanic co stress corro	embrittlement of cra <b>DN TESTING</b> – Classification – & Weighing – Expo becimens after expo rrosion high temper bion – NACE Test us tests of metals.	Purpose sure Tec sure – te sure and	e – Mate hniques – emperatur I pressure	rials and spe - Duration – F e – Standard e – Erosion –	cimens – s Planned Inte expression Intergranula	surface p erval Tes s for cor ir corrosio	ts Aeration - rosion rate - on – pitting 8	- - k
<b>CORROSIC</b> Materials S mediums – comparison	<b>DN PREVENTION</b> election: Metals & Inhibitors. Design: . Coatings: Metallic Failure Analysis.	Wall Thi	ckness –	Design Rules	. Cathodic&	& Anodic	protection - osion contro	-
							TotalHours	45
1988. 2. Raoul	<b>s):</b> G. Fontana, Corrosi Francois, "Corrosior er, 2018							
Reference								
1. J. H. E York, 1	Brophy, R. M.Rose,					-		nc., Ne
	R. Roberge, "Handb							

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#### **Course Contents and Lecture Schedule**

S.No	Торіс	No.of Hours
1	Planning and Functional Requirements	
1.1	Cost of Corrosion	1
1.2	Corrosion Engineering	1
1.3	Definition of Corrosion – Environments	1
1.4	Corrosion Damage – Classification of Corrosion.	1
1.5	Corrosion Principles.	1
1.6	Introduction – Corrosion Rate Expressions.	1
1.7	Electrochemical Aspects: Electrochemical Reactions – Polarisation – passivity.	1
1.8	Environmental Effects: Effect of oxygen and oxidizers – Effect of Velocity – Effect of temperature	1
1.9	Effects of Corrosive concentration – Effect of Galvanic Coupling – Metallurgical Aspects	1
2		
2.1	Galvanic Corrosion : EMF and Galvanic Series – Environmental Effects – Distance Effect – Area Effect	1
2.2	Prevention. Crevice Corrosion: Environmental Factors – Mechanism – Combating Crevice Corrosion	1
2.3	Filiform Corrosion. Pitting – Solution composition – Velocity – Metallurgical Variables	1
2.4	Evaluation & Prevention of pitting damage. Intergranularcorrosion Austentic Stainless Steels – Weld Decay – Knife Line Attack.	1
2.5	Selective Leaching: Dezincification Characteristics, Mechanism, prevention – Graphitization – Other Alloy systems.	1
2.6	Erosion Corrosion: Surface Films – Velocity – Turbulence – Impingement - Galvanic Effect	1
2.7	Combating Erosion corrosion. Stress corrosion: crack morphology	1
2.8	Stress effects – time to cracking – Environmental & Metallurgical factors	1
2.9	Mechanism – methods of prevention – corrosion Factors – Hydrogen Blistering – Hydrogen Embrittlement – Prevention.	1
3	CORROSIVE ENVIRONMENTS	
3.1	Mineral Acids: Sulfuric Acid – Nitric Acid	1
3.2	Hydrochloric Acid – Hydrofluoric Acid	1
3.3	Phosphoric Acid. Organic Acids – Alkalies	1
3.4	Atmosphere Corrosion – Sea water – Fresh water	1
3.5	High purity water – soils – Aerospace	1
3.6	Biological corrosion – Human body – Corrosion of metals by halogens	1
3.7	Liquid metals and fused salts – sewage and plant – waste treatment	1
3.8	Dew point corrosion – liquid metal embrittlement of cracking	1
3.9	Hydrogen peroxide – Rebar corrosion	1
4	CORROSION TESTING	
4.1	Introduction – Classification – Purpose – Materials and specimens	1
4.2	surface preparation – Measuring & Weighing – Exposure Techniques	1

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AW

4.3	Duration – Planned Interval Tests Aeration	1		
4.4	Cleaning specimens after exposure			
4.5	temperature – Standard expressions for corrosion rate	1		
4.6	Galvanic corrosion high temperature and pressure – Erosion	1		
4.7	Intergranular corrosion pitting & stress corrosion	1		
4.8	NACE Test methods – Linear polarization	1		
4.9	Paint Tests – Sea water tests – Miscellaneous tests of metals.	1		
5	CORROSION PREVENTION			
5.1	Materials Selection: Metals & Alloys	1		
5.2	Metal purification.	1		
5.3	Alteration of Environment: changing mediums – Inhibitors	1		
5.4	Design: Wall Thickness	1		
5.5	Design Rules	1		
5.6	Cathodic& Anodic protection – comparison	1		
5.7	Coatings: Metallic & other Inorganic coatings	1		
5.8	corrosion control standards	1		
5.9	Failure Analysis.	1		
	Total	45		

# **Course Designer**

1. Dr.M.VELUMANI

- velumani@ksrct.ac.in

**R1/ w.e.f. 12.07.2023** Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

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		Category	L	Т	Ρ	Credit
60PSE E46	PRINCIPLES AND DESIGN OF BIOLOGICAL TREATMENT SYSTEM	PE	3	0	0	3

- To know the Principles of Aerobic and anaerobic treatment of waste water.
- To design the Aerobic treatment of waste water.
- To identify the anaerobic treatment of waste water.
- To find out the solution of sludge treatment.
- To Know the Construction, operation and maintenance of waste water treatment units

#### Pre requisite

Basic knowledge of properties learnt in basics of Biological treatment system

#### Course Outcomes

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

CO1	Able to develop conceptual schematics required for biological treatment of wastewater	Knowledge/ Analyse/ Apply
CO2	Ability to translate pertinent criteria into system requirements	Knowledge/ Analyse/ Apply
CO3	Analyze the and best solution for anaerobic treatment of wastewater	Knowledge/ Analyse/ Apply
CO4	Design the sludge digestion process.	Knowledge/ Analyse/ Apply
CO5	Identify the construction operation and maintenance aspects	Knowledge/ Analyse/ Apply

### Mapping with Programme Outcomes

COs	P01	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	3	2	2
CO2	2	3	3	3	3	2
CO3	2	3			2	2
CO4	3	2		2	3	3
CO5	3	2	2	2	3	1

#### Assessment Pattern

	ContinuousAsse	ssmentTests (Marks)	End SemExamination
Bloom'sCategory	1	2	(Marks)
Knowledge (Kn)	20	20	30
Apply (Ap)	30	20	50
Analyse (An)	10	20	20
Create (Cr)		-	-

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4.15 **BoS Chairman** 

	K.S.Rang	asamy Co	ollege of	Technology-A	Autonomou	sR2022			
	60PSE E46-	PRINCIP	LES AND	DESIGN OF	BIOLOGIC	AL TREA	TMENT S	SYSTE	М
			TRUCTU						
O a ma a atam			IRUCIU				<b>A :</b>	Maulia	
Semester	Hours			Total hrs	Credit		Maximum	-	
	L	T	Р		C	CA	ES	To	
III         3         0         0         45         3         40         60         100									
Principles									[09]
	of biological treatr								
	rowth – Factors a								
	fficients for organi		/al – Bio	odegradability	assessmen	it -select	tion of p	rocess-	-
	ch-continuous type								
	Aerobic Treatment								[09]
	ewage treatment pla								
	lembrane Biologica								-
	d reactors, aerate								
	tment systems, con				- disposai d	options –	reclamat	ion and	
	v charts, layout, hyc Treatment of Was		nie, recer	nt trends					
	I suspended growt		of unito		w filtoro El	uidizad b	odo conti	o topk	
	il – Nutrient remova								
	atment and Dispo			lan Layout and				nus.	[09
	sludge managemer		مەلىرام م	thickening s		stion hid	nap sen	oration	
	atering (mechanical								
	esidue disposal – re					upgraan		y planta	
	on Operations and			pects					[09]
	n and Operational N				shootina –	Planning	Organizi	ing and	
	of plant operations								
managemer		, ,		, -	5			5	
0							Total	Hours	45
Textbook(	s):								
1. Arceiva	ala, S.J., "Wastewat	er Treatm	ent for Po	ollution Control	". TMH. Nev	v Delhi. S	Second Ed	dition. 2	2000
	S.K., "Environmenta							undon, 2	
_			iliy voi.	II, MIAIIIA F UK			2003.		
Reference	.,								
	l on "Sewerage			atment" CPH	EEO, Minis	stry of	Urban D	evelop	men
	nment of India, New								
2. Metcalf & Eddy, INC, 'Wastewater Engineering - Treatment and Reuse'', Fourth Edition, Tata Metcalf									
<ul> <li>Graw-Hill Publishing Company Limited, New Delhi, 2003.</li> <li>3. Qasim, S.R. "Wastewater Treatment Plant, Planning, Design &amp; Operation", Technomic Publications,</li> </ul>									
		Treatment	t Plant, Pl	anning, Desigr	n & Operatio	on", Tech	nomic Pu	blicatio	ns,
	rk, 1994.		. =						
4. Karia (	G L & Christian R	A, "Waste	ewater Ti	reatment", Pre	ntice Hall c	ot India,	New Dell	וו, 2013	8.

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#### Course Contents and Lecture Schedule

S.No	Торіс	No.of Hours
1	Principles	
1.1	Objectives of biological treatment	1
1.2	aerobic and anaerobic treatment kinetics of biological growth	2
1.3	Factors affecting growth	1
1.4	attached and suspended growth	1
1.5	Determination of Kinetic coefficients for organics removal	1
1.6	Biodegradability assessment	1
1.7	Classification of reactors	1
1.8	batch-continuous type	1
2	Design of Aerobic Treatment Systems	
2.1	Design of sewage treatment plant units	1
2.2	Activated Sludge process	1
2.3	Sequencing Batch reactors	1
2.4	Membrane Biological Reactors	1
2.5	Trickling Filters	1
2.6	Moving Bed Reactors and fluidized bed reactors	1
2.7	aerated lagoons and waste stabilization ponds	1
2.8	constructed wet land	1
2.9	reclamation and reuse	
3	Anaerobic Treatment of Wastewater	
3.1	Attached and suspended growth	2
3.2	Design of units - UASB	2
3.3	Nutrient removal systems	1
3.4	septic tank and disposal	1
3.5	septic tank and disposal	1
3.6	Flow chart Layout and Hydraulic profile	2
4	Sludge Treatment and Disposal	
4.1	Design of sludge management facilities,	1
4.2	sludge thickening, sludge digestion	2
4.3	biogas generation	2
4.4	sludge dewatering	1
4.5	Layout PID hydraulics profile	1
4.6	upgrading existing plants	1
4.7	ultimate residue disposal	1
5	Construction Operations and Maintenance Aspects	
5.1	Construction and Operational Maintenance problems	2
5.2	Trouble shooting	1
5.3	Planning, Organizing and Controlling of plant operations	1

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5.4	capacity building	1
5.5	sewage treatment plants	2
5.6	sludge management facilities	1
5.7	Case studies	1
	Total	45

# CourseDesigners

Dr.S.RAMESH - rameshs@ksrct.ac.in

**R1/ w.e.f. 12.07.2023** Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

A.W.

