K.S. Rangasamy College of Technology

(Autonomous)

Curriculum & Syllabus

of

M.E Structural Engineering

(For the batch admitted in 2019 – 2020)

R 2018

Courses Accredited by NBA, Accredited by NAAC with 'B^{++}' Grade,
Approved by AICTE, Affiliated to Anna University, Chennai.

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

R1/w.e.f/09.05.2019

VISION

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

- 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: Our graduates are professionally competent in their chosen career and use appropriate techniques and modern Engineering tools in executing projects.

PEO2: Our graduates apply mathematical, scientific and engineering principles to solve complex problems in Civil Engineering through lifelong learning.

PEO3: Our graduates work in multidisciplinary projects with professional and ethical responsibilities.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

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

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

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

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

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

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

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

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

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

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

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

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

Engineering Graduates will be able to:

PSO1: The graduates will have the ability to plan, analyse, design, execute cost effective project related to Civil Engineering structures with conservation and protection of natural resources for sustainable growth.

PSO2: The graduates will have the ability to take up employment, new start-ups, entrepreneurship, research and development, chartered Engineering professional to serve the society with honesty and integrity.

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

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

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

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

SEMESTER I

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	50 PSE 101	Matrix method of Structural Analysis	PC	3	3	0	0	3
2.	50 PSE 102	Theory of Elasticity and Plasticity	PC	5	3	2	0	4
3.	50 PSE E**	Elective I	PE	3	3	0	0	3
4.	50 PSE E**	Elective II	PE	3	3	0	0	3
5.	50 PSE 103	Research Methodology and IPR	PC	3	3	0	0	3
6.	50 AT**	Audit Course I	AC	2	2	0	0	0
PRACTICALS								
7.	50 PSE 1P1	Experimental Techniques Laboratory	EEC	4	0	0	4	2
			Total	**23**	**17**	**2**	**4**	**18**

SEMESTER II

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	50 PSE 201	Finite Element Method of Structures	PC	5	3	2	0	4
2.	50 PSE 202	Structural Dynamics	PC	5	3	2	0	4
3.	50 PSE 203	Design of Sub Structures	PC	3	3	0	0	3
4.	50 PSE E**	Elective III	PE	3	3	0	0	3
5.	50 PSE E**	Elective IV	PE	3	3	0	0	3
6.	50 AT**	Audit Course II	AC	2	2	0	0	0
PRACTICALS								
7.	50 PSE 2P1	Advanced Structural Engineering Laboratory	EEC	4	0	0	4	2
			Total	**25**	**17**	**4**	**4**	**19**

SEMESTER III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	50 PSE E**	Elective V	PE	3	3	0	0	3
2.	50 PSE E**	Elective VI	PE	3	3	0	0	3
PRACTICALS								
3.	50 PSE 3P1	Project Work – Phase I	EEC	20	0	0	20	10
4.	50 PSE 3P2	In-plant Training	EEC	0	0	0	0	2
			Total	**26**	**6**	**0**	**20**	**18**

SEMESTER IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
PRACTICALS								
1.	50 PSE 4P1	Project Work – Phase II	EEC	32	0	0	32	16
			Total	**32**	**0**	**0**	**32**	**16**

TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 71

Note: HS- Humanities and Social Sciences including Management Courses, BS- Basic Science Courses, ES-Engineering Science Courses, PE-Professional Core Courses, PE-Professional Elective Courses, OE- Open Elective Courses, EEC-Employability Enhancement Courses & MC- Mandatory Courses

HUMANITIES AND SOCIAL SCIENCES (HS)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
NIL								

BASIC SCIENCE (BS)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
NIL								

ENGINEERING SCIENCES (ES)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
NIL								

PROFESSIONAL CORE (PC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 PSE 101	Matrix method of Structural Analysis	PC	3	3	0	0	3
2.	50 PSE 102	Theory of Elasticity and Plasticity	PC	5	3	2	0	4
3.	50 PSE 103	Research Methodology and IPR	PC	3	3	0	0	3
4.	50 PSE 1P1	Experimental Techniques Laboratory	PC	4	0	0	4	2
5.	50 PSE 201	Finite Element Method of Structures	PC	5	3	2	0	4
6.	50 PSE 202	Structural Dynamics	PC	5	3	2	0	4
7.	50 PSE 203	Design of Sub Structures	PC	3	3	0	0	3
8.	50 PSE 2P1	Advanced Structural Engineering Laboratory	PC	4	0	0	4	2

PROFESSIONAL ELECTIVES (PE)

SEMESTER I, ELECTIVE I

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 PSE E11	Theory of Structural Stability	PE	3	3	0	0	3
2.	50 PSE E12	Theory of Plates and Shells	PE	3	3	0	0	3
3.	50 PSE E13	Design of Tall Buildings	PE	3	3	0	0	3
4.	50 PSE E14	Design of Structures for Dynamic Loads	PE	3	3	0	0	3
5.	50 PSE E16	Advanced Groundwater Hydrology	PE	3	3	0	0	3
6.	50 PSE E17	Groundwater Modeling and Management	PE	3	3	0	0	3
7.	50 PSE E18	Fracture Mechanics of Concrete Structures	PE	3	3	0	0	3

SEMESTER I, ELECTIVE II

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 PSE E21	Analytical and Numerical Methods for Structural Engineering	PE	3	3	0	0	3
2.	50 PSE E22	Structural Health Monitoring	PE	3	3	0	0	3
3.	50 PSE E23	Structural Optimization	PE	3	3	0	0	3
4.	50 PSE E24	Bridge Engineering	PE	3	3	0	0	3
5.	50 PSE E25	Non-linear Analysis of Structures	PE	3	3	0	0	3
6.	50 PSE E26	Solid and Hazardous Waste Management	PE	3	3	0	0	3
7.	50 PSE E27	Municipal Solid Waste Management	PE	3	3	0	0	3

SEMESTER II, ELECTIVE III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 PSE E31	Advanced Steel Design	PE	3	3	0	0	3
2.	50 PSE E32	Soil Structure Interaction	PE	3	3	0	0	3
3.	50 PSE E33	Design of Shell and Spatial Structures	PE	3	3	0	0	3
4.	50 PSE E34	Off Shore Structures	PE	3	3	0	0	3
5.	50 PSE E35	Experimental Techniques and Instrumentation	PE	3	3	0	0	3
6.	50 PSE E36	Secondary Treatment of Wastewater	PE	3	3	0	0	3
7.	50 PSE E37	Industrial Wastewater Pollution - Prevention and Control	PE	3	3	0	0	3

SEMESTER II, ELECTIVE IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 PSE E41	CADD for Structures	PE	3	3	0	0	3
2.	50 PSE E42	Design of Industrial Structure	PE	3	3	0	0	3
3.	50 PSE E43	Disaster Resistant Structures	PE	3	3	0	0	3
4.	50 PSE E44	Industrial Steel Structures	PE	3	3	0	0	3
5.	50 PSE E45	Corrosion Engineering	PE	3	3	0	0	3
6.	50 PSE E46	Principles and Design of Biological Treatment System	PE	3	3	0	0	3
7.	50 PSE E47	Research Methodology - Engineering And Management Studies	PE	3	3	0	0	3

SEMESTER III, ELECTIVE V

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 PSE E51	Prestressed Concrete Structures	PE	3	3	0	0	3
2.	50 PSE E52	Steel Concrete Composite Structures	PE	3	3	0	0	3
3.	50 PSE E54	Aseismic Design of Structures	PE	3	3	0	0	3
4.	50 PSE E55	Prefabricated Structures	PE	3	3	0	0	3
5.	50 PSE E56	Transportation of Water and Wastewater	PE	3	3	0	0	3
6.	50 PSE E57	Design of Concrete Structures	PE	3	3	0	0	3

SEMESTER III, ELECTIVE VI

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 PSE E61	Advanced Concrete Technology	PE	3	3	0	0	3
2.	50 PSE E62	Maintenance and Rehabilitation of Structures	PE	3	3	0	0	3
3.	50 PSE E63	Modern Construction Materials	PE	3	3	0	0	3
4.	50 PSE E64	Remote Sensing and GIS for Hydrology and Water Resources	PE	3	3	0	0	3
5.	50 PSE E65	Principles and Design of Physico-Chemical Treatment Systems	PE	3	3	0	0	3
6.	50 PSE E66	Design of Water and Wastewater Retaining Structures	PE	3	3	0	0	3

SEMESTER I/II, AUDIT COURSE

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 AT 001	English for Research Paper Writing	AC	2	2	0	0	0
2.	50 AT 002	Disaster Management	AC	2	2	0	0	0
3.	50 AT 003	Sanskrit for Technical Knowledge	AC	2	2	0	0	0
4.	50 AT 004	Value Addition	AC	2	2	0	0	0
5.	50 AT 005	Pedagogy Studies	AC	2	2	0	0	0
6.	50 AT 006	Stress Management by Yoga	AC	2	2	0	0	0
7.	50 AT 007	Personality Development through Life Enlightenment Skills.	AC	2	2	0	0	0
8.	50 AT 008	Constitution of India	AC	2	2	0	0	0

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	50 PSE 1P1	Experimental Techniques Laboratory	EEC	4	0	0	4	2
2.	50 PSE 2P1	Advanced Structural Engineering Laboratory	EEC	4	0	0	4	2
3.	50 PSE 3P1	Project Work – Phase I	EEC	20	0	0	20	10
4.	50 PSE 3P2	In-plant Training	EEC	0	0	0	0	2
5.	50 PSE 4P1	Project Work – Phase II	EEC	32	0	0	32	16

SUMMARY

S.No.	Category	Credits Per Semester								Total Credits	Percentage %
		I	II	III	IV	V	VI	VII	VIII		
1.	HS	-	-	-	-	-	-	-	-	**-**	**-**
2.	BS	-	-	-	-	-	-	-	-	**-**	
3.	ES	-	-	-	-	-	-	-	-	**-**	**-**
4.	PC	10	11	-	-	-	-	-	-	**21**	**29.58**
5.	PE	6	6	6	-	-	-	-	-	**18**	**25.35**
6.	OE	-	-	-	-	-	-	-	-	**-**	**-**
7.	EEC	2	2	12	16	-	-	-	-	**32**	**45.07**
8.	AC	ACI	ACII	-	-	-	-	-	-	**-**	**-**
Total		**18**	**19**	**18**	**16**					**71**	**100**