	TRANS
60PSE E47	

Category	L	Т	Ρ	Credit
PE	3	0	0	3

- To understand the fluid characteristics
- To know concepts related to water transmission mains .

WATER

- To find the water distribution system, sewer networks and .
- To design the storm water drain, with emphasis on computer application.
- To know the Case studies on transportation of water and waste water

#### Pre requisite

Basic knowledge of Environmental Engineering courses

#### Course Outcomes

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

CO1	Understand the general hydraulics and principles of flow measurements.	Knowledge/ Analyse/ Apply
CO2	Describe the components of water transmission system.	Knowledge/ Analyse/ Apply
CO3	Analyze the water distribution networks plan the wastewater collection from various sources	Knowledge/ Analyse/ Apply
CO4	Evaluate the conveyance of wastewater and various appurtenances	Knowledge/ Analyse/ Apply
CO5	Estimate the storm water drainage quantity by various methods.	Knowledge/ Analyse/ Apply

#### Mapping with Programme Outcomes

COs	P01	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	3	3
CO2	3	2	2	3	3	2
CO3	2	3			3	2
CO4	3	2		2	3	1
CO5	3	2	3	3	2	2

#### Assessment Pattern

	ContinuousAsse	End SemExamination			
Bloom'sCategory	1 2		(Marks)		
Knowledge (Kn)	20	20	30		
Apply (Ap)	30	20	50		
Analyse (An)	10	20	20		
Create (Cr)		-	-		

#### K.S.Rangasamy College of Technology–Autonomous

R2022

A. Ko **BoS Chairman** CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

Fluid properties; fluid flow – continuity principle, energy principle and momentum principle; frictional head       [09]         Dess in free and pressure flow, minor heads losses, Carrying Capacity–Flow measurement.       [09]         Vater Transmission and Distribution       [09]         Ved for Transport of water and waste water-Planning of water system-Selection of pipe materials-Water ransmission main design-gravity and pumping main, selection of pumps-characteristics-economics; specials, jointing and maintenance, water hammer analysis, water distribution pipe network design, inalysis and optimization-appurtenances-corrosion prevention-minimization of water losses-leak letection, storage reservoir.       [09]         Wastewater Collection and Conveyance       [09]         Planning factors – Design of sanitary sewer; partial flow in sewers, economics of sewer design; Vastewater pumps and pumping stations- sewer appurtenances; material, construction, inspection and naintenance of sewers; Design of sewer outfalls-mixing conditions; conveyance of corrosive vastewaters.       [09]         Storm Water Drainage       [09]         Necessity- combined and separate system; Estimation of storm water run off Formulation of rainfall ntensity duration and frequency relationships- Rational methods.       [09]         Case Studies and Software Applications       [09]         Jse of computer software in water transmission, water distribution and sewer design – LOOP version 4.0, SEWER, BRANCH, Canal ++ and GIS based soft ware's.       [09]				TRUCTU					
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<ol> <li>Textbook(s):         <ol> <li>Bajwa, G.S. "Practical Handbook on Public Health Engineering", Deep Publishers, Shimla, 2003</li> <li>M.J.Hammer, "Water and Wastewater Technology", Regents / Prentice Hall, New Jercy, 2001.</li> </ol> </li> <li>Reference(s):         <ol> <li>"Manual on water supply and Treatment", CPHEEO, Ministry of Urban Development, Government India, New Delhi, 1999.</li> <li>"Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Urban Development Government of India, New Delhi, 1993.</li> <li>Ronald L Droste, "Theory and Practice of water and Wastewater Treatment", Wiley Publications.</li> <li>Syed R Qasim, "Wastewater Treatment Plants – Planning, Design and Operations, CRC Press</li> </ol> </li> </ol>						vater run of	f Formula	tion of rair	
<ol> <li>Bajwa, G.S. "Practical Handbook on Public Health Engineering", Deep Publishers, Shimla, 2003</li> <li>M.J.Hammer, "Water and Wastewater Technology", Regents / Prentice Hall, New Jercy, 2001.</li> <li>Reference(s):         <ul> <li>"Manual on water supply and Treatment", CPHEEO, Ministry of Urban Development, Government India, New Delhi, 1999.</li> <li>"Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Urban Development Government of India, New Delhi, 1993.</li> <li>Ronald L Droste, "Theory and Practice of water and Wastewater Treatment", Wiley Publications.</li> <li>Syed R Qasim, "Wastewater Treatment Plants – Planning, Design and Operations, CRC Press</li> </ul> </li> </ol>	Case Studie	ation and frequency as and Software A puter software in w	relationshi	ps- Ration ission, wat	al methods.				nfall [09
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<ul> <li>Reference(s):</li> <li>1. "Manual on water supply and Treatment", CPHEEO, Ministry of Urban Development, Government India, New Delhi, 1999.</li> <li>2. "Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Urban Developme Government of India, New Delhi, 1993.</li> <li>3. Ronald L Droste, "Theory and Practice of water and Wastewater Treatment", Wiley Publications.</li> <li>4. Syed R Qasim, "Wastewater Treatment Plants – Planning, Design and Operations, CRC Press</li> </ul>	ntensity dura case Studie Jse of comp .0, SEWER	ation and frequency es and Software A outer software in w 8, BRANCH, Canal	relationshi	ps- Ration ission, wat	al methods.			OOP versi	nfall [09 on
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<ul> <li>India, New Delhi, 1999.</li> <li>"Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Urban Developme Government of India, New Delhi, 1993.</li> <li>Ronald L Droste, "Theory and Practice of water and Wastewater Treatment", Wiley Publications.</li> <li>Syed R Qasim, "Wastewater Treatment Plants – Planning, Design and Operations, CRC Press</li> </ul>	tensity dura ase Studie lse of comp .0, SEWER Textbook( 1. Bajwa, 2. M.J.Ha	ation and frequency es and Software A puter software in w 8, BRANCH, Canal (s): G.S. "Practical Ha ammer, "Water and	y relationshi pplications ater transm ++ and GIS	ps- Ration ission, wat based sof	al methods. er distribution a t ware's. ealth Engineer	and sewer c	lesign – L Publishers	OOP versie <b>TotalHou</b> s, Shimla, 2	nfall [09 on <b>rs 45</b> 2003
<ul> <li>Government of India, New Delhi, 1993.</li> <li><sup>3.</sup> Ronald L Droste, "Theory and Practice of water and Wastewater Treatment", Wiley Publications.</li> <li>4. Syed R Qasim, "Wastewater Treatment Plants – Planning, Design and Operations, CRC Press</li> </ul>	ase Studie Ise of comp .0, SEWER Textbook( 1. Bajwa, 2. M.J.Ha Reference	ation and frequency as and Software A buter software in w BRANCH, Canal (s): G.S. "Practical Ha ammer, "Water and as (s):	y relationshi <b>pplications</b> ater transm ++ and GIS andbook or d Wastewa	ps- Ration ission, wat based sof	al methods. er distribution a t ware's. ealth Engineer ology", Regent	and sewer c ing", Deep I s / Prentice	lesign – L Publishers Hall, New	OOP version <b>TotalHou</b> s, Shimla, 2 v Jercy, 20	nfall [09 on <b>109</b> <b>rs 45</b> 2003 01.
4. Syed R Qasim, "Wastewater Treatment Plants – Planning, Design and Operations, CRC Pre	Textbook(         1.       Bajwa,         2.       M.J.Ha         Reference       1.         1.       Manual         India, 1       Manual	ation and frequency as and Software A buter software in w BRANCH, Canal (s): G.S. "Practical Ha ammer, "Water and (s): al on water supply New Delhi, 1999.	y relationshi pplications ater transm ++ and GIS andbook or d Wastewat y and Treat	ps- Ration ission, wat based sof <u>n Public He</u> ter Techno tment", CF	al methods. er distribution t ware's. ealth Engineer plogy", Regent PHEEO, Minist	and sewer c ing", Deep I s / Prentice ry of Urban	lesign – L Publishers Hall, New	OOP version <b>TotalHou</b> s, Shimla, 2 v Jercy, 20 ment, Gov	nfall [09] on <b>[09]</b> rs 45 2003 01. rernment
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S.No	Торіс				
1	General Hydraulics and Flow Measurement				
1.1	Fluid properties	1			
1.2	fluid flow – continuity principle, energy principle and momentum principle	2			
1.3	frictional head loss in free and pressure flow	2			
1.4	minor heads losses	2			
1.5	Flow measurement	2			
2	Water Transmission and Distribution				

A Works

2.1	Need for Transport of water and waste water	1
2.2	Planning of water system	1
2.3	Selection of pipe materials	1
2.4	Water transmission	1
2.5	selection of pumps	1
2.6	jointing and maintenance	1
2.7	water distribution pipe network design	1
2.8	appurtenances	1
2.9	minimization of water losses	1
3	Wastewater Collection and Conveyance	
3.1	Design of sanitary sewer	1
3.2	partial flow in sewers	2
3.3	Wastewater pumps and pumping stations	1
3.4	sewer appurtenances	1
3.5	inspection and maintenance of sewers	1
3.6	Design of sewer outfalls	2
3.7	Conveyance of corrosive wastewaters.	1
4	Storm Water Drainage	
4.1	Necessity of storm water drainage	1
4.2	combined and separate system	2
4.3	Estimation of storm water run off	2
4.4	Formulation of rainfall intensity duration	2
4.5	Frequency Analysis	1
4.6	Rational methods.	1
5	Case Studies and Software Applications	
5.1	Use of computer software in water transmission	2
5.2	water distribution and sewer design	2
5.3	LOOP version 4.0	1
5.4	SEWER -BRANCH	1
5.5	Canal ++	1
5.6	GIS based soft wares	2
	Total	45

# **Course Designers**

1. Dr.P.MAGESHKUMAR - mageshkumarp@ksrct.ac.in

**R1/ w.e.f. 12.07.2023** Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

4 10----

		Category	L	Т	Ρ	Credit
60 PSE E51	PRESTRESSED CONCRETE STRUCTURES	PE	3	0	0	3

- Understand the principles and general mechanical behavior of prestressed concrete
- To analyze the transfer of prestress and time dependent factors like losses of prestress
- · Design of prestressed concrete flexural members
- Design of tension and compression members in prestressed concrete.
- Analyze and design of composite members and special structural elements like water tank, poles, pipes.