K.S.Rangasamy College of Technology – Autonomous R2018

50 PSE 101– MATRIX METHOD OF STRUCTURAL ANALYSIS

M.E. STRUCTURAL ENGINEERING

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	50	50	100

Objective(s)	At the end of the course the students is expected to • Learn the basics of concepts of structural analysis, matrix analysis of structures by using flexibility and stiffness method. • Learn about matrix analysis of beams and frames.
Course Outcomes	1. Understand the concepts of energy theorems 2. Formulation of stiffness and flexibility matrix for various co-ordinates 3. To solve the beam using stiffness and flexibility methods 4. To solve the frame using stiffness and flexibility methods 5. To understand the concepts of solving the truss using stiffness and flexibility methods

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

Concepts In Structural Analysis

Structure-Loads-Response-Equilibrium of Force-Compatibility of Displacements-Force- Displacement relation-Levels of structural analysis-Energy methods-Energy concepts based on displacement and force field. [9]

Matrix Concepts and Matrix Analysis of Structures

Matrix-matrix operations-linear simultaneous equations-Eigen values and Eigen vectors-coordinate systems-transformation matrix-stiffness and flexibility matrix-Equivalent joint loads-stiffness and flexibility methods. [9]

Matrix Analysis of Structures With Axial Elements

Introduction-axial stiffness and flexibility matrix-analysis by conventional stiffness method for axial element (2 DOF)-analysis by flexibility method. Analysis by conventional stiffness method for plane truss element (4 DOF) - analysis by flexibility method. [9]

Matrix Analysis of Beams

Conventional stiffness method for beams-beams element stiffness (4 DOF)-generation of stiffness matrix for continuous beams-Flexibility method for continuous beams-force transformation matrix-element flexibility matrix-analysis procedure. [9]

Matrix Analysis of Plane Frames

Conventional stiffness method for plane frame-element stiffness matrix(6DOF)-generation of structural stiffness matrix and analysis procedure-flexibility method for plane frames-force transformation matrix-element flexibility matrix and analysis procedure. [9]

Total Hours 45

Text book (s) :

1	Devados Menon, “Advanced Structural Analysis”, Narosa Publishing House,New Delhi,2010.

Reference(s) :

1	Madhujit Mukhopadhyay,Abdul Hamid Sheikh,”Matrix and Finite Element Analyses of Structures”, .Ane books India,2009.
2	Rajesekaran S. and Sankara Subramanian G. “Computational Structural Mechanics”, Prentice Hall of India Pvt Ltd, New Delhi, 2011.
3	Manickaselvam M.K.,” Elements of Matrix And Stability Analysis of Structures”, Khanna Publishers, New Delhi,2004.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE 102 - THEORY OF ELASTICITY AND PLASTICITY								
M.E. STRUCTURAL ENGINEERING								
Semester	**` Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**	60	**C**	**CA**	**ES**	**Total**
I	3	2	0		4	50	50	100
Objective(s)	At the end of the course the students is expected to • Learn the basics of elasticity, solutions of elasticity, torsion analysis of non circular section. • Learn different energy methods and also basics of plasticity and fracture mechanics.							
Course Outcomes	1. Understand the equilibrium equation and stress-strain relationship with various coordinate System. 2. Analyze the problem with bi-harmonic equations. 3. Identify the different approaches for solving the torsional problems and thin walled open and closed sections 4. Analyze the elasticity problems with various energy methods. 5. State the assumptions of plasticity and solve plastic problems.							

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

Elasticity

Analysis of stress and strain, equilibrium equations – Compatibility equations – stress strain relationship. Generalized Hooke's law. [9]

Elasticity Solution

Plane stress and plane strain problems -Two dimensional problems in Cartesian and Polar co-ordinates - Airy's stress function – Bi harmonic equation – Saint Venant's principle. [9]

Torsion of Non Circular Section

St.venant's approach – Prandtl's approach – membrane analogy – Torsion of thin walled open and closed sections. [9]

Energy Methods

Strain energy - Principle of Virtual Work-Energy theorem - Rayleigh Ritz method-finite difference method – application to elasticity problems. [9]

Plasticity

Physical assumption – Yield criteria - Yield surface, Flow rule – Plastic stress strain relationship- Elastic – Plastic problems in bending - Torsion and Thick cylinders. [9]

Total Hours 45+15(Tutorial) = 60

Text book (s) :

1	Sadhu singh," Theory of Elasticity", Khanna Publishers, New Delhi, 2011.
2	Sadhu singh," Theory of Plasticity", Khanna Publishers, New Delhi, 2011.
3	Sadhu singh, "Applied Stress Analysis", Khanna Publishers, New Delhi, 2007.

Reference(s) :

1	Timoshenko.S and Goodier.J.N.," Theory of Elasticity", Mc Graw Hill Book Co., New York, 2010
2	Slater R.A.C, "Engineering Plasticity", John Wiley and son, New York, 1977.
3	Chou P.C. and Pagano, N.J. "Elasticity Tensor, Dyadic and Engineering approaches", D.Van Nostrand Co., Inc., London, 1967.
4	Hearn, E.J."Mechanics of Materials", Vol.2, Perrgamon Press, Oxford, 1985.
5	Irving H.Shames and James, M.Pitarresi, "Introduction to Solid Mechanics", Prentice Hall of India Pvt. Ltd., New Delhi , 2002.

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50 PSE 103 - RESEARCH METHODOLOGY AND IPR

M.E. STRUCTURAL ENGINEERING

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	50	50	100

Objective(s)

- To develop the basic framework of research process and techniques.
- To identify various sources of information for literature review and data collection.
- To gain knowledge in report writing and research proposal.
- To know the latest developments in Intellectual property rights.

Course Outcomes

At the end of this course, students will be able to

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property
6. Right to be promoted among students in general & engineering in particular.
7. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

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

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations [8]

Unit 2: Effective literature studies approaches, analysis Plagiarism, Research ethics, [5]

Unit 3: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee [8]

Unit 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT. [8]

Unit 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. [8]

Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs [8]

Total Hours 45

Text book (s) :

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

Reference(s) :

1. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
3. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE 1P1 - EXPERIMENTAL TECHNIQUES LABORATORY								
M.E. STRUCTURAL ENGINEERING								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I	0	0	4	45	2	60	40	100
Objective(s)	At the end of the course the student is expected to have learnt • Concrete materials and their properties, mix design methods • Non destructive testing of concrete, tests on fresh and hardened concrete.							
Course Outcomes	1. Identify the choice of Concrete making materials by quality test and perform the mix design for economic construction. 2. Describes the various tests on fresh concrete and predict appropriate proportions of ingredients. 3. Illustrates the basic testes of harden concrete and ascertain the excellence. 4. Examine the strength of existing structure by non – destructive testing methods. 5. Rate the durability of harden concrete by appropriate testes.							

LIST OF EXPERIMENTS

1. Tests on concrete making materials
   a) Test on cement – setting time, Compressive strength, soundness, fineness, density
   b) Test on aggregate – soundness, flakiness , density and Fineness modulus

2. Concrete Mix Design as per IS 10262 -2009 method, ACI Method
3. Tests on self compacting concrete
4. Tests on hardened concrete
   a) Core test
   b) Stress strain behavior of concrete under compression.
5. Non-Destructive testing Methods
   a) Ultra sonic Pulse Velocity Meter
   b) Rebound hammer
   c) Rebar locator
6. Durability test on hardened concrete
   a) Sulphate attack
   b) Chloride attack
   c) Permeability test.
   d) RCPT Test

Text book (s) :

1	M.S Shetty, “Concrete Technology Theory and Practice”, S. Chand & Company Ltd., 2012

Reference(s) :

1	Santhakumar A.R “Concrete Technology, Oxford Higher Education ,NewDelhi,2016

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50 PSE 201 - FINITE ELEMENT METHOD OF STRUCTURES

M.E. STRUCTURAL ENGINEERING

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	2	0	60	4	50	50	100

Objective(s)	At the end of the course students can know the fundamentals concepts of • Finite element method and to expose them the aspects of application • Method to realistic engineering problem through computational simulations.
Course Outcomes	1. Construct and solve the element equation for one dimensional structural element. 2. Describe the concept of two dimensional elements. 3. Analyze the 2D problems using isoparametric quadrilateral elements and Implement the Gaussian Quadrature expression for numerical integration. 4. Identify the concepts of Non-linear Analysis of the structures. 5. Apply the knowledge on application of Finite Element method

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

Introduction to Finite Element Analysis

Introduction-basic concepts of finite element analysis-steps in finite element analysis-Weighted Residual methods – Variational formulation of boundary value problem Finite element modeling - Element equation-Linear and quadratic shape functions- Bar, Beam and Truss Elements. [9]

Finite Element Analysis of 2D Problems

Basic boundary value problem in 2 Dimensions – Triangular, quadrilateral, higher order elements-Poisson and Laplace equation-weak formulation-Linear strain triangular elements. [9]

Isoparametric Formulation

Natural co-ordinate systems-Lagrangian interpolation polynomials-Isoperimetric element formulation-axisymmetry element-Numerical integration- one and two point problems. [9]

Non-Linear Analysis

Definition – geometric and material nonlinearity – strain displacement – stress- strain– finite element format – software usage for large deflection – software for inelastic behaviour. [9]

Practical Application of Finite Element Analysis

Modeling and analysis using software packages-types of analysis-meshing-material properties and boundary conditions-Error evaluation. [9]

Total Hours 45+15 (Tutorial) = 60

Text book (s) :

1	Chandrapatla T.R and Belegundu A.D, " Introduction to Finite Elements in Engineering", Prentice Hall of India Private Ltd., 2002.
2	P.Seshu, "Finite Element Analysis", Prentice Hall of India Pvt. Ltd., New Delhi, 2009.

Reference(s) :

1	Madhujit Mukhopadhyay,Abdul Hamid Sheikh., Matrix and Finite element Analyses of Structures. Ane Books India.2008.
2	Rao, S.S., "The Finite Element Method in Engineering", Pergamon Press, 1999
3	Bathe, K.J., "Finite Element Procedures in Engineering Analysis", Prentice Hall, 1995.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE 202 - STRUCTURAL DYNAMICS								
M.E. STRUCTURAL ENGINEERING								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	3	2	0	60	4	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt • Basic principles of dynamics, different methods of multi degree of freedom system and their dynamic response, modeling • Designing of continuous systems and structures subjected to dynamic loads, with IS code provisions.							
Course Outcomes	1. Understand the basic concepts of vibration analysis. 2. Calculate the natural frequency and mode shape of two degree of freedom system 3. Analyze and study dynamic response of multi degree of freedom system. 4. Understand the basic concepts of dynamic analysis of continuous systems 5. Apply the practical applications of structural dynamics in analyzing the frames.							

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

Principles of Vibration Analysis

Equations of Motion by equilibrium and energy methods, Free & Forced vibration of single degree of freedom systems, Effect of damping – transmissibility [9]

Multi Degree of Freedom System

Formulation of Structure, property matrices - Eigen value problems – problems on two degree of freedom system – Mode shapes - Orthonormality of modes [9]

Dynamic Analysis of Multi Degree of Freedom Systems

Multi degree of freedom systems, Orthogonality of normal modes, approximate methods- Dunkerly's method- Holzer method- Stodola method-Rayleigh's method- Rayleigh Ritz method-Mode superposition technique-Numerical integration techniques [9]

Dynamic Analysis of Continuous Systems

Free and forced vibration of continuous system –Rayleigh Ritz method – formulation using conservation of energy- formulation using virtual work. [9]

Practical Applications

Idealization of multi-storeyed frames – Impact loading - blast loading - aerodynamics, gust phenomenon-principles of analysis. [9]

Total Hours 45+15 (Tutorial) = 60

Text book (s) :

1	Madhujith Mukhopadhyay "Structural Dynamics (Vibration & systems)",Ane books Pvt.Ltd,2015.
2	Paz,M," Structural Dynamics-Theory and Computation", Springer, 2007.

Reference(s) :

1	Anil K Chopra, "Dynamics of Structures – Theory and Applications to Earthquake Engineering", Prentice Hall,New Delhi, 2007.
2	Roy R.Craig and Andrew J.Kurdila,"Fundamentals of Structural dynamics",John Wiley and Sons, 2011.
3	Clough R.W. and Penzien J., Dynamics of Structures, McGraw Hill Book Co. Ltd., 1993.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE 203 - DESIGN OF SUB STRUCTURES								
M.E. STRUCTURAL ENGINEERING								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt • Purpose, procedure of sub surface exploration, 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.							
Course Outcomes	1. State the knowledge on soil exploration 2. Analysis the concepts of safe bearing capacity of shallow foundation 3. Explain pile foundation and their types 4. Estimation the wall foundations and sheet pile wall 5. Identify the general analysis of machine foundation and soil dynamics							

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

Sub Surface Exploration

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

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

Design of Caissons and Well foundations - Foundations for towers –Sheet Pile wall-Coffer dams. [9]

Machine Foundations

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 machines, framed foundations. [9]

Total Hours 45

Text book (s) :

1	Swamy Saran , “Analysis and Design of Substructures”, Oxford and IBH Publishing Co., Pvt.Ltd., New Delhi,2006.
2	Venkatramaiah.C, “Geotechnical Engineering”, New Age International Ltd., New Delhi,2007.

Reference(s) :

1	Thomlinson, M.J. and Boorman. R. “Foundation Design and Construction”,ELBS Longman VI, 1995
2	Nayak, N.V., “Foundation Design manual for Practicing Engineers”, Dhanpat Rai and Sons, 2002.
3	Winterkorn H.F., and Fang H.Y., “Foundation Engineering Hand Book - VanNostrard - Reinhold - 1976.
4	Brain J Bell and Smith M.J.“Reinforced Concrete Foundations” George Godwin Ltd., 1981.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE 2P1 - ADVANCED STRUCTURAL ENGINEERING LABORATORY								
M.E. STRUCTURAL ENGINEERING								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	0	0	4	45	2	60	40	100
Objective(s)	At the end of the course the student is expected to have learnt • Behaviour of beams and slabs in flexure and shear • Strain recording instruments and also the measurement of vibration.							
Course Outcomes	1. Construct the concrete beam and absorb the behavior of flexural member for different loading conditions. 2. Demonstrate the testing for strength and deflection behavior of steel sections. 3. Illustrates the behavior of column under axial load and compute the direct and bending stresses. 4. Familiarize the behavior of cantilever beam under dynamic loading and evaluate the mode shapes. 5. Employ the static cyclic testing on frames and predict the stiffness and energy dissipation of the frame.							

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

LIST OF EXPERIMENTS

1. Fabrication, casting and testing of simply supported reinforced concrete beam for strength and deflection behaviour.
2. Testing of simply supported steel beam for strength and deflection behavior.
3. Fabrication, casting and testing of reinforced concrete column subjected to concentric and eccentric loading.
4. Dynamic testing of cantilever beams.
   a. To determine the damping coefficients from free vibrations.
   b. To evaluate the mode shapes.
5. Static cyclic testing of single bay two storied frames and evaluate
   a. Drift of the frame
   b. Stiffness of the frame.
   c. Energy dissipation capacity of the frame

Text book (s) :

1	Sadhu Singh, " Experimental Stress Analysis", Khanna Publications, New Delhi, 2000.

Reference(s) :

1	Dalleey J W, and Riley W F, "Experimental Stress Analysis", McGraw-Hill, Inc. New York, 1991.
2	Srinath L.S, Raghavan M.R, Lingaish K, Gargesha G, Paint B, and Ramachandra K, "Experimental Stress Analysis", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 1984.

K.S.Rangasamy College of Technology – Autonomous R2018								
50 PSE 3P1 PROJECT WORK PHASE I								
M.E. STRUCTURAL ENGINEERING								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
III	0	0	20	60	10	100	0	100
Objective(s)	• To import the practical knowledge to the students and also to make them to carry out the technical procedures in their project work. • To provide an exposure to the students to refer, read and review the research articles, journals and conference proceedings relevant to their project work and placing this as their beginning stage for their final presentation.							
Course Outcomes	**At the end of the course, the students will be able to** 1. Survey the relevant literature such as books, national/international refereed journals and contact resource persons for the selected topic of research. 2. Use different experimental techniques/different software/ computational/analytical tools. 3. Design and develop an experimental set up/ equipment/test rig. 4. Conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them. 5. Work in a research environment or in an industrial environment.							

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.

K.S.Rangasamy College of Technology – Autonomous R2018								
50 PSE 3P2 IN-PLANT TRAINING								
M.E. STRUCTURAL ENGINEERING								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
III	0	0	0	0	2	100	0	100
Objective(s)	At the end of this course the students will able to gain practical knowledge by undergoing training in the construction filed							
Course Outcomes	**At the end of the course, the students will be able to** 1. Understand the industrial process, safety management systems, policies, education and training about the concern industry. 2. Document the report of the inplant training undergone 3. Present the report of the documentation.							

- Students undergo in-plant training during second semester summer vacation (Minimum of Two weeks)
- Reports containing the observation of the students after the training with their personal comments/suggestion are to be prepared and submitted in the beginning of third semester
- A technical presentation to be done by the students immediately after submission of the report at the beginning of third semester

K.S.Rangasamy College of Technology – Autonomous R2018								
50 PSE 4P1 PROJECT WORK – PHASE II								
M.E. STRUCTURAL ENGINEERING								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
IV	0	0	32	60	16	50	50	100
Objective(s)	• This enables and strengthens the students to carry out the project on their own and to implement their innovative ideas to forefront the risk issues and to retrieve the hazards by adopting suitable assessment methodologies and staring it to global.							
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 deal with people working in diversified field will. 2. Write technical reports and research papers to publish at national and international level. 3. Develop strong communication skills to defend their work in front of technically qualified audience.							

It is a continuation of Project work started in semester III. He has to submit the report in prescribed format and also present a seminar. The dissertation should be presented in standard format as provided by the 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.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E11 - THEORY OF STRUCTURAL STABILITY								
M.E. STRUCTURAL ENGINEERING								
ELECTIVE I								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I	**3**	**0**	**0**	**45**	**3**	**50**	**50**	**100**
Objective(s)	At the end of the course the students is expected to • Learn behaviour of structural elements under compressive loads, the stability of columns, beams and plates under various load conditions. • Introduction to numerical techniques							
Course Outcomes	1. Obtain the concept of structural stability of structures 2. Compare the method and analysis of structures 3. Design a beam column behaviour with the portal frame 4. Explain the torsional buckling in beam 5. Interpret the use of energy methods with numerical techniques							

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

Stability of Columns

Concepts of Elastic Structural stability- Analytical approaches to stability - characteristics of stability analysis- Elastic Buckling of columns- Equilibrium - Energy and Imperfection approaches – Non-prismatic columns- Built up columns- orthogonality of buckling modes- Effect of shear on buckling load - Large deflection theory. [9]

Methods of Analysis and in Elastic Buckling

Approximate methods – Rayleigh and Galerkin methods – numerical methods – Finite difference and finite Element - analysis of columns – Experimental study of column behaviour – South well plot - Column curves - Derivation of Column design formula - Effective length of Columns - Inelastic behaviour- Tangent modulus and Double modulus Theory. [9]

Beam Columns and Frames

Beam column behaviour- standard cases- Continuous columns and beam columns – Column on elastic foundation – Buckling of frames – Single storey portal frames with and without side sway – Classical and stiffness methods – Approximate evaluation of critical loads in multistoried frames – Use of Wood's charts. [9]

Buckling of Beams

Lateral buckling of beams – Energy method- Application to Symmetric and unsymmetric I beams – simply supported and Cantilever beams - Narrow rectangular cross sections- – Numerical solutions – Torsional buckling – Uniform and non uniform Torsion on open cross section - Flexural torsional buckling – Equilibrium and energy approach. [9]

Buckling of Thin Plates

Isotropic rectangular plates - Governing Differential equations - Simply Supported on all edges – Use of Energy methods – Plates with stiffeners – Numerical Techniques. [9]

Total Hours: 45

Text book (s) :

1	Chajes, A. "Principles of Structures Stability Theory", Prentice Hall of India, 1990.
2	Ashwin Kumar, "Stability of Structures", Allied Publishers Ltd, New Delhi, 1998.