#### Prerequisite

Fundamentals of Mathematics, knowledge in mechanics.

#### **Course Outcomes**

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

CO1	Evaluate the internal forces and deflection in prestressed concrete.	Remember/Apply
CO2	Design the pre-stressing layout and understand the behavior of pre-stressed	Evaluate/Apply
	concrete elements under practical loading conditions	
CO3	Practice the Analysis and design of continuous beams and extend the	Analysis/Apply
	knowledge on concept of linear transformation.	
CO4	Outline the design of tension and compression members in prestressing.	Remember/ Analysis
CO5	Illustrates the design of composite members and partial prestressing.	Understand

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6				
CO1	2	1	1	3	2	3				
CO2	2	1	2	3	2	3				
CO3	3	2	2	2	1	3				
CO4	2	2	1	2	3	3				
CO5	1	2	1	1	3	3				
	3- Strong;2-Medium;1-Some									

#### Assessment Pattern

Bloom's Category	Continuous (	End Sem. Examination	
	1	2	(Marks)
Remember	10	10	10
Understand	10	10	10
Apply	10	10	20
Analyse	10	10	20
Evaluate	10	10	10
Create	10	10	30

4.15

	K.S.Rangasamy College of Technology – Autonomous R2022											
	60 PSE E51 - PRESTRESSED CONCRETE STRUCTURES											
M.E. STRUCTURAL ENGINEERING Elective V												
	Somester Hours / Week Total Hours Credit Maximum Marks											
50		L	Т	Р		С	CA	ES	Total			
		3	0	0	45	3	40	60	100			
Princi	iples of F	Prestressin Prestressing s, deflection	- types	and systems ng term), cam	of prestressing, need for ber, cable layouts.	High Strer	ngth mate		Analysis 9]			
Beha	viour of fl		bers, dete		ultimate flexural strength – sign of end blocks.	Codal provi	sions -De	esign o [9]				
Analy	sis and d	<b>itinuous Be</b> esign of cor ble profile ar	ntinuous I		ods of achieving continuity	– concept c	of linear t	ransfo [9]	rmations,			
Desig water flagm <b>Desig</b>	n of tensi tanks - asts and s <b>gn of Con</b>	ion member Design of c similar struc n <b>posite Me</b>	s - applic compress tures. <b>mbers</b>	ion members	esign of prestressed pipes a with and without flexure -	its applicat	ion in th	e des [9]	ign piles,			
		ams - anai d applicatioi		design, ultin	nate strength - their appli	cations. Pa	-	[9]	-			
							Т	otal H	ours:45			
1 ext			Prestress	ed Concrete"	, Tata McGraw-Hill Publis	hing Compa	any Ltd.,	New	Delhi,			
	2018.	<u> </u>	<b>.</b>		<u> </u>	<u> </u>	4000					
2 Pofor			Design of	Prestressed	Concrete Structures" John \	wiley & Son	s, 1982.					
Refer	rence(s) :		AKSO	agunta "Droc	tressed Concrete Structure	(Wob Cour						
1	Notes,	2008.		0		Υ.						
2		a Raju.N, "I elhi, 2015.	Problems	& Solutions	- Prestressed Concrete",	CBS Publis	shers & I	Distrib	utors.,			
3	Rajago	palan.N "Pr	estressed	d Concrete", N	larosa Publishing House, 20	005.						
4	IS: IS 1	343: 2012,	"Prestres	sed Concrete	- Code of Practice" Second	Revision						
С	ourse Co	ontents and	Lecture	Schedule								
	S.N	0			Торіс		No.of Hour					

S.NO	Горіс	NO.OF Hours
1	Principles of Prestressing	
1.1	Principles of Prestressing	2
1.2	Types and systems of prestressing	2
1.3	Analysis methods losses	2
1.4	Deflection (short-long term)	2
1.5	Cable layouts	1
2	Design of Flexural Members	
2.1	Behaviour of flexural members	1
2.2	Determination Of Ultimate Flexural Strength	1

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2.3	Codal provisions	1
2.4	Design of flexural members	2
2.5	Design for shear,	1
2.6	Design for bond	1
2.7	Design for torsion	1
2.8	Design of end blocks	1
3	Design of Continuous Beams	
3.1	Analysis of continuous beams	2
3.2	Design of continuous beams	2
3.3	Methods of achieving continuity	2
3.4	Concept of linear transformations	1
3.5	Concordant cable profile and gap cables	2
4	Design of Tension and Compression Members	
4.1	Design of tension members	1
4.2	Application in the design of prestressed pipes	1
4.3	Prestressed concrete cylindrical water tanks	1
4.4	Design of compression members with flexure	2
4.5	Design of compression members without flexure	2
4.6	Application in the design piles, flagmasts and similar structures	2
5	Design of Composite Members	
5.1	Composite beams- Introduction	1
5.2	Analysis and design of Composite beams	2
5.3	Ultimate strength of Composite beams	2
5.4	Partial prestressing	2
5.5	Advantages and Applications of Partial prestressing	2
	Total	45

# CourseDesigners

1. Dr.R.Jagadeesan - jagadeesan@ksrct.ac.in

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		Category	L	Т	Ρ	Credit
60PSE E52	ADVANCED CONCRETE TECHNOLOGY	PE	3	0	0	3

- To understand the knowledge of properties of durability of concrete.
- To conduct various tests on properties of special concretes.
- To gain knowledge about formwork and quality control.
- To gain knowledge about the properties of concreting under special circumstances.
- To understand the Mix design using IS method.

#### Pre requisite

Basic knowledge of properties of concrete making materials.

#### Course Outcomes

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

CO1	Discuss about the methods of concrete mix design	Analyse/ Apply
CO2	Describe the special concretes	Remember
CO3	Outline the durability of concrete.	Remember/ Analyse/
CO4	Identify the concepts form work and quality control	Remember
CO5	Illustrate the behavior of concreting under special circumstances.	Remember

#### Mapping with Programme Outcomes

COs	P01	PO2	PO3	PO4	PO5	PO6	
CO1	3	2	2	2	2	2	
CO2	3	3	2	2	2	2	
CO3	3	3			2	1	
CO4	2	2		3	3	1	
CO5	3	2	2	3	3	1	
3- Strong:2-Medium:1-Some							

3- Strong;2-Medium;1-Some

#### Assessment Pattern

Bloom's Category	Continuous A (N	End Sem Examination	
Dicom a category	1	2	(Marks)
Remember (Re)	20	20	30
Apply (Ap)	30	20	50
Analyse (An)	10	20	20
Create (Cr)		-	-

4. 16-**BoS Chairman** CHAIRMAN Baculty of Civil Engineering Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

				of Technology - A			R	2022		
	60			ED CONCRETE TEC		(				
				URAL ENGINEERIN						
Semester		ours / Week	с   Р	Total Hours	Credit	Maxim				
	L 3	<b>T</b>	р 0	45	<b>C</b>	<b>CA</b> 40	<b>ES</b> 60	-	otal 00	
Concrete - Ch	t, Present and F	uture- Cons eral Admixtu	tituent Mat ures-Prope	terialsStrength of ( rties of Fresh and h	Concrete- D	imensional S	stabilit	y of	[9]	
Concrete-Stee	nd Heavy Weigh	rced Conc		gth Concrete-High Po cement Concrete-V					[9]	
concrete-fire	hemical attack-	ods of ma	king dura	/ of water - marine ble concrete - Mas e Construction.					[9]	
Formwork Ma	d Quality Contr terials and Syst crete Construction	ems-Specifi		sign-Recommendati	ons of IS 4	56- 2000 on	Quali	ity -	[9]	
Formwork Ma Errors in Cond Concreting U Underground Cold weather	terials and Syst crete Construction <b>nder Special C</b> Construction-Co concreting. Tes ests on Harden	ems-Specifions-Quality M incumstanc increting in I sts on Conc	Manageme es Marine Env rete: Evalu	sign-Recommendati	ter Constru f existing s	ction-Hot wea	ather	and	[9]	
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S.No	Торіс	No.of Hours
1	Introduction	
1.1	Introduction about concrete and concrete making materials	1
1.2	Concrete - Past, Present and Future	1
1.3	Constituent Materials - Concrete	1
1.4	Strength of Concrete	1
1.5	Dimensional Stability of Concrete	1
1.6	Chemical and Mineral Admixtures	1
1.7	Properties of Fresh and hardened Concrete	1
1.8	Principles of Concrete Mix Design	1
1.9	Methods of Concrete mix design.	1
2	Special Concretes	
2.1	Lightweight and Heavy Weight Concrete	1
2.2	High Strength Concrete	1
2.3	High Performance Concrete	1
2.4	Polymers in Concrete	1
2.5	Steel fiber Reinforced Concrete	1
2.6	Ferro cement Concrete	1
2.7	Vacuum Concrete	1
2.8	Ready Mixed Concrete	1
2.9	SIFCON – SIMCON	1
3	Durability of Concrete	
3.1	Permeability & chemical attack	1
3.2	sulphate attack & Quality of water	2
3.3	marine conditions	1
3.4	Thermal properties of concrete - fire resistance	2
3.5	methods of making durable concrete	1
3.6	Mass Concrete	1
3.7	Formwork for concrete	1
3.8	Structural Concrete & Block Masonry	
3.9	Quality Control of Concrete Construction.	
4	Formwork and Quality Control	
4.1	Formwork Materials and Systems	1
4.2	Specifications	2
4.3	Design	2
4.4	Recommendations of IS 456- 2000 on Quality	1
4.5	Recommendations of IS 456- 2000 on Quality	1
4.6	Errors in Concrete Constructions	1