Reference(s) :

1	Iyengar, N.G.R, "Structural Stability of Columns and Plates" East West Press Pvt Ltd, New Delhi, 1986
2	Timoshenko, S.P, and Gere, J.M. "Theory of Elastic stability", McGraw-Hill Company, 2010

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E12 - THEORY OF PLATES AND SHELLS								
M.E. STRUCTURAL ENGINEERING								
Elective I								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I	3	0	0	45	3	50	50	100

Objective(s)	At the end of the course the student is expected to have learnt • Behaviour of laterally loaded plates,rectangular plates and circular plates. • Design of cylindrical shells .
Course Outcomes	1. Explain about governing different equation to use various boundary conditions. 2. Gain the knowledge of Navier's solution, Levy's solution and solve for the rectangular plate and Use finite difference method for solving plate problems. 3. Analyze circular plates for any boundary conditions. 4. To identify bending of plates and Structural behavior of thin shells . 5. Design of R. C. Cylindrical shells and long shells.

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

Laterally Loaded Plates

Thin Plates with small defection, Laterally loaded thin plates, governing differential equation, various boundary conditions. [9]

Rectangular Plates

Rectangular plates. Simply supported rectangular plates, Navier solution and Levy's methods, Rectangular plates with various edge conditions - Energy methods, Finite difference and Finite element methods. [9]

Circular Plates

Symmetrical bending of circular plates, plates on elastic foundation. [9]

Theory of Shells

Structural behavior of thin shells – classification of shells – Translational and rotational ruled surface, Design of the following shells: spherical, conical, paraboloid and ellipsoid. [9]

Design of Cylindrical Shells

Design of R.C cylindrical shell with edge beams using theory for long shells – Design for long shells – Design of shells with ASCE manual coefficients [9]

Total Hours: 45

Text book (s) :

1	Timoshenko,S and Woinowsky – Kreiger,"Theory of plates and shells".Mc Graw- Hill book Company, Newyork.1990.

Reference(s) :

1	Bairagi, "Plate Analysis", Khanna Publishers, 1996.
2	Reddy J N, "Theory and Analysis of Elastic Plates and Shells", McGraw Hill Book Company, 2006.
3	Szilard, R.,"Theory and Analysis of Plates- Classical and Numerical Methods", Prentice Hall of India, 1995.
4	Chandrashekahara,K. "Theory of Plates", University Press (India) Ltd., Hyderabad, 2001.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E13 - DESIGN OF TALL BUILDINGS								
M.E. STRUCTURAL ENGINEERING								
Elective I								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt • The design criteria of the tall buildings, materials used, modern concepts, different types of loads to be considered in designing, behaviour of structural systems, analysis . • The design of tall structures using different methods and also the stability analysis of the tall buildings.							
Course Outcomes	1. Implement design philosophies for the development of high rise structures. 2. Find out the design loads for high rise buildings. 3. Analyse the behaviour of tall building subjected to lateral loading. 4. Perform computerized general three dimensional analysis for high rise building. 5. Perform stability analysis using various methods for tall buildings.							

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

Design Criteria

Design Philosophy, Materials – Modern concepts – High Performance Concrete, Fibre Reinforced Concrete, Light weight concrete, Self Compacting Concrete. [9]

Loading

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 [9]

Behaviour of Structural Systems

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. [9]

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. [9]

Stability Analysis

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. [9]

Total Hours: 45

Text book (s) :

1	Bryan Stafford Smith and Alexcoull, “Tall Building Structures - Analysis and Design”, John Wiley and Sons, Inc., 2011.Wiley India Pvt.Ltd. New Delhi.

Reference(s) :

1	Taranath B.S, “Structural Analysis and Design of Tall Buildings”, McGraw-Hill, 1988.
2	Coull, A. and Smith, Stafford, B. “Tall Buildings”, Pergamon Press, London, 2003
3	Lynn S.Beedle, “Advances in Tall Buildings”, CBS Publishers and Distributors, Delhi, 1996.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E14 - DESIGN OF STRUCTURES FOR DYNAMIC LOADS								
M.E. STRUCTURAL ENGINEERING								
Elective I								
Semester	**Hours / Week`**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I	3	0	0	45	3	50	50	100

Objective(s)	At the end of the course the student is expected to have learnt • Design factors, behaviour of structures in cyclic loads, recap of structural dynamics with reference of different systems, ductility, earth quake design of structures, design against blast and impact • Design against wind loads as per BIS code of practice and special consideration in the design of structures.
Course Outcomes	1.Explain the behavior of structures under dynamic loads 2.Design structures for earthquake, blast and impact loads 3.Perform ductile detailing

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

Introduction

Factors affecting design against dynamic loads - Behaviour of concrete, steel, masonry and soil under impact and cyclic loads - Recap of Structural dynamics with reference to SDOF, MDOF and continuum systems – Ductility and its importance [9]

Design Against Earthquakes

Earthquake characterization - Response spectra - seismic co-efficient and response spectra methods of estimating loads - Response of framed, braced frames and shear wall buildings - Design as per BIS codes of practice - Ductility based design [9]

Design Against Blast And Impact

Displacement method for three dimensional Structure - Coordinate transformations - Analysis of space trusses and space frames [9]

Design Against Wind

Characteristics of wind - Basic and Design wind speeds - Pressure coefficient - Aero elastic and Aerodynamic effects - Design as per BIS code of practice including Gust Factor approach - tall buildings, stacks and chimneys. [9]

Special Considerations

Energy absorption capacity - Ductility of the material and the structure - Detailing for ductility - Passive and active control of vibrations - New and favorable materials [9]

Total Hours: 45

Text book (s) :

1	Paulay, .T. and Priestly, .M.N.J., “A seismic Design of Reinforced Concrete and Masonry building ", John Wiley and Sons, 1991.
2	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, 1990.
2	Dowling, .C.H., “Blast vibration - Monitoring and control ", Prentice Hall Inc., Englewood Cliffs, 1985.
3	Kolousek, .V., “Wind effects on Civil Engineering Structures ", Elsevier, 1984.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E16 - ADVANCED GROUNDWATER HYDROLOGY								
M.E. STRUCTURAL ENGINEERING								
Elective I								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt 1.The basic empirical knowledge of the residence and movement of groundwater, as well as a number of quantitative aspects. 2.Evaluate the aquifer parameters and groundwater resources for different hydro-geological boundary conditions.							
Course Outcomes	1. Study the ground water hydrologic cycle and types of acquifiers. 2. Understand the ground water movement and principles of ground water flow and equation. 3. Analyze the aquifer parameters and well characteristics. 4. Discuss the construction of wells and design of wells. 5. Explain the methods of ground water recharge and assessment.							

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

Introduction to Groundwater

Groundwater in Hydrologic Cycle – Occurrence of groundwater– Hydrogeology – Hydrometeorology – soil sample analysis - Water bearing materials - Types of aquifers – parameters of Aquifers – Determination of specific yield and permeability [9]

Groundwater Hydraulics

Groundwater Movement - Darcy's law and its limitations - Stream lines and flow net analysis – Potential flow theory – Discharge and draw down for various condition of groundwater flow - Principles of groundwater flow and its equation – Dupuit – Forchheimer assumptions – Influent and Effluent streams - Evaluation of well loss parameters – Partial penetration of wells – Interference of wells – Collector wells and Infiltration galleries [9]

Pumping Test Analysis

Determining aquifer parameters for unconfined, leaky and non-leaky aquifers – steady and transient conditions - Slug test – Locating hydro geological boundaries – Image well theory – Determination of well characteristics and specific capacity of wells – Well characteristics of large diameter wells. [9]

Well Design and Construction

Well design criteria – Construction of wells – Well drilling methods – Filter design – Artificial and natural packing – Well castings and screens – Production test – Maintenance of production wells. [9]

Special Topics

Methods of artificial groundwater recharge – Groundwater assessment and balancing – Seawater intrusion in coastal aquifers – Land Subsidence - Wells in hard rock areas. [9]

Total Hours: 45

Text book (s) :

1. Todd D.K., "Groundwater Hydrology", John Wiley & Sons, Inc, New York, 2005.

Reference(s) :

1. Bear J., "Hydraulics of Groundwater", McGraw-Hill, New York, 1979.
2. Bouwer H., "Groundwater Hydrology", McGraw-Hill, New York, 1978.
3. Driscoll, "Groundwater and Wells", Johnson Filtration Systems, Inc., 1986.
4. Hantush M.S., "Hydraulics of wells in Advances in Hydro science", Academic Press, 1964.
5. Ojha, C.S.P, Berndtsson, R and Bhunya, P.,"Engineering Hydrology", Oxford University Press, New Delhi, 2008.

K.S.Rangasamy College of Technology - Autonomous R2018

50 PSE E17 - GROUNDWATER MODELING AND MANAGEMENT

M.E. STRUCTURAL ENGINEERING

Elective I

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	50	50	100

Objective(s)	At the end of the course the student is expected to have learnt 1.Groundwater quantity and qualities aspects. 2.The inputs, system parameters, policy, variables and outputs of a groundwater management models.
Course Outcomes	01. Acquired knowledge on ground water exploration through various geophysical methods by surface and substance investigation. 02. Understand about the term model and it's types. 03. Gain knowledge about different equations related to ground water modelling. 04. Acquired knowledge on various types of groundwater contamination induced parameters and its assessment. 05. Familiar to create the need based model and its development. 06.Gain knowledge on various types of groundwater management related analytical model creation.

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

Groundwater Prospecting

Investigation and evaluation – Geophysical methods- Electrical Resistivity methods – Interpretation of data – Seismic method – Subsurface investigation – Test drilling – Resistivity logging – Application of remote sensing techniques . [9]

Groundwater Flow Model

Physical models – Analog models – Mathematical modeling – Unsaturated flow models Numerical modeling of groundwater flow – Finite Differential equations - Finite difference solution – Successive over Relaxation, Alternating direction implicit procedure – Crank Nicolson equation – Iterative methods -Direct methods - Inverse problem – Finite element method [9]

Contaminant Transport Model

Contaminant transport theory – Advection, dispersion equation – Longitudinal and transverse dispersivity – Hydrodynamic dispersion – Analytical models – Numerical simulation of solute transport – Solution methods - Sorption model – Subsurface mass transport through the vadose zone - Density driven flow - Heat transport. [9]

Model Development

Data requirements – Conceptual model design : Conceptualization of aquifer system – Parameters, Input-output stresses, Initial and Boundary conditions - Model design and execution : Grid design, Setting boundaries, Time discretization and Transient simulation – Model calibration : steady state and unsteady state – sensitivity analysis – Model validation and prediction – Uncertainty in the model prediction [9]

Groundwater Management Model

Optimal groundwater development – Indian GEC norms – Conjunctive use models Modeling multilayer groundwater flow system -Modeling contaminant migration – Modeling fracture flow system – Artificial recharge feasibility through modeling – Simulation of movements of solutes in unsaturated zone – Stochastic modeling of groundwater flow - Groundwater contamination, restoration and management [9]

Total Hours: 45

Reference(s) :

1	Anderson M.P., and Woessner W.W., Applied Groundwater Modelling : Simulation of flow and advective transport, Academic Press, Inc., 1992
2	Fetter C.W., “Contaminant Hydrogeology”, Prentice Hall, 1999
3	Rushton K.R., “Groundwater Hydrology” : Conceptual and Computational Models, Wiley, 2003
4	Elango L. and Jayakumar, R. Modelling in Hydrology, Allied Publishers Ltd., 2001
5	Remson I., Hornberger G.M. and Moltz F.J.,” Numerical Methods in Subsurface Hydrology”, Wiley, New York, 1971
6	Robert Willis and William W.G.Yenth, “Groundwater System Planning and Management”, Prentice Hall, Englewood Cliffs, New Jersey, 1987
7	Groundwater Hydraulics and Pollutant Transport, Randall J.Charbeneau, Printice Hall, 2000

K.S.Rangasamy College of Technology - Autonomous R2018

50 PSE E18 – FRACTURE MECHANICS OF CONCRETE STRUCTURES

M.E. STRUCTURAL ENGINEERING

Elective I

Semester I	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
	3	0	0	45	3	50	50	100

Objective(s)	At the end of the course the student is expected to have learnt • 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.
Course Outcomes	1. Students will gain knowledge on the Mechanics of Fractures. 2. They will be able apply it to solve engineering problems. 3. They will be able to do research on fracture mechanics.

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

INTRODUCTION: 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. [9]

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. [9]

ELASTIC – PLASTIC FRACTURE MECHANICS: Crack –tip- opening displacement – J contour integral – Crack growth resistance curves – Jcontrolled fracture – Crack tip constraint under large –scale yielding – Sealing model for clearage fracture. [9]

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 [9]

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. [9]

Total Hours: 45

Text book (s) :

1	Anderson,T.L. “Fracture Mechanics Fundamentals and Applications”, Taylor & Francis Group, 2015.
2	David Broek “Elementary engineering fracture mechanics” Kluwer Academic Publisher, 2012

Reference(s) :

1	Elementary engineering fracture mechanics – David Broek – Sijthoff & Noordhoff – Alphen aan den Rijn – Netherlands
2	Fracture mechanics of concrete structures – Theory and applications – Rilem Report – Edited by L. Elfgreen – Chapman and Hall – 1989.
3	Fracture mechanics – applications to concrete – Edited by Victor, C. Li, & Z.P. Bazant – ACI SP 118.
4	Valliappan S. "Continuum Mechanics Fundamentals" (1982), Oxford IBH, N D. New Delhi.
5	Venkataraman & Patel “Structural Mechanics with introduction to Elasticity and Plasticity” – Mcgraw Hill, 1990.
6	Shanes – “Introduction to Solid Mechanics – II Edition, PH, 1989.

K.S.Rangasamy College of Technology - Autonomous								
50 PSE E21 – ANALYTICAL AND NUMERICAL METHODS FOR STRUCTURAL ENGINEERING								
M.E. STRUCTURAL ENGINEERING								
Elective II								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I	3	0	0	45	3	50	50	100

Objective(s)	• To apply the appropriate numerical techniques for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations. • To impart a basic working knowledge of a range of widely used numerical techniques with some of the supporting theoretical ideas. • To understand the principles of least square and interpolation techniques applied to usual civil engineering structures.
Course Outcomes	**At the end of the course, the students will be able to** 1. Know how root finding techniques can be used to solve the nonlinear equation in practical engineering problems. 2. Solve the system of linear equations and eigen value problems numerically. 3. Apply appropriate techniques for numerical integration and numerically approximate functions with polynomials. 4. Solve ordinary and partial differential equations using finite difference scheme. 5. Write a program to solve a mathematical problem.

Nonlinear Equations

Bisection Method - Fixed-Point Iteration Method - Secant Method - Regula-Falsi method - Newton Method - Horner's method - Graeffe's Root Squaring method.

Linear System of equations and Eigen value problems

Solution of Linear system of equations: Gauss elimination method - Gauss Jordan method - Inversion of a matrix by Gauss Jordan method - Gauss-Seidel method.Eigen value problems: Power method - Jacobi method - QR method.

Interpolation and Numerical integration

Newton's forward and backward difference formula - Lagrange's interpolation formula - Newton's divided difference formula - Method of least square.

Numerical Integration:Trapezoidal Rule - Simpson's $\frac{1}{3}$ and $\frac{3}{8}$ Rules - Two and Three point Gaussian quadrature.

Boundary Value Problems

Numerical solution of ordinary differential equations by finite difference method - Finite difference solution for one dimensional heat equation by Implicit and explicit methods (Bender-Schmidt method and Crank – Nicholson method) - Two dimensional Laplace and Poisson equations.

Computer Algorithms

Fuzzy set - Operations on Fuzzy sets - Fuzzy relations - Neural nets - Algorithms in neural networks - Genetic algorithms.

Text book(s):

1	Jain, M, K., Iyengar, S, R, K., Jain, R, K.,"Numerical Methods For Scientific and Engineering Computation", 6th Edition, New Age International (P) Ltd., Publishers, New Delhi, 2012

Reference(s):

1	Atkinson, K, E., "An Introduction to Numerical Analysis", John Wiley & Sons, 1989.
2	Kandasamy, P.,Thilagavathy, K., Gunavathi, K.,"Numerical Methods", 3rd Edition, S.Chand & Company Pvt. Ltd., New Delhi, 2006.
3	George j, Klir, Bo yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", 1st Edition, PHI Learning, 2009.
4	NPTEL Web link: http://nptel.ac.in/courses/105105043/12

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E22 - STRUCTURAL HEALTH MONITORING								
M.E. STRUCTURAL ENGINEERING								
Elective II								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course, the student able to learn, • Concept of structural health monitoring and its investigation. • Various static and dynamic testing methods for structural health monitoring. • Advanced Repairs and Rehabilitation techniques.							
Course Outcomes	1. Understand the concept and measures of structural health and monitoring. 2. Explain procedure of structures health monitoring. 3. Assess the health of structure using static field methods. 4. Assess the health of structure using dynamic field test. **5.** Apply suitable repair and rehabilitation techniques.							

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

Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance and monitoring structural monitoring - Concepts, Various Measures, Structural Safety in Alteration. [9]

Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures. [9]

Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement. [9]

Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring. [9]

Repairs and Rehabilitations of Structures: Case Studies (Site Visits), piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique. [9]

Total Hours: 45

Text book (s) :

1	Structural Health Monitoring, Daniel Balageas, Claus_Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006.

Reference(s) :

1	Health Monitoring of Structural Materials and Components, Methods with Applications, Douglas E Adams, John Wiley and Sons, 2007.
2	Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc, 2014.
3	Structural Health Monitoring and Intelligent Infrastructure, Two volume set: Proceedings of the 2nd International conference on Structural Health Monitoring of Intelligent Infrastructure, Nov.16-18, 2005, Shenzhen China Jinping ou, Huili, Zhongdong Duan.

K.S.Rangasamy College of Technology – Autonomous R2018								
50 PSE E23 - STRUCTRUAL OPTIMIZATION								
M.E. STRUCTURAL ENGINEERING								
Elective II								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt • Basics concepts of optimizing in structural design, optimization techniques, and application of algorithms, linear programming using computer search methods • Optimization theorems, optimality criterion methods and about the different types of non – traditional optimization techniques.							
Course Outcomes	1. Apply the knowledge on the recent advances in optimization. 2. Write algorithm for Geomatic and Dynamic programming. 3. To know the basis of univariate and multivariate minimization. 4. Understand the concepts kof optimization structural theorems. 5. Understand the concepts of optimization problems in the Structural Engineering							

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

Introduction

Basic concepts of minimum weight, minimum cost design, objective function, constraints, classical methods [9]

Optimization Techniques And Algorithms

Linear programming, Integer Programming, Quadratic Programming. Dynamic Programming and geometric Programming methods for optimal design of structural elements. [9]

Computer Search Methods

Linear Programming methods for plastic design of frames. Computer search for univariate and multivariate Minimization [9]

Optimization Theorems

Optimization by structural theorems, Maxwell, Mitchell and Heyman's Theorems for trusses and frames, fully stressed design with deflection constraints, optimality criterion methods. [9]

Non-Traditional Optimization Techniques

Methods land on national evolution – Genetic Algorithm – simulated annealing – Truss problem – Hand simulation for simple problems. [9]

Total Hours: 45

Text book (s) :

1	Rao., S.S., " Optimization theory and Applications", Wiley Eastern Limited, New Delhi, 1995.
2	William R.Spillers., "Structural Optimization", Keith M.MacBain, 2009, Springer.

Reference(s) :

1	Christensen, "An Introduction to Structural Optimization", Peter, Klarbring, Anders, 2009, Springer.
2	"Optimization: Theory and Applications"by SS Rao.