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4.7	Quality Management.	1
5	Concreting Under Special Circumstances	
5.1	Underground Construction	1
5.2	Concreting in Marine Environment	1
5.3	Under water Construction	1
5.4	Hot weather and Cold weather concreting	1
5.5	Tests on Concrete: Evaluation of Strength of existing structures- investigation Techniques	2
5.6	Tests on Hardened Concrete-Non Destructive Testing	1
5.7	Semi destructive testing techniques	1
5.8	Tests on fresh Concrete	1
	Total	45

# CourseDesigners

1. Dr. S. Gunasekar – gunasekar@ksrct.ac.in

R1/ w.e.f. 12.07.2023 Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

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RAC Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		Category	L	Т	Ρ	Credit
60 PSE E53	ASEISMIC DESIGN OF STRUCTURES	PE	3	0	0	3

## Objective

- To learn the fundamentals of seismology and basic earthquake mechanisms, tectonics types of ground motion, and propagation of ground motion.
- Determine the maximum dynamic response of an elastic vibrating structure to a given forcing function
- Learn the fundamentals of building code based structural design
- Determine the static design base shear based on the type of structural system, irregularity, location and occupancy
- Recognize special conditions such as irregular buildings, building separation, P-delta

## Prerequisite

Fundamentals of Mathematics, knowledge of basic Science

#### **Course Outcomes**

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

	Identify the causes and effects of earthquake and describe the terms related to	Remember,
	earthquake.	Understand, Apply
CO2	Define the basic concepts of elements of vibration and behavior of structures under	Remember,
	cyclic loading.	Understand,
		Analyze
CO3	Practice the codal provisions for design and detailing of earthquake resistant	Remember,
	structures.	Understand, Apply,
		Analyze
CO4	Formulate the design principles for Non-engineered buildings and design provisions for	Analyze
	bridges and dams.	-
CO5	Categorize the new concepts on different types of base isolation techniques.	Understand and
		Apply

## Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6		
CO1	3	3	2	2	3			
CO2	3	3	3	2	3	3		
CO3	2	3	3	3	2	2		
CO4	2	2	3	3	2	1		
CO5	2	3	2	3	2	2		
	3- Strong;2-Medium;1-Some							

## Assessment Pattern

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

R1/ w.e.f. 12.07.2023

Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

4. 14 **BoS** Chairman CHAIRMAN Board of Studies Faculty of Civil Engineerin K.S.Rangasamy College of Techno TIRUCHENGODE - 637 215 ring



				-	llege of Technolog				
			60	PSE E53 -	ASEISMIC DESIGN	OF STRUCTURE	S		
				M.E. \$	STRUCTURAL ENG	SINEERING			
6		۲.	lours / W	eek	Total Hours	Credit	М	aximum N	larks
26	emester	L	Т	Р	45	С	СА	ES	Total
	III	3	0	0	45	3	40	60	100
Elem	nents of Se	ismology		L			•		
Elem	ents of Eng	gineering Se	eismology,	Character	istics of Earthquake	s, History, Seism	ic Susceptibi	lity of India	n
Subc	ontinent, P	erformance	of structu	res during	past earthquakes, L	essons learnt fro	m past eartho	quakes.	[9]
Theo	ory of Vibra	ations							
Theo	ory of vibra	tions ,Build	ling Syste	ms , Rigio	d Frames, Braced	Frames, Shear	Walls, Beha	vior of RC	;, Steel and
Prest	tressed cor	ncrete eleme	ents under	cyclic load	ling ,Soil liquefactior	n and prevention	methods		[9]
Coda	al Provisio	ns for Desi	gn & Deta	ailing					
Conc	ept of Eart	thquake Re	- sistant De	sign, Resp	onse Spectrum ,De	sign Spectrum F	Provisions of	Seismic Co	ode IS 1893
(Part	1) – 2002	Structural (	Configurat	ion,3Dc	omputer analysis of	f building (Theory	/) ,Design an	nd Detailing	of Frames
-	-	d Framed W	-			0	.,		[9]
		d Buildings	,						
	•	•		on. strenath	nening of buildings, l	Desian Provision	s for Bridaes	and Dams	[9]
		Technique		,			<b>----------</b>		1.1
		•		lontive svst	tems and Case stud	ies			[9]
mout								Tat	al Hours 45
Text	book (s) :							101	
1	. ,	Earthouake	-resistant o	lesian of bu	ilding structures", Ra	ikamal Press.Dell	ni.First edition	-2013.	
2		-		-	design of structures",	-			
Refe	rence(s) :					~			
1		opra, "Dynam Iall Inc., 200 <sup>-</sup>		ctures – The	eory and applications	to Earthquake Er	ngineering",		
2									
3	-				tructures', McGraw-H				
4	Pankaj Ag 2008.	jarwal & Ma	nish Shrik	nande, "Eai	rthquake Resistant [	Design of Structur	es", PHI Leai	rning Pvt Li	d, New Dell

**R1/ w.e.f. 12.07.2023** Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023



Ros Chairman CHAIRMAN Bock Studies Faculty of Civile Studies Faculty of Civile of Tachnology K.S.Rangasamy College of Tachnology TIRUCHENGODE - 637 215

S.No	Торіс	No. of Hours
1	Elements of Seismology	
1.1	Elements of Engineering Seismology	1
1.2	Characteristics of Earthquakes	1
1.3	Seismic Susceptibility of Indian Subcontinent	1
1.4	Performance of structures during past earthquakes	2
1.5	Lessons learnt from past earthquakes	1
2	Theory of Vibrations	
2.1	Theory of vibrations	1
2.2	Building Systems	1
2.3	Rigid Frames and Braced Frames	2
2.4	Behavior of RC under cyclic loading	1
2.5	Behavior of Steel elements under cyclic loading	1
2.6	Behavior of Prestressed concrete elements under cyclic loading	1
2.7	Soil liquefaction and prevention methods	2
3	Codal Provisions for Design & Detailing	
3.1	Concept of Earthquake Resistant Design	1
3.2	Response Spectrum	1
3.3	Design Spectrum	1
3.4	Provisions of Seismic Code IS 1893 (Part I) – 2002	1
3.5	3 D computer analysis of building (Theory)	2
3.6	Design and Detailing of Frames	1
3.7	Shear Walls and Framed Walls	1
3.8	Provisions of IS-13920	1
4	Non Engineered Buildings	
4.1	Design of Non Engineered construction	2
4.2	Strengthening of buildings	1
4.3	Design Provisions for Bridges	3
4.4	Design Provisions for Dams	3
5	Base Isolation Techniques	
5.1	Modern Concepts	1
5.2	Base Isolation	3
5.3	Adoptive systems	3
5.4	Case studies	2
_	Total	45

**Course Designers** 

1.

Dr.J.Abdul Bari - abdulbari@ksrct.ac.in

R1/ w.e.f. 12.07.2023 Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023

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RoS Chairman CHAIRMAN BOCHAIRMAN BOCHAIC OF Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		Category	L	Т	Ρ	Credit
60 PSE E54	MAINTENANCE AND REHABILITATION OF STRUCTURES	PE	3	0	0	3

## Objective

- To study the quality assurance for concrete construction, causes of deterioration of concrete structures.
- To study the different types of techniques for repair and rehabilitation of structure.
- To design and suggest repair strategies for deteriorated concrete structures including repairing with composites.
- To understand the strength and durability properties, their effects due to climate and temperature.
- To understand the mechanism of deterioration of concrete, damage assessment, repair materials

#### Prerequisite

Fundamentals of Mathematics, knowledge of properties of construction materials and its mechanics and concrete technology.

## **Course Outcomes**

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

CO1	Learn the properties related to mechanics of deterioration of concrete.	Understand
CO2	Evaluate the basic concepts of the corrosion.	Evaluate
CO3	Point out various types of techniques to repair crack, wear, fire and leakage.	Create
CO4	Study the various types and properties of repair materials.	Remember
CO5	Describe the various demolition techniques and demolition methods	Understand

## Mapping with Programme Outcomes

COs	P01	PO2	PO3	PO4	PO5	PO6		
CO1	2	1	1	3	2	3		
CO2	2	1	2	3	2	3		
CO3	3	2	2	2	1	3		
CO4	2	2	1	2	3	3		
CO5	1	2	1	1	3	3		
	3- Strong;2-Medium;1-Some							

#### **Assessment Pattern**

Bloom's Category		Assessment Tests Marks)	End Sem. Examination
Dicom s category	1	2	(Marks)
Remember	10	10	10
Understand	10	10	10
Apply	10	10	20
Analyse	10	10	20
Evaluate	10	10	10
Create	10	10	30