K.S.Rangasamy College of Technology – Autonomous R2018								
50 PSE E24 - BRIDGE ENGINEERING								
M.E. STRUCTURAL ENGINEERING								
Elective II								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I	3	0	0	65	3	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt • Classification of, bridges, roads on bridges, design of solid slab, bridges, R.C. girder bridges, long span girder bridge, plate girder bridges • Design of prestressed concrete bridge, bearing, sub structures and footings for bridges.							
Course Outcomes	1. List out the components and classification of a bridge. 2. Design a deep foundation and well foundation. 3. List out the different forms of reinforced bridges. 4. List out the different forms of steel bridges. 5. Show the rehabilitation for bridges.							

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

Introduction

Definition and components of a bridge – layout and planning of a bridge – classification – investigation of a bridge – preliminary data collection – choice and type of a bridge – hydraulic design of a bridge – traffic design – loading – highway and railway loading – specification [9]

Analysis of Substructure

Analysis and design of foundation – shallow foundation – open foundation – deep foundation – pile foundation – well foundation – caisson foundation – piers and abutments – bridge bearing – steel rocker and roller bearings – reinforced concrete rocker and roller bearings – elastomeric bearings. [9]

Analysis of Superstructure

Reinforced concrete and prestressed concrete bridge: Straight and curved bridge decks - decks of various types – slab hollow and voided slab – beam – slab box – reinforced concrete slab bridge – load distribution – Pigeaud's theory – skew slab deck – RC tee beam and slab bridge – continuous beam bridge – fixed point method – influence lines –balanced Cantilever bridge – rigid frame bridge – box girder bridge – bow string girder bridge – Pre-stressed concrete bridge – analysis and design for static, moving and dynamic loading. [9]

Steel Bridge

Plate girder bridge – box girder bridge – composite beam bridge – truss bridge – influence lines for forces in members – suspension bridge – cable stayed bridge – analysis for static, moving and dynamic loading. [9]

Construction And Maintenance

Construction methods – short span – long span - false work for concrete bridges – construction management – inspection and maintenance – lesson from bridge – rehabilitation of a bridge failures – load testing of bridges. [9]

Total Hours: 45

Text book (s) :

1	Ponnuswamy, S., "Bridge Engineering", Tata McGraw –Hill Pub co., New Delhi, 2010.

Reference(s) :

1	Jhnson Victor, D., "Essentials of Bridge Engineering", Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 1999.
2	Krishna Raju, N., "Design of Bridge", Oxford Publishing Co Pvt. Ltd., New Delhi, 1998.
3	Bakht B and Jaeger L.G.., "Bridge Deck Analysis Simplified", McGraw – Hill, International Studnets' edition, Singapore, 1987.
4	Raina, V.K. "Concrete Bridge Practice" Tata McGraw – Hill Publishing Co, New Delhi.1991.
5	Taylor, F.W., Thomson, S.E., and Smulski, E., "Reinforced Concrete Bridges", John Wiley and Sons, Newyork, 1995.

K.S.Rangasamy College of Technology – Autonomous R2018								
50 PSE E25 - NON LINEAR ANALYSIS OF STRUCTURES								
M.E. STRUCTURAL ENGINEERING								
Elective II								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course, students will be able to • To study the concept of nonlinear behaviour and analysis of elements and simple structures.							
Course Outcomes	1.Describe the concept of Non-Linear Analysis of the structures. 2.Analyse the members subjected to deformations and analysis of bars with and without restraints. 3.Apply the knowledge of vibration theory on flexural members and identify its behaviour under cyclic loading. 4.Identify the Non-linear behaviour of plates. 5.Solve the elemental equation of beams Non linear vibrations.							

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

INTRODUCTION TO NONLINEAR ANALYSIS : Material nonlinearity, geometric nonlinearity; statically 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	Fertis, D.G, Non-linear Mechanics, CRC Press, 1999

Reference(s) :

1	Reddy.J.N, Non-linear Finite Element Analysis, Oxford University Press, 2008.
2	Sathyamoorthy.M, Nonlinear Analysis of Structures, CRC Press, 2010.

K.S.Rangasamy College of Technology – Autonomous R2018

50 PSE E26 - SOLID AND HAZARDOUS WASTE MANAGEMENT

M.E. STRUCTURAL ENGINEERING

Elective II

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	50	50	100

Objective(s)	At the end of the course the student is expected to have learnt 1. The elements of managing solid wastes from Municipal and industrial sources including the related engineering principles 2. Design criteria, methods and equipments of solid waste management
Course Outcomes	01. Explain the types, quantity, nature of solid and hazardous wastes. 02. Identify the characteristics and composition of solid and hazardous wastes. 03. Discuss the storage collection and transport of wastes. 04. Explore the possibility of reuse, recycling and recovery of materials from solid wastes. 05. Summaries the waste processing techniques and methods composting. 06. Describe the landfill classification methods and landfill gas management.

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

Sources, Classification and Regulatory Framework

Types and Sources of solid and hazardous wastes - Need for solid and hazardous waste management – Elements of integrated waste management and roles of stakeholders - Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, lead acid batteries, electronic wastes , plastics and fly ash – Financing waste management. [9]

Waste Characterization and Source Reduction

Waste generation rates and variation - Composition, physical, chemical and biological properties of solid wastes – Hazardous Characteristics – TCLP tests – waste sampling and characterization plan - Source reduction of wastes –Waste exchange - Extended producer responsibility - Recycling and reuse [9]

Storage, Collection and Transport Of Wastes

Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations Optimizing waste allocation– compatibility, storage, labeling and handling of hazardous wastes – Hazardous waste manifests and transport [9]

Waste Processing Technologies

Objectives of waste processing – Material separation and processing technologies – Biological and chemical conversion technologies – Methods and controls of Composting - Thermal conversion technologies and energy recovery – Incineration – Solidification and stabilization of hazardous wastes - Treatment of biomedical wastes [9]

Waste Disposal

Waste disposal options – Disposal in landfills - Landfill Classification, types and methods – Site selection - Design and operation of sanitary landfills, secure landfills and landfill bioreactors – Leachate and landfill gas management – Landfill closure and environmental monitoring – Rehabilitation of open dumps – Landfill remediation [9]

Total Hours: 45

Refe**rence(s) :**

1	George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, “Integrated Solid Waste Management”, Mc-Graw Hill International edition, New York, 1993.
2	CPHEEO, “Manual on Municipal Solid Waste Management”, Central Public Health and Environmental Engineering Organisation , Government of India, New Delhi, 2000.
3	Vesilind P.A., Worrell W and Reinhart, “Solid waste Engineering”, Thomson Learning Inc., Singapore, 2002.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E27 MUNICIPAL SOLID WASTE MANAGEMENT								
M.E. STRUCTURAL ENGINEERING								
Elective II								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt 1. Different aspects of the types, sources, generation of municipal solid waste 2. Storage, collection, transport, processing and disposal of municipal solid waste.							
Course Outcomes	01. Identify the sources, types and characteristics of solid wastes. 02. Describe the health, environmental effects and solid waste management strategies. 03. Choose the on-site storage methods and segregation of municipal solid wastes. 04. Summaries the methods of collection and operating, maintenance of transfer station. 05. Explain the off-site processing techniques and equipments. 06. Describe the design and operation aspects of sanitary landfills							

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

Sources and Types

Sources and types of municipal solid wastes-Waste generation rates-factors affecting generation, characteristics-methods of sampling and characterization; Effects of improper disposal of solid wastes-Public health and environmental effects. Elements of solid waste management – Municipal solid waste (M&H) rules-Integrated management.- Social and Financial aspects; Public awareness; Role of NGO's. [9]

Source Reduction and On-Site Storage

Source reduction of waste- Reduction, Reuse and Recycling - On-site storage methods- Effect of storage, materials used for containers- segregation of solid wastes – Public health and economic aspects of open storage – waste segregation and storage – case studies under Indian conditions. [9]

Collection and Transfer

Methods of Residential and commercial waste collection – Collection vehicles – Manpower –Collection routes – Analysis of collection systems; Transfer stations – Selection of location, operation & maintenance; options under Indian conditions – Field problems – solving. [9]

Processing of Wastes

Objectives of waste processing – Physical Processing techniques and Equipments; Resource recovery from solid waste composting and biomethanation; Thermal processing options- case Studies under Indian conditions. [9]

Disposal

Land disposal of solid waste; Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners - Management of leach ate and landfill gas – Land fill Bioreactor.-Dumpsite Rehabilitation. [9]

Total Hours: 45

Reference(s) :

1	George Tchobanoglous and Frank Kreith, "Handbook of Solid waste Management", Mc Graw Hill, Newyork, 2002.
2	Paul T Williams, "Waste Treatment and Disposal", John Wiley and Sons, 2000.
3	Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2000.
4	Bhide A.D. and Sundaresan, B.B. "Solid Waste Management Collection, Processing and Disposal", 2001,
5	Manser A.G.R and Keeling A.A, "Practical Handbook of Processing and Recycling of Municipal solid Wastes", Lewis Publishers, CRC Press, 1996.

K.S.Rangasamy College of Technology – Autonomous R2018								
50 PSE E31 - ADVANCED STEEL DESIGN								
M.E. STRUCTURAL ENGINEERING								
Elective III								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the student will be able to • The analysis and design of steel structures, types of steel connections, and their design, analysis of cold formed steel structures • Analysis and design of special steel structures and advanced design philosophies and concepts.							
Course Outcomes	1. Assess the general behaviour of beam –column employ them to design beam-column – crane column. 2. Classify the different types of connection and identity suitable connections to apply for required situation. 3. Analyse the cold formed steel sections and design them. 4. Evaluate the various forces acting on self-supporting chimney guyed steel chimney and design them. 5. Calculate the base shear and employ them to design a structure.							