4. 45 Ros Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		К.	S.Rangas	amy College	of Technology - Autonor	nous R202	2			
	60PSE E54 MAINTENANCE AND REHABILITATION OF STRUCTURES									
	M.E. STRUCTURAL ENGINEERING									
					Elective V					
Se	emester		lours / W		Total Hours	Credit	redit Maximum Marks			
		L	Т	Р		С	CA ES		Total	
		3	0	0	45	3	40	60	100	
	duction						[9]	-		
	•				concrete properties strength,				rties and	
	•		iate, tempe	erature, chemi	cals, wear and erosion, Desig	gn and cons				
Dura	bility of St	ructures					[	9]		
Corro	sion mech	anism – dia	gnosis- ca	uses and effe	cts - cover thickness and cra	acking, meas	urement	s for co	rrosion -	
meth	ods of corro	osion protec	tion, corro	sion inhibitors	, corrosion resistant steels, c	oatings, cath	nodic pro	tection.		
Main	tenance ar	nd Repair S	trategies					[9]		
Defin	itions: Maii	ntenance, r	epair and	rehabilitation,	Facets of Maintenance imp	portance of	Maintena	ance Pi	eventive	
meas	ures on va	arious aspe	cts. Inspe	ction, Assess	ment procedure for evaluati	ing a damag	ged strue	cture ca	auses of	
deter	ioration - te	sting techni	ques.							
Mate	rials for Re	epair					[9	9]		
Spec	ial concret	es and mo	rtar, conc	rete chemica	ls, special elements for ac	celerated st	rength o	gain, E	xpansive	
					ete, ferro cement concrete, f			-	-	
			-		ed concrete, mortar and dry p					
	•	-		ation of struc	• •	,		[9]		
	-	-			repair for cracks, shoring and	dunderninni	ng Rena		vercome	
						-	• ·			
		•		•	cal disruption, weathering w	/ear, me, lea	акауе, п		sposure	
Engir	ieerea aerr		niques for	Dilapilated str	uctures - case studies					
Tart	hook (a) -							otal H	ours:45	
lext	book (s) :		Allon and	Harald Dana	r "Conorata Structuras M	atoriala Ma	intonon		Donair"	
1		•		nical UK, 200	r, "Concrete Structures – M 1.	ateriais, ivia	lintenano	ce and	Repair,	
<ul> <li>Peter H. Emmons, "Concrete Repair and Maintenance", Galgotia Publications Ed Second, 2010.</li> </ul>										
Refe	rence(s) :	,		•			,			
1		n and S.C.	Edwards,	"Repair of Co	oncrete Structures", Blakie a	and Sons, U	K, 2007			
2	Vidivelli, E	3. "Repair a	ind Rehat	oilitation of St	ructures", Standard Publish	ers & Distrib	outors, N	D,2010	).	
3				•	ering Handbook", Mc Graw					
4	S Macdor	nald ,"Conc	rete – Bui	Iding Patholo	gy", John Wiley and Sons E	d First, 200	2			

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Ros Chairman CHAIRMAN Bochairman Faculty of Civiliage of Technology K.S.Rangasamy Collidge of Technology TIRUCHENGODE - 637 215

S.No	Торіс	No.of Hours
1	Introduction	
1.1	Introduction	1
1.2	Quality assurance for concrete	1
1.3	Permeability of Concrete	1
1.4	Thermal Properties and Cracking	2
1.5	Effects due to climate, temperature, chemicals, wear and erosion	2
1.6	Design and construction errors	2
2	Durability of Structures	
2.1	Corrosion Mechanism	1
2.2	Causes and Effectsof Corrosion	1
2.3	Cover Thickness and Cracking	2
2.4	Measurements for Corrosion	1
2.5	Methods of Corrosion Protection	1
2.6	Corrosion Inhibitors	1
2.7	Corrosion Resistant Steels	1
2.8	Coatings for reinforcement	1
2.9	Cathodic Protection	2
3	Maintenance and Repair Strategies	
3.1	Various types of Repair and Rehabilitation Techniques	2
3.2	Maintenance of Structures	2
3.3	Facets of Maintenance	1
3.4	Importance of Maintenance and Their Preventive Measures	1
3.5	Inspection and their types	1
3.6	Assessment procedure for evaluating a damaged structures	1
3.7	Testing Techniques.	1
4	Materials for Repair	
4.1	Special concretes and mortar	2
4.2	Concrete Chemicals	1
4.3	Special Elements for Accelerated Strength Gain	1
4.4	Expansive cement	1
4.5	Polymer Concrete, Sulphur Infiltrated Concrete	1
4.6	Ferro Cement Concrete, Fibre Reinforced Concrete	1
4.8	Foamed Concrete, Mortar and Dry Pack, Vacuum Concrete	1
5	Techniques for Repair and rehabilitation of structures	
5.1	Rust, Gunite and Shotcrete Epoxy injection	2
5.2	Mortar Repair for Cracks	1
5.3	Shoring and Underpinning	1

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5.4	Repairs to overcome low member strength	1
5.5	Deflection, Cracking, Chemical Disruption, Weathering Wear	1
5.6	Fire and Leakage	1
5.7	Marine Exposure Engineered Demolition Techniques for Dilapilated Structures	1
5.8	Case Studies	1
	Total	45

# CourseDesigners

1. Dr.K.VIJAYA SUNDRAVEL

- vijayasundravel@ksrct.ac.in

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RoS Chairman CHAIRMAN BOCHAIRMAN BOCHAIC OF Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		Category	L	Т	Р	Credit
60 PSE E55	MODERN CONSTRUCTION MATERIALS	PE	3	0	0	3

## Objective

- To gain knowledge of modern construction materials to be used in the field.
- To study about special concrete commonly used in civil engineering construction.
- To understand the properties of metals and its applications.
- To study about the properties of various water proofing materials.
- To adopt smart materials for smart structures.

#### Pre requisite

Basic knowledge of properties of construction materials.

### Course Outcomes

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

CO1	Understand the properties of special concrete and its applications.	Analyse/ Apply
CO2	Learn about various types of metals and its properties.	Knowledge
CO3	Gain knowledge about various composite materials and its applications in concrete construction.	Knowledge/ Analyse/
CO4	Learn about various water proofing materials and its functions.	Knowledge
CO5	Study about types of smart materials and its applications.	Knowledge

### Mapping with Programme Outcomes

COs	P01	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	2	2	2
CO2	3	3	2	2	2	2
CO3	3	3			2	1
CO4	2	2		3	3	1
CO5	3	2	2	3	3	1
	3- 3	Strong;2	2-Mediu	m;1-Sor	ne	

#### **Assessment Pattern**

	Continue	ous (Marks)	End Sem Examination
Bloom's Category	1	2	(Marks)
Remember (Re)	20	20	30
Apply (Ap)	30	20	50
Analyse (An)	10	20	20
Create (Cr)		-	-

4. Wr **BoS** Chairman CHAIRMAN BORT OF Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

		К	.S.Ranga	asamy Co	ollege of Technology	/ - Autonomo	us		R2022
			60PSE	E55 - MO	DERN CONSTRUCT	ION MATERI	ALS		
				M.E. S	TRUCTURAL ENGIN	EERING			
Semester	to r	Но	urs / We	ek	Total Hours	Credit	Мах	kimum Mar	ks
Serr	iester –	L	Т	Р	Total Hours	С	CA	ES	Tota
		3	0	0	45	3	40	60	100
Concre		viour of co			ength and High Perfo e Materials to concret		rete – Fibre	Reinforced	[9]
<b>Metals</b> Steels		y Steels -	- Aluminu	m and its	Products –Coatings t	to reinforceme	ent – Applica	ations.	[9]
<b>Compo</b> Plastics	o <b>sites</b> s –Reinfor	ced Polyn	ners – FF	RP – Appli	ications				[9]
	<b>Materials</b> Proofing C	ompound	s – Non-	weatherin	g Materials – Flooring	and Facade	Materials		[9]
	<b>and Intell</b> and Intellig			ntelligent l	buildings - Special fea	atures			[9]
								Total H	ours:45
Text bo	ook(s):								
1 (	Ganapathy	/, C., Mod	ern Cons	truction N	/laterials, Eswar Press	s, 2015.			
2 5	Shetty M.S	, "Concre	te Techn	ology: Th	eory and Practice", S.	Chand & Con	npany Ltd., 2	2005.	
Refere	nce(s) :								
1 5	Shan Som	ayaji, "Civ	il Engine	ering Mat	erials", Prentice Hall I	nc., 2001.			
					gy, Oxford University		elhi, 2005.		
3 5	S K Sharm	ia, "Civil E	ingineerii	ng and co	nstruction material," k	Khanna Publui	shing Hous	e, 2016.	
					e design and constru nerican Concrete Instit		rnally bond	ed RP syst	ems for

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RoS Chairman CHAIRMAN BOCHAIRMAN BOCHAIRMAN Faculty of Civil Englistering K.S.Rangasamy College 1 Technology TIRUCHENGODE - 637 215

S.No	Торіс	No.of Hours
1	Special Concretes	
1.1	Concretes – introduction	1
1.2	Types of concrete	1
1.3	Behaviour of concretes	1
1.4	Behaviour of concretes	1
1.5	High Strength and High Performance Concrete	1
1.6	High Strength and High Performance Concrete	1
1.7	Fibre Reinforced Concrete	1
1.8	Self-compacting concrete	1
1.9	Alternate Materials to concrete	1
2	Metals	
2.1	Steels – Introduction and Manufacturing	1
2.2	New Alloy Steels	2
2.3	Aluminum and its Products	2
2.4	Coatings to reinforcement	2
2.5	Applications	2
3	Composites	
3.1	Plastics - Introduction	2
3.2	Plastics - Applications and Types	2
3.3	Reinforced Polymers	2
3.4	FRP	2
3.5	Applications	1
4	Other Materials	
4.1	Water Proofing Compounds	1
4.2	Non-weathering Materials	3
4.3	Flooring Materials	3
4.4	Facade Materials	2
5	Smart and Intelligent Materials	
5.1	Smart Materials - Introduction	1
5.2	Smart and Intelligent Materials for intelligent buildings	3
5.3	Smart and Intelligent Materials for intelligent buildings	3
5.4	Special features	2
	Total	45

# CourseDesigners

1. Dr. S.Gunasekar – gunasekar@ksrct.ac.in

R1/ w.e.f. 12.07.2023

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60PSE	E56

## REMOTE SENSING AND GIS FOR HYDROLOGY AND WATER RESOURCES

## Objective

- The fact related to hydrology
- Acquired the knowledge about important terms and definitions related to drainage basin.
- Familiar to use the remote sensing and GIS as a tool in the field of assessing the water resources.
- Groundwater quality and potential can be studied through modeling.
- Knowledge on effective management over the surface groundwater by mapping and modeling.

## Pre requisite

Basic knowledge of Remote Sensing and GIS courses

#### Course Outcomes

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

CO1	Understand about hydrological cycle and its various stages.	Knowledge/		
		Analyse/	Apply	
CO2	Acquired knowledge on remote sensing and GIS techniques effective usage in	Knowle	dge/	
	water resources application oriented data interpretation model creation.	Analyse/	Apply	
CO3	Understand the fundamental procedure which are most necessary for water	Knowle	dge/	
	shed management	Analyse/	Apply	
CO4	Familiar to GIS mapping concept through which multiple levels of assessment	Knowle	dge/	
	could be done in the field of natural disasters.	Analyse/	Apply	
CO5	Understand about thematic mapping preparation for groundwater related GIS	Knowle	dge/	
	analysis of spatial and temporal distribution	Analyse/	Apply	

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	3	3
CO2	3	2	2	3	3	2
CO3	2	3			3	2
CO4	3	2		2	3	1
CO5	3	2	3	3	2	2
	3- 3	Strong;2	2-Mediu	m;1-Sor	ne	

#### Assessment Pattern

Bloom's Category		Assessment Tests Marks)	End Sem Examination
Bioom s outegoly	1	2	(Marks)
Remember (Re)	20	20	30
Apply (Ap)	30	20	50
Analyse (An)	10	20	20
Create (Cr)		-	-

S. Wor **BoS** Chairman CHAIRMAN BORT OF Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

			MES	TRUCTU	RAL ENGINE	FRING			
Seme	ester	Hours	/Week		Totalhrs	Credit	N	/laximumM	arks
			Т	Р		C	CA	ES	Total
		3	0	0	45	3	40	60	100
lydro - evap	poration – tr	e – estimation anspiration –	evapo–tra	inspiration	ents of hydrolc – interceptior ter modeling –	n – depressi	on storag	iinfall – run e – spectra	off I
Vater	sis – linear –				and codification				[09
<b>real</b> /lappi lamag	Assessme ing of snow ge assessm	covered are	sture area	a – droug	off – flood fo ht forecasting				
Groun	nd water pro		face wate		rs – vegetatio		, soil aqu	uifer – aqu	[09 fer
nathe nodel ropei	ematical mod ling of sea rties. Water	dels – GIS ap water intrus	plication i sion – wa ping and r	n ground ater qualit monitoring	ound water p water modelir ty parameters g – correlation	ig – study o s – physica	nydrologic n sea wa l, chemic	budgeting ter intrusio cal, biologi	ו – ו – cal
nathe nodel roper uspe rigat rojec anal vater water	ematical mod ling of sea rties. Water nded sedim tion and Wa tinvestigati alignment – – Mapping a er harvesting shed –mode	dels – GIS ap water intrus quality mapp ent concentra <b>atershed Mar</b> on, implement depth-area ca and monitorin g structures – ling of sustair	pplication i sion – wa bing and r ation– case <b>nagement</b> atation, ma apacity cur g the catc sediment nable deve	n ground ater qualit monitoring studies. intenance ve genera hment cor yield – mo elopment -	water modelin ty parameters	ng – study o – physica model for on of storage ctive use of artificial rec ervoir siltatio	nydrologic n sea wa l, chemic pollution e/ diversio surface a charge of n – priorit	budgeting ter intrusio cal, biologi detection a on works – nd ground groundwate tization of	- cal nd [09
nathe nodel roper uspe rigat rojec anal vater water	ematical mod ling of sea rties. Water nded sedim tion and Wa tinvestigati alignment – – Mapping a er harvesting shed –mode	dels – GIS ap water intrus quality mapp ent concentra atershed Mar on, implement depth-area ca and monitorin g structures –	pplication i sion – wa bing and r ation– case <b>nagement</b> atation, ma apacity cur g the catc sediment nable deve	n ground ater qualit monitoring studies. intenance ve genera hment cor yield – mo elopment -	water modelin ty parameters g – correlation e stage- location ation, - conjun- mmand area – odeling of rese	ng – study o – physica model for on of storage ctive use of artificial rec ervoir siltatio	nydrologic n sea wa l, chemic pollution e/ diversio surface a charge of n – priorit	budgeting ter intrusio cal, biologi detection a nd ground groundwat tization of m for	r – cal nd <b>[09</b>
nathe nodel roper uspe <b>rrigat</b> rojec anal vater water vaters latura	ematical mod ling of sea rties. Water nded sedim tion and Wa tinvestigati alignment – – Mapping a er harvesting shed –mode	dels – GIS ap water intrus quality mapp ent concentra <b>atershed Mar</b> on, implement depth-area ca and monitorin g structures – ling of sustair	pplication i sion – wa bing and r ation– case <b>nagement</b> atation, ma apacity cur g the catc sediment nable deve	n ground ater qualit monitoring studies. intenance ve genera hment cor yield – mo elopment -	water modelin ty parameters g – correlation e stage- location ation, - conjun- mmand area – odeling of rese	ng – study o – physica model for on of storage ctive use of artificial rec ervoir siltatio	nydrologic n sea wa l, chemic pollution e/ diversio surface a charge of n – priorit	budgeting ter intrusio cal, biologi detection a on works – nd ground groundwate tization of	r – cal nd <b>[09</b>
rrigat Project anal Vater Vaters Jatura <b>Text</b> 1. L 2. P	ematical mod ling of sea rties. Water nded sedim tion and Wa et investigati alignment – – Mapping a er harvesting shed –mode al resource n book(s): J M Shams 2005.	dels – GIS ap water intrus quality mapp ent concentra atershed Mar on, implement depth-area ca and monitorin g structures – ling of sustair management	polication i sion – wa bing and r ation– case <b>nagement</b> tation, ma apacity cur g the catc sediment nable deve – case stu	n ground ater qualit monitoring e studies. intenance ve genera hment cor yield – me elopment - idies. Water, W	water modelin ty parameters g – correlation e stage- location ation, - conjun- mmand area – odeling of rese	ng – study o	nydrologic n sea wa l, chemic pollution e/ diversio surface a charge of n – priorit tion syste vater Syst	budgeting ter intrusio cal, biologi detection a on works – nd ground groundwat tization of m for <b>TotalHou</b> tems,CRC,	r – cal nd [09 er
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AW

RoS Chairman CHAIRMAN BOCHAIRMAN BOCHAIRMAN Faculty of Civil Englistering K.S.Rangasamy College 1 Technology TIRUCHENGODE - 637 215

S.No	Торіс	No.of Hours
1	Basics of Hydrology	
1.1	Hydrological cycle	1
1.2	estimation of various components of hydrology cycle	2
1.3	Rainfall and runoff	1
1.4	evaporation & transpiration	1
1.5	Evapo-transpiration and interception	1
1.6	spectral properties of water	1
1.7	GIS application in surface water modeling	2
2	Drainage Basin	
2.1	Introduction to watershed management	1
2.2	Delineation and codification of watersheds morphometric analysis	4
2.3	relief aspects	1
2.4	runoff modeling	2
2.5	urban hydrology	1
3	Areal Assessment	
3.1	Mapping of snow covered area	2
3.2	snow melt runoff	1
3.3	flood forecasting	1
3.4	flood damage assessment	1
3.5	drought forecasting and damage assessment	2
3.6	GIS application in aerial assessment	2
4	Ground Water and Water Quality	
4.1	surface water indicators	1
4.2	aquifer parameters	1
4.3	estimation of ground water potential	1
4.4	hydrologic budgeting	1
4.5	GIS application in ground water modeling	2
4.6	water quality parameters	1
4.7	correlation model for pollution detection and suspended sediment concentration	2
5	Irrigation and Watershed Management	
5.1	Project investigation	1
5.2	location of storage/ diversion works	1
5.3	canal alignment	2
5.4	Mapping and monitoring the catchment command area	1
5.5	artificial recharge of groundwater	1
5.6	modeling of reservoir siltation	2

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4.45-

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5.7	Development of information system for Natural resource management	1
	Total	45

# CourseDesigners

1. Dr.S.RAMESH

- rameshs@ksrct.ac.in

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A. W.

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		Category	L	Т	Ρ	Credit
60PSE E57	PRINCIPLES AND DESIGN OF PHYSICO- CHEMICAL TREATMENT SYSTEMS	PE	3	0	0	3

### Objective

- To know the working principles and characteristics of physio-chemical treatment.
- To design of various physical treatment systems for water and wastewater.
- To find the chemical treatment systems for water and wastewater.
- To understand and design of municipal water treatment plant
- To design the wastewater treatment plant

## Pre requisite

Basic knowledge of Environmental Engineering courses

### Course Outcomes

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

CO1	Know about pollutant in water and wastewater	Remember /
		Analyse/
		Apply
CO2	Able to develop conceptual schematics required for the physical treatment of	Remember /
	water and wastewater	Analyse/
		Apply
CO3	Ability to create the principles and applications of chemical treatment	Remember
		/Analyse/
		Apply
CO4	Formulate the preliminary design of municipal water treatment plant	Remember /
		Analyse/
		Apply
CO5	To gain knowledge about design of wastewater treatment plant	Remember /
		Analyse/
		Apply

### Mapping with Programme Outcomes

COs	P01	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	3	3	2
CO2	3	2	3	3	3	3
CO3	3	3	2		2	2
CO4	3	3		3	3	2
CO5	2	2		3	3	2
	3- 3	Strong;2	2-Mediu	m;1-Sor	ne	•

#### Assessment Pattern

Bloom's Category		Assessment Tests Marks)	End Sem Examination
Dioonin's outegory	1	2	(Marks)
Remember (Re)	20	20	30
Apply (Ap)	30	20	50
Analyse (An)	10	20	20
Create (Cr)		-	-