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

Analysis and Design of Beam Column

Introduction-General behaviour of beam column-Beam column under bi-axial loading- Design of beam-columns-Beams column subjected to tension and bending-crane column. [9]

Behaviour and Design of Joints

Connection Behaviour – Design Requirements of Bolted and welded Connection – Un stiffened and stiffened Seat connection – Framed connection – Moment resistant connection – Tee Stub and End plate connections – Column Stiffeners and other reinforcements – design of moment resistant base plate - -concept of semi rigid connections. [9]

Analysis and Design of Cold Formed Steel Structures

Types of cross sections – Concept of local buckling and effective width –Design of compression and tension members – Concept of lateral buckling- Design of beams-Combined stresses and connections – Empirical design of Z –Purlins with lips and wall studs. [9]

Analysis and Design of Special Structures

Design of self supporting chimney and guyed steel stacks-Design of bunkers and silos. [9]

Seismic Design of Steel Structures

Base shear calculations –IS 1893-2002,codal provisions – Design and detailing-IS 800-2007(Theory only) [9]

Total Hours: 45

Text book (s) :

1	Subramaniam.N.,“Design of Steel Structures “,(As per IS 800-2007),Oxford University Press,2014.

Reference(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.

K.S.Rangasamy College of Technology – Autonomous R2018								
50 PSE E32 - SOIL STRUCTURE INTERACTION								
M.E. STRUCTURAL ENGINEERING								
Elective III								
Semester	**Hours / Week`**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt • Soil foundation interaction problems, behaviors, models, beams of elastic foundation soil models, plate on elastic medium, plate types, numerical analysis of finite plates, elastic analysis of single pile and group of piles • Interaction analysis of piles, and about the analysis of laterally loaded piles							
Course Outcomes	1. Generate concepts of soil structure Interaction 2. Assess the soil models as isotropic elastic half-space 3. Formulate winkler foundation model for elastic continum 4. Calculate elastic medium for rectangular and circular plates 5. Estimate the load distribution in pile							

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

Soil-Foundation Interaction

Introduction to soil-foundation interaction problems – Soil behaviour, Foundation behaviour, Interface behaviour, Scope of soil foundation interaction analysis, Soil response models, Elastic continuum, two parameter elastic models, Elastic plastic behaviour, Time dependent behaviour. [9]

Beam on Elastic Foundation- Soil Models

Infinite beam, two parameters, Isotropic elastic half-space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness. [9]

Plate on Elastic Medium

Infinite plate, Winkler, Two parameters, Isotropic elastic medium, Thin and thick plates, Analysis of finite plates, rectangular and circular plates, Numerical analysis of finite plates, Simple solutions. [9]

Elastic Analysis of Pile

Elastic analysis of single pile, Theoretical solutions for settlement and load distributions, Analysis of pile group, Interaction analysis, Load distribution in pile. [9]

Laterally Loaded Pile

Load deflection prediction for laterally loaded piles, Sub grade reaction and elastic analysis, Interaction analysis, Pile raft system, Solutions through influence charts. [9]

Total Hours: 45

Text book (s) :

1	Selvadurai, A.P.S., “Elastic Analysis of Soil Foundation Interaction”, Elsevier, 1979

Reference(s) :

1	Poulos, H.G., and Davis, E.H., “Pile Foundation Analysis and Design”, John Wiley, 1980
2	Scott, R.F., “Foundation Analysis”, Prentice Hall, 1981
3	Structure-Soil Interaction – State of Art Report”, Institution of Structural Engineers, 1978
4	ACI 336, “Suggested Analysis and Design Procedures for combined footings and Mats”, American Concrete Institute, Delhi, 1988

K.S.Rangasamy College of Technology – Autonomous R2018

50 PSE E33 - DESIGN OF SHELL AND SPATIAL STRUCTURES

M.E. STRUCTURAL ENGINEERING

Elective III

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P	45	C	CA	ES	Total
II	3	0	0		3	50	50	100

Objective(s)	At the end of the course the student is expected to have learnt • Classification of shells, membrane theory of shells, and design of folded plate structures • Design philosophy of space frame, optimization techniques and structural theorems.
Course Outcomes	1. Analyze various types of shells and using membrane theory. 2. Analyze various shapes of plates using various methods. 3. Principles and design philosophy of space frames. 4. Analyze and design space frames. 5. Analyze various optimization structural members.

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

Membrane Theory of Shells

Classification of shells – Types of shells – Structural action – Membrane theory – Shells of revolution and shells of translation – Examples – Limitations of membrane theory. [9]

Design of Folded Plates

Folded Plate structures – structural behaviour – Types – Design by ACI – ASCE Task Committee method. [9]

Space Frame – Design Philosophy

Space frames – configuration – types of nodes – general principles of design Philosophy – Behaviour [9]

Analysis of Space Frames

Analysis of space frames – Formex Algebra, Formian – Detailed design of Space frames [9]

Optimization

Optimization by structural theorems – Maxwell, Mirchell and Heyman's Theorems for trusses and frames – Fully stressed design with deflection constraints – Genetic Algorithm. [9]

Total Hours: 45

Text book (s) :

1	Timoshenko, S. and Krieger S.W. "Theory of Plates and Shells", McGraw Hill book company, New York,2003
2	Reddy J.N " Theory and analysis of elastic plates and shells", McGraw Hill Book company, New York, 2006.

Reference(s) :

1	Ramasamy, G.S., "Design and Construction of Concrete Shell Roofs", CBS Publishers, New Delhi, 1999..
2	Belegundu, A.D., "Optimization Concepts and Applications in Engineering ", Pearson Education, 2002.

K.S.Rangasamy College of Technology – Autonomous R2018								
50 PSE E34 - OFF SHORE STRUCTURES								
M.E. STRUCTURAL ENGINEERING								
Elective III								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt 1. To understand the demand for coastal and offshore structures, overview of different types of ocean structures. 2. 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. 3. To learn various types of structural systems/forms, brief overview of various environmental loads. 4. To be familiar with the problems associated with the material behavior in marine environment and various protection methods. 5. To understand the inspection and testing methods, repair and rehabilitation processes.							
Course Outcomes	1. Understand the functions and behaviour of offshore structures 2. Identify the different types of loads acting on the structures 3. Understand the behaviour of waves and its effects on structures 4. Evaluate the behaviour of structures for its dynamic loads							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.								
Module 1: Wave generation process, small, finite amplitude and nonlinear wave theories. [9] **Module 2:** Wind forces, wave forces on small bodies and large bodies – current forces – Morison equation.[9] **Module 3:** Different types of offshore structures, foundation modeling, fixed jacket platform structural modeling. [9] **Module 4:** Static method of analysis, foundation analysis and dynamics of offshore structures. [9] **Module 5:** Design of platforms, helipads, Jacket tower, analysis and design of mooring cables and pipelines. [9]								
Total Hours: 45								
Text book (s) :								
1	Reddy. D. V and Swamidas A. S. J., Essential of Offshore Structures, CRC Press, 2013**.**							
Reference(s) :								
1	API RP 2A-WSD, Planning, Designing and Constructing Fixed Offshore Platforms – Working Stress Design – API Publishing Services, 2005							
2	James F. Wilson, Dynamics of Offshore Structures, John Wiley and Sons, Inc, 2003.							
3	Reddy, D. V. and Arockiasamy, M., Offshore Structures, Vol. 1 and Vol. 2, Krieger Publishing Company, 1991.							
4	Turgut Sarpkaya, Wave Forces on Offshore Structures, Cambridge University Press, 2010.							

K.S.Rangasamy College of Technology – Autonomous R2018

50 PSE E35 - EXPERIMENTAL TECHNIQUES AND INSTRUMENTATION

M.E. STRUCTURAL ENGINEERING

Elective III

Semester	Hours / Week`			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	50	50	100

Objective(s)	At the end of the course the student is expected to have learnt • Basics in measurements, strain gauge types, and applications, Indicating and recording devices static and dynamic techniques • Non destructive testing techniques and equipments
Course Outcomes	1. Demonstrate strain measuring equipments. 2. Understand various vibration measuring equipments. 3. Choose various data indicating and recording instrument. 4. Outline the concept of photoelasicity 5. Apply suitable non destructive testing methods.

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

Force and Strain Measurements

Basic Concept – Measurements of displacement, strain pressure, force, torque etc, Strain gauges (Mechanical, Electrical, Acoustical etc) – Strain gauge circuits - potentiometer and wheat stone bridge – Rosette analysis. Hydraulic Jack, Load cell, Proving Ring. [9]

Vibration Measurements

Liner Variable Differential Transducers (LVDT) – Transducers for velocity and acceleration measurements. Vibration meter – Seismographs. [9]

Data Acquisition Systems

Indicating and recording devices - Static and dynamic data recording –Data acquisition and processing systems – Cathode Ray Oscilloscope – XY Plotter – Chart plotters – Digital data acquisition systems. [9]

Photoelasticity

Photoelasticity – Optics of photoelasticity – Polariscope – Isoclinics and Isochromatics - Methods of stress separation [9]

Non Destructive Testing Methods

Ultrasonic testing principles and application – Rebound Hammer – Holography – Use of laser for structural testing – Advanced NDT methods – Ultrasonic pulse echo, impact echo, impulse radar techniques, GECOR, Ground penetrating radar (GPR). [9]

Total Hours: 45

Text book (s) :

1	Sadhu Singh, “Experimental Stress Analysis”, Khanna Publishers, New Delhi,1996

Reference(s) :

1	Rangan C S., ”Instrumentation – Devices and Systems”, Tata McGraw-Hill Publishing Co., Ltd., New Delhi, 1997
2	Dally J W and Riley W.F, “Experimental stress Analysis”, McGraw-Hill, Inc. NewYork, 1991
3	Sirohi. R.S.,Radhakrishna.H.C, “Mechanical Measurements”, New Age International (P) Ltd. 1997
4	Charles J Hellier, Handbook of Non destructive Evaluation, Second Edition, Mc graw Hill Education.
5	Ravisankar.K. and Chellappan.A., “Advanced course on Non-Destructive Testing and Evaluation of Concrete Structures” SERC, Chennai, 2007.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E36 - SECONDARY TREATMENT OF WASTEWATER								
M.E. STRUCTURAL ENGINEERING								
Elective III								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt 1.Process analysis and kinetics of secondary treatment 2.Suspended and attached growth treatment of wastewater							
Course Outcomes	01.Identify the biological treatment process and analysis 02.Evaluate the biokinetic coefficients 03. Recognize the common physical, chemical and biological unit operations encountered in treatment process 04.Characterize the treatment process 05.Formulate the application of the attached growth treatment process							

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

Introduction, Process Analysis and Selection

Biological treatment processes – objectives - Choice of treatment method – Environmental impact and other considerations in planning the treatment – Cost of Wastewater treatment – Reactors used for the treatment – mass balance analysis – Reactions, Reaction rates – Enzyme reaction. Modeling of ideal flow and non ideal flow reactors – Reactors in parallel – Reactors in series – Tracer tests – Estimation of dispersion coefficient. [9]

Fundamentals of Process Kinetics

Role of microorganisms – Microbial growth kinetics - Biological oxidation process - loading – MCRT - F/ M ratio - Determination of biokinetic coefficients – Modelling of suspended growth treatment process – Description, Design and operating parameters – Modelling of plug flow reactors.. [9]

Suspended Growth Treatment Process - Activated Sludge Process and Ponds

Treatment Process Loading – Biological & solids retention time – F/M ratio – Determination of Bio-kinetic constants – application of kinetics to Biological Treatment - Suspended Growth Treatment Process – Modelling of Suspended Growth Treatment Process – CFSTR – PFR - Design of Activated Sludge Process – Modifications (only theory) – Oxidation pond – Aerated lagoons – Oxygen requirements – arrangement for transfer of oxygen – Secondary clarifier - design features.