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4. Wr **BoS Chairman** 

CHAIRMAN BORT OF Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

	60PSE E5								
			M.E. S	TRUCTU	RAL ENGINE	ERING			
Semes	ter	Hours	Week		Totalhrs	Credit	1	MaximumM	arks
		L	Т	Р		С	CA	ES	Tota
		3	0	0	45	3	40	60	100
Classi	fication of F	Pollutants				•	•		[0]
nysico					tics, Standard es of reactor-	•		•	
hysic	al Treatme	nt Principle	S						[0]
ashino otherr	g – Evapora ms – Princi	ation – Inci ples, kinetio	neration - cs, regene	- gas tra eration m	– Sedimentat nsfer – mass nembrane sep ialysis, distillat	transfer contraction, Re	oefficient everse O	Adsorptior smosis, na	i – ino
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eeding ressur reatmo lants – eesidue Design ludge /astew oatatic spects oftwar 1. Me 20 2. Sin 20 <b>Refere</b> 1. Qa 1. Qa 2. Sin 20 2. Sin 2. Si	on of Treatm – Floccular re filter, Dua ent Units- S flow charts e manageme n of Wastew of municip thickening- vater Treatm on units-oil s s – case stud re application ook(s): etcalf and Ec 03. ncero and S 09 ence(s): asim, S.R., M entice Hall, I be, C.C. and ewyork, 1995	nent – Desig tion – clarif al media inl election of p – Layouts – ent – Upgrac vater Treatn al wastewa sludge dev ment Units- skimmer- flo dies, Residu- n. ddy, "Wastew incero, Envir Motley, E.M. <u>New Delhi, 2</u> Shun dar Li 9.	gn of mur ies – tube lets Displa process – Hydraulic dation of e nent Plant ter treatm vatering s Equalizati w charts - e manage water Eng mater Eng ronmental and Zhu.(2002. n, "Handb	nicipal wa e settling acement Design o Profile PI xisting pla ts nent units systems-s on- Neu - Layouts ment – U ineering", Engineer	<ul> <li>filters – R</li> <li>and gaseous</li> <li>of softeners –</li> <li>D construction</li> <li>ants – Recent</li> <li>s-screens-detr</li> <li>sludge drying</li> <li>tralization-Ches</li> <li>Hydraulic P</li> <li>pgradation of</li> </ul> Treatment an Ting: A Design works Engine	apid sand type. Desi Demineralis and O&M a Trends – So itors-grit ch beds - emical Fee Profile PID c existing plan d Reuse, Ta Approach, I ering – Plan ngineering (	filters slo gn of Ind sers –Rev aspects – oftware ap amber-se Design of ding Dev construction nts – Rec ata McGra Prentice F	w sand filt dustrial Wa verse osmo case studi oplication. ettling tank of Industri vices-mixer on and O& ent Trends <b>TotalHou</b> aw Hill, New Hall India Le sign and Op	cal er, ter sis es, 5- al s- VI - v Delhi, earning operation



S.No	Торіс	No.of Hours
1	Classification of Pollutants	
1.1	Pollutants in water and wastewater	1
1.2	Characteristics, standards for performance	2
1.3	Significance of physico-chemical treatment	2
1.4	Selection criteria and types of reactor	2
1.5	Batch-continuous type	2
2	Physical Treatment Principles	
2.1	Principles of Screening	1
2.2	Sedimentation	2
2.3	Filtration	2
2.4	Evaporation and Incineration	1
2.5	Mass transfer coefficient Adsorption	1
2.6	Principles and kinetics	1
2.7	Reverse Osmosis	1
2.8	Nano filtration, ultra filtration and hyper filtration	1
2.9	Electrodialysis and distillation	1
3	Chemical Treatment Principles	
3.1	Principles of Chemical treatment	1
3.2	Coagulation flocculation	2
3.3	Precipitation	1
3.4	Flotation solidification and stabilization	2
3.5	Disinfection	1
3.6	Electrolytic methods	2
3.7	Advanced oxidation /reduction	1
4	Design of Municipal Water Treatment Plant	
4.1	Selection of Treatment	1
4.2	Design of municipal water treatment plant units	2
4.3	Aerators	1
4.4	Flocculation	1
4.5	Rapid sand filter and slow sand filter	2
4.6	O&M aspects	1
4.7	Residue management	1
5	Design of Wastewater Treatment Plants	
5.1	Screens	1
5.2	Grit chamber	1
5.3	Settling tanks	2
5.4	Sludge thickening	1

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4.45-

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5.5	Dewatering systems	1
5.6	Design of Industrial Wastewater Treatment Units	1
5.7	Equalization and Neutralization	1
5.8	Chemical Feeding Devices	1
	Total	45

# **Course Designers**

1. Dr.P.MAGESHKUMAR - mageshkumarp@ksrct.ac.in

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AW

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60 DAC 001		Category	L	т	Р	Credit
60 PAC 001	ENGLISH FOR RESEARCH PAPER WRITING	PC	2	0	0	0

## Objectives

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

## Pre-requisite

-NIL-

#### **Course Outcomes**

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

CO1	Understand that how to improve your writing skills and level of readability	Remember, Understand &Apply
CO2	Learn about what to write in each section	Remember, Understand &Apply
CO3	Understand the skills needed when writing a Title	Remember, Understand &Apply
CO4	Understand the skills needed when writing the Conclusion	Remember, Understand &Apply
CO5	Ensure the good quality of paper at very first-time submission	Remember, Understand &Apply

## MappingwithProgrammeOutcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	3	1
CO2	3	3	2	2	3	1
CO3	3	3	2	2	3	1
CO4	3	3	2	3	2	1
CO5	3	3	2	3	2	1
3- Strong;2-M	ledium;1-Some	·		·		

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4. Wr **BoS Chairman** 

CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

## AssessmentPattern

Bloom'sCategory	ContinuousAs (Ma	Model Exam (Marks)	
	1	2	
Remember (R)	10	10	20
Understand (U)	20	20	30
Apply (Ap)	30	30	50
Analyze (An)	0	0	0
Evaluate (Ev)	0	0	0
Create (Cr)	0	0	0
Total	60	60	100

# Syllabus

					of Technolog			2	
		60 I			FOR RESEA		R WRITING		
							Γ	N 4	
Semes	ator	-	Hours/Wee	P P	Total hrs	Credit C	СА	Maximum Mar ES	ks Total
	-	L	1	-		•			
 		2		0	30	0	40	60	100
	Introduction to Research Paper Writing Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and								[6]
					lancy, Avoiding				
	tation Sk			0		0 0 )			[0]
					dings, Hedgin	ig and Critic	cizing, Parap	hrasing and	[6]
<u> </u>			aper, Abstra	cts, Introdu	uction				
	riting Ski								
					kills are neede needed when				[6]
					Final Check	i whung a i	Review of th	e Literature,	
	Writing S								
			ing the Meth	nods skills	needed when	writing the l	Results skills	are needed	[6]
					en writing the				
Verifica	ation Skil	s							501
Useful p	ohrases, o	hecking P	lagiarism, h	ow to ensi	ure paper is as	good as it o	could possibl	y be the first	[6]
time sul	bmission								
								Total Hours:	30
TextBo									
1.			English for	Writing F	Research Pape	ers, Springe	er New York	Dordrecht He	eidelberg
	London	·							
2.	,	low to Wri	te and Publi	sh a Scien	itific Paper, Ca	mbridge Un	iversity Press	2006	
Referer	. ,								
1.				-	versity Press (			,	
2.	Highma	n N, Hand	book of Writ	ing for the	Mathematical	Sciences, S	SIAM. Highma	n's book 1998	
-	Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.Phill Williams, Advanced Writing skills for students of English, Rumian Publishers, 2018								
3.	Phill Wi	lliams, Adv	anced Writi	ng skills fo	r students of E	nglish, Rum	•		•

ANT RoS Chairman CHAIRMAN BOCHAIRMAN BOCHAIRMAN Faculty of Civil Englistering K.S.Rangasamy College 1 Technology TIRUCHENGODE - 637 215

S.No.	Topics	No.of hours
1.0	Introduction to Research Paper Writing	
1.1	Planning and Preparation, Word Order	2
1.2	Breaking up long sentences, Structuring Paragraphs and Sentences	1
1.3	Being Concise and Removing Redundancy	2
1.4	Avoiding Ambiguity and Vagueness	1
2.0	Presentation Skills	
2.1	Clarifying Who Did What, Highlighting Your Findings	2
2.2	Hedging and Criticizing	2
2.3	Paraphrasing and Plagiarism, Sections of a Paper	1
2.4	Abstracts, Introduction	1
3.0	Title Writing Skills	
3.1	Key skills are needed when writing a Title	1
3.2	Key skills are needed when writing an Abstract, key skills are needed when writing an Introduction	2
3.3	Skills needed when writing a Review of the Literature	2
3.4	Methods, results, discussion, conclusions, the final check	1
4.0	Result Writing Skills	
4.1	Skills are needed when writing the Methods	2
4.2	Skills needed when writing the Results	1
4.3	Skills are needed when writing the Discussion	1
4.4	Skills are needed when writing the Conclusions	2
5.0	Verification Skills	
5.1	Useful phrases	2
5.2	Checking Plagiarism	2
5.3	How to ensure paper is as good as it could possibly be the first time submission	2

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AW

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60 PAC 002		Category	L	т	Р	Credit
60 FAC 002	DISASTER MANAGEMENT	PC	2	0	0	0

## Objectives

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches Teach how to improve writing skills and level of readability

#### Pre-requisite

-NIL-

#### Course Outcomes

#### Onthesuccessful completion of the course, students will beable to

CO1	Ability to summarize basics of disaster	Remember, Understand &Apply
CO2	Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.	Remember, Understand &Apply
CO3	Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.	Remember, Understand &Apply
CO4	Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.	Remember, Understand &Apply
CO5	Ability to develop the strengths and weaknesses of disaster management approaches	Remember, Understand &Apply

#### MappingwithProgrammeOutcomes

PO2			PO3			PO4			PO5		PO6
3			2			2			3		1
3			2			2			3		1
3			2			2			3		1
3			2			3			2		1
3			2			3			2		1
3			2			3				2	2
	PO2 3 3 3 3 3 3	PO2 3 3 3 3 3 3 3	PO2       3       3       3       3       3       3       3	PO2         PO3           3         2           3         2           3         2           3         2           3         2           3         2           3         2           3         2           3         2           3         2	PO2         PO3           3         2           3         2           3         2           3         2           3         2           3         2           3         2           3         2           3         2           3         2	PO2         PO3           3         2           3         2           3         2           3         2           3         2           3         2           3         2           3         2           3         2           3         2	PO2PO3PO4322322322323323	PO2PO3PO4322322322323323	PO2PO3PO4322322322323323	PO2PO3PO4PO5322332233223323232323232	PO2PO3PO4PO5322332233223323232323232

S. Wor **BoS** Chairman CHAIRMAN Board of Studies Faculty of Civil Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215

## AssessmentPattern

Bloom'sCategory	ContinuousAss (Ma	Model Exam (Marks)	
	1	2	
Remember (R)	10	10	20
Understand (U)	20	20	30
Apply (Ap)	30	30	50
Analyze (An)	0	0	0
Evaluate (Ev)	0	0	0
Create (Cr)	0	0	0
Total	60	60	100

# Syllabus

		60	PAC 002	– DISASTER	MANAGEM	ENT		
			M.E STR	UCTURAL EN	GINEERING			
		Hours/Week Total hrs Credit	Credit		Maximum Mar	ks		
Semester	L	Т	Р		C	CA	ES	Total
	2	0	0	30	0	40	60	100
Introduction Disaster: Defin and Manmade		0				d and Disa	ster; Natural	[6]
Repercussion Economic Dar Disasters: Ear	nage, Loss thquakes,	s of Hum Volcanism	an and A s, Cyclon		, Floods, Di	oughts An	d Famines,	[6]
Oil Slicks And			isease An				il Accidents,	
	Spills, Outb e <b>Areas In</b> ic Zones; A onic and C	reaks Of D <b>India</b> Areas Prone	e to Floods	d Epidemics, V	Var And Con	flicts. and Avalan	ches; Areas	[6]

A W RoS Chairman CHAIRMAN BOCHAIRMAN BOCHAIRMAN Faculty of Civil Englistering K.S.Rangasamy College 1 Technology TIRUCHENGODE - 637 215

Disaste Risk Si	<b>Risk Assessment</b> Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.							
	Total Hours:							
TextBo	ok(s):							
1.	<ol> <li>Goel S. L., Disaster Administration and Management Text And Case Studies", Deep &amp; Dee Publication Pvt. Ltd., New Delhi,2009.</li> </ol>							
2.	2. NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "New Royal book Company,2007.							
Refere	nce(s):							
1.	Sahni, Pardeepet.al.," Disaster Mitigation Experiences and Reflections", Prentice Hall of Ind	dia, 2001.						
2.	Subramanian R,"Disaster Management", Vikas publishing Housing Pvt. Ltd., 2018.							
3.	<ol> <li>Chu-huaKuei, Christian N Madu, Handbook of Disaster Management Risk Reduction &amp; Management Climate change and Natural Disaster, world scientific, 2017.</li> </ol>							
4.	JankiAndharia, Disaster studies: Exploring Intersectional ties in Disaster Discourse, Spring	er, 2020.						

S.No.	Topics	No.of hours
1.0	Introduction	
1.1	Disaster: Definition, Factors and Significance	2
1.2	Difference between Hazard and Disaster	2
1.3	Natural and Manmade Disasters	2
1.4	Difference, Nature	2
1.5	Types and Magnitude	1
2.0	Repercussions of Disasters and Hazards	1
2.1	Economic Damage, Loss of Human and Animal Life	2
2.2	Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones	2
2.3	Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches	2
2.4	Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents	1
2.5	Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts	2
3.0	Disaster Prone Areas In India	1
3.1	Study of Seismic Zones	1

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3.2	Areas Prone to Floods and Droughts	2
3.3	Landslides and Avalanches	2
3.4	Areas Prone to Cyclonic and Coastal Hazards with Special Reference To Tsunami	2
3.5	Post-Disaster Diseases and Epidemics	2
4.0	Disaster Preparedness and Management	
4.1	Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard	2
4.2	Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches	2
4.3	Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches	2
4.4	Application of Remote Sensing, Data from Meteorological and other Agencies	2
4.5	Media Reports: Governmental and Community Preparedness	1
5.0	Risk Assessment	
5.1	Disaster Risk: Concept and Elements	2
5.2	Disaster Risk Reduction, Global and National Disaster Risk Situation	2
5.3	Techniques of Risk Assessment	2
5.4	Global Co-Operation in Risk Assessment and Warning	2
5.5	People's Participation in Risk Assessment. Strategies for Survival	1

# CourseDesigner

Dr.M.Velumani- velumani@ksrct.ac.in

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فلاتيكا ومدمه

RoS Chairman CHAIRMAN BOCHAIRMAN BOCHAIRMAN Faculty of Civil Englistering K.S.Rangasamy College 1 Technology TIRUCHENGODE - 637 215

60 PAC 003		Category	L	т	Р	Credit
00 FAC 003	CONSTITUTION OF INDIA	PC	2	0	0	0

## Objectives

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional. Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolutionin1917and its impact on the initial drafting of the Indian Constitution.

# Pre-requisite

-NIL-

## Course Outcomes

Onthesuccessful completion of the course, students will beable to

CO1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.	Remember, Understand &Apply
CO2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India	Remember, Understand &Apply
CO3	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.	Remember,Underst and &Apply
CO4	Discuss the passage of the Hindu Code Bill of 1956.	Remember, Understand &Apply
CO5	Discuss the role and functioning of election commission of India.	Remember, Understand &Apply

### MappingwithProgrammeOutcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	3	1
CO2	3	3	2	2	3	1
CO3	3	3	2	2	3	1
CO4	3	3	2	3	2	1
CO5	3	3	2	3	2	1

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## AssessmentPattern

Bloom'sCategory	ContinuousA (M	Model Exam (Marks)	
	1	2	
Remember (R)	10	10	20
Understand (U)	20	20	30
Apply (Ap)	30	30	50
Analyze (An)	0	0	0
Evaluate (Ev)	0	0	0
Create (Cr)	0	0	0
Total	60	60	100

# Syllabus

		K.S.	Rangasan	ny College	of Technolog	gy – Autonoi	mous R 2022	2	
			6		B – CONSTITU		DIA		
		r			CTURAL ENG	INEERING			
_	Hours/Week Total hrs Credit Maximum Marks						-		
Semes	ster	L	Т	Р		С	CA	ES	Total
		2	0	0	30	0	40	60	100
•		-	ndian Cons						[3]
			(Compositi		ing)				
			Constitutio	n					[3]
Preamb	ole, Salient	Features							
Contou	irs of Con	stitutional	Rights an	d Duties					
Fundam	nental Rigl	hts, Right t	o Equality,	Right to Fr	eedom, Right a	against Explo	oitation, Right	t to Freedom	[6]
0				ights, Righ	t to Constitution	onal Remedi	es, Directive	Principles of	
State P	olicy, Fund	damental D	uties.						
-	of Gover								[6]
		•			squalifications,	Powers ar	nd Functions	, Executive,	
Preside	· · · · · · · · · · · · · · · · · · ·								
				nisters, J	udiciary, App	ointment an	d Transfer	of Judges,	
		rnor, Cou wers and F		nisters, J	udiciary, App	ointment an	nd Transfer	of Judges,	
Qualific		wers and F		nisters, J	udiciary, App	ointment an	nd Transfer	of Judges,	
Qualific Local A District's	ations, Po <b>dministra</b> s Adminis	wers and F <b>ation</b> tration hea	unctions. ad: Role ar	nd Importa	nce Municipal	ities: Introdu	ction, Mayor	and role of	
Qualific Local A District's Elected	ations, Po dministra s Adminis Represer	wers and F ation tration hea ntative, CE0	unctions. ad: Role ar O, Municipa	nd Importa al Corporati	nce Municipal ion. Panchaya	ities: Introdu t raj: Introduc	ction, Mayor ction, PRI: Zil	and role of aPanchayat.	[6]
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R1/ w.e.f. 12.07.2023 Passed in BoS Meeting held on 19.05.2023 Approved in Academic Council Meeting held on 03/06/2023



RoS Chairman CHAIRMAN BOCHAIRMAN BOCHAIRMAN Faculty of Civil Englistering K.S.Rangasamy College 1 Technology TIRUCHENGODE - 637 215

Referer	Reference(s):					
1.	Jain, M P, "Indian Constitution Law", 7th Edition, Lexis Nexis,2014					
2.	Basu, D D, "Introduction to the Constitution of India", Lexis Nexis, 2015.					
3.	Bhansali S R., "Textbook on The Constitution of India", Universal Publishers, 2015					
4.	Jain, M P., "Outlines of Indian Legal and Constitutional History", Lexis Nexis, 2014					

S.No.	Topics	No.of hours					
1.0	History of Making of The Indian Constitution						
1.1	History	1					
1.2	Drafting Committee, (Composition & Working)	2					
2.0	Philosophy of The Indian Constitution						
2.1	Preamble, Salient Features	3					
3.0	Contours of Constitutional Rights and Duties						
3.1	Fundamental Rights, Right to Equality, Right to Freedom	1					
3.2	Right against Exploitation, Right to Freedom of Religion	1					
3.3	Cultural and Educational Rights	1					
3.4	Right to Constitutional Remedies	1					
3.5	Directive Principles of State Policy, Fundamental Duties	2					
4.0	Organs of Governance						
4.1	Parliament, Composition, Qualifications and Disqualifications	2					
4.2	Powers and Functions, Executive	1					
4.3	President, Governor, Council of Ministers						
4.4	Judiciary, Appointment and Transfer of Judges	1					
4.5	Qualifications, Powers and Functions	1					
5.0	Local Administration						
5.1	District's Administration head: Role and Importance Municipalities	1					
5.2	Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation	1					
5.3	Panchayat raj: Introduction, PRI: ZilaPanchayat. Elected officials and their roles	1					
5.4	CEO ZilaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments)	1					
5.5	Village level: Role of Elected and Appointed officials, Importance of grass root democracy	2					

## **Course Designer**

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A. W.

RoS Chairman CHAIRMAN BOCHAIRMAN BOCHAIC OF Engineering K.S.Rangasamy College of Technology TIRUCHENGODE - 637 215