Stabilization ponds – Classification – Application – Process design, flow pattern and analysis of Aerobic ponds – Facultative ponds – Anaerobic ponds – maturation ponds – Construction and performance. [9]

Suspended Growth Treatment Process - Digestion Process

Sludge Digestion – Sources of sludge – Characteristics – Quantities – Anaerobic digestion – Process – Kinetic relationship – gas production – design considerations. Anaerobic treatment of liquid wastes – Anaerobic sludge blanket process – design considerations. Aerobic Digestion – Kinetics – Oxygen requirements – Design considerations [9]

Attached Growth Treatment Process

Attached Growth Treatment Process – Substrate Removal in Attached Growth Treatment Process - Trickling Filter – Process – Classification - design based on popular design equations – NRC, Rankine's and Eckenfelder equation - Rotating Biological contactors – Anaerobic attached growth treatment processes – up flow packed bed – up flow expanded bed – Fluidized bed – Down flow bed. (Only theory) [9]

Total Hours: 45

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.
5	Arceivala S. J., “Wastewater Treatment and Pollution control”, Tata McGraw-Hill Co., New Delhi, 1998.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E37- INDUSTRIAL WASTEWATER POLLUTION - PREVENTION AND CONTROL								
M.E. STRUCTURAL ENGINEERING								
Elective III								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt 1. Characteristics of industrial wastewater, techniques and approaches for minimizing the generation . 2. Application of physio chemical and biological treatment methods for recovery, reuse and disposal supported with case studies under Indian situations.							
Course Outcomes	01.Discuss about the source and environmental impact of industrial waste water 02.Able to develop the methods for prevention and control of industrial pollution 03.Formulate the various methods for industrial waste water treatment 04. Know about the design of effluent treatment plant 05.Identify the various case studies associated in industrial wastewater treatment							

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

Introduction

Industrial scenario in India– Industrial activity and Environment - Uses of Water by industry – Sources and types of industrial wastewater – Nature and Origin of Pollutants - Industrial wastewater and environmental impacts – Regulatory requirements for treatment of industrial wastewater – Industrial waste survey – Industrial wastewater monitoring and sampling -generation rates, characterization and variables –Toxicity of industrial effluents and Bioassay tests – Major issues on water quality management [9]

Industrial Pollution Prevention

Prevention and Control of Industrial Pollution – Benefits and Barriers – Waste management Hierarchy - Source reduction techniques – Pollution Prevention of Assessment - Material balance - Evaluation of Pollution prevention options –Cost benefit analysis – payback period - Waste minimization Circles [9]

Industrial Wastewater Treatment

Equalisation - Neutralisation – Oil separation – Flotation – Precipitation – Heavy metal Removal– Aerobic and anaerobic biological treatment – Sequencing batch reactors – High Rate reactors - Chemical oxidation – Ozonation – carbon adsorption - Photocatalysis – Wet Air Oxidation – Evaporation – Ion Exchange – Membrane Technologies – Nutrient removal.- Treatability studies. [9]

Wastewater Reuse And Residual Management

Individual and Common Effluent Treatment Plants – Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse – Industrial reuse , Present status and issues - Disposal on water and land – Residuals of industrial wastewater treatment – Quantification and characteristics of Sludge – Thickening, digestion, conditioning, dewatering and disposal of sludge – Management of RO rejects. [9]

Case Studies

Attached Growth Treatment Process – Substrate Removal in Attached Growth Treatment Process - Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – metal finishing – Oil Refining – Pharmaceuticals – Sugar and Distilleries [9]

Total Hours: 45

Reference(s) :

1	Eckenfelder, W.W., 'Industrial Water Pollution Control', Mc-Graw Hill, 2000.
2	Nelson Leonard Nemerow, "Industrial waste treatment – contemporary practice and vision for the future",

	Elsevier, Singapore, 2007
3	Frank Woodard, “Industrial waste treatment Handbook”, Butterworth Heinemann, New Delhi, 2001.
4	World Bank Group, “Pollution Prevention and Abatement Handbook – Towards Cleaner Production”, World Bank and UNEP, Washington D.C., 1998
5	Paul L. Bishop, “Pollution Prevention: - Fundamentals and Practice’, Mc-Graw Hill International, Boston, 2000.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E41 - CADD FOR STRUCTURES								
M.E. STRUCTURAL ENGINEERING								
Elective IV								
Semester	**Hours / Week `**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt • Computer graphics, software usage in drafting, computer methods of structural analysis, computer aided designing and detailing, optimizing, • Project scheduling using CPM and PERT, and about the artificial intelligence systems.							
Course Outcomes	1.Be familiar with 2 D drafting and can use drafting software. 2.Perform structural analysis using analysis package 3.Design the structures with computer methodologies. 4.Optimize the structural design with various computer packages and graphics. 5.Apply artificial intelligence to real life applications.							

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

Computer Graphics

Graphic primitives - Transformations - Basics of 2D drafting - Modeling of curves and surfaces – Solid modeling - Graphic standards - Drafting software packages and usage. [9]

Structural Analysis

Computer methods of structural analysis - Finite Element programming – Analysis through application packages [9]

Structural Design

Computer aided design of steel and RC Structural elements - Detailed drawing – Bill of materials [9]

Optimization

Linear programming - Simplex algorithm - Post-optimality analysis – Project scheduling - CPM and PERT applications Genetic algorithm and applications. [9]

Artificial Intelligence

Introduction - Heuristic search - knowledge based expert systems - Architecture and applications of KBES - Expert system shells - Principles of neural network. [9]

Total Hours:45

Text book (s) :

1. Krishnamoorthy,C.S.and.Rajeev, S,"Computer Aided Design", Narosa Publishing House, New Delhi, 1991.

Reference(s) :

1. Harrison H.B., "Structural Analysis and Design ", Vol. I & II, Pergamon Press, 1991
   Hinton E.and Owen, D.R.J."Finite Element Programming", Academic Press 1977.
2. Billy E.Gillet, "Introduction to Operations Research -A computer oriented algorithmic approach", Tata McGraw-Hill, 1982.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E42 - DESIGN OF INDUSTRIAL STRUCTURES								
M.E. STRUCTURAL ENGINEERING								
Elective IV								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course, the student will be able to: • Design of Steel Gantry Girders. • Design of Steel Portal, Gable Frames. • Design of Steel Bunkers and Silos. • Design of Chimneys and Water Tanks.							
Course Outcomes	• Evaluate the various forces due to a moving crane over a gantry girder and design a suitable section. • Design procedure for portal frames with different support conditions and concept of light weight structures. • Design of steel bunkers, silos & chimneys. • Calculate the various forces acting on steel water tanks. • Assets the general behaviour of pressed steel water tank and design various parts and their joints.							

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

Steel Gantry Girders – Introduction, loads acting on gantry girder, permissible stress, types of gantry girders and crane rails, crane data, maximum moments and shears, construction detail, design procedure. [8]

Portal Frames – Design of portal frame with hinge base, design of portal frame with fixed base - Gable Structures – Lightweight Structures [5]

Steel Bunkers and Silos – Design of square bunker – Jansen's andAiry's theories – IS Code provisions – Design of side plates – Stiffeners – Hooper – Longitudinal beams Design of cylindrical silo – Side plates – Ring girder – stiffeners. [8]

Chimneys – Introduction, dimensions of steel stacks, chimney lining, breech openings and access ladder, loading and load combinations, design considerations, stability consideration, design of base plate, design of foundation bolts, design of foundation. [8]

Water Tanks – Design of rectangular riveted steel water tank – Tee covers – Plates – Stays – Longitudinal and transverse beams –Design of staging – Base plates – Foundation and anchor bolts [8]

Design of pressed steel water tank – Design of stays – Joints – Design of hemispherical bottom water tank – side plates – Bottom plates – joints – Ring girder –Design of staging and foundation. [8]

Total Hours:45

Text book (s) :

1	Design of Steel Structures, Ram Chandra, 13th Ed., Standard Publishers, 2011.

Reference(s) :

1	Design of Steel Structure, Punmia B. C., Jain Ashok Kr., Jain Arun Kr., Lakshmi Publishers, 2011.
2	Subramaniyam, N. "Design of Steel Structures", (As per IS 800-2007), Oxford University press, 2014.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E43 - DISASTER RESISTANT STRUCTURES								
M.E. STRUCTURAL ENGINEERING								
Elective IV								
Semester	**Hours / Week `**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt • The behaviour of life line structures during natural disasters, response on community structures, strengthening measures, safety analysis, rehabilitation and retrofitting of damaged structures, use of modern materials and methods in different type of structures • Assessment procedure for damaged structures, along with ground improvement techniques.							
Course Outcomes	• Apply design philosophy to resist natural calamites • Discuss the national and international code of practice fir urban and semi urban areas • Evaluate the response of dams and bridges due to an disaster • Identify strengthening technique and perform reliability assessment for structures affected by natural calamities. • Discuss the testing and evaluation procedure damaged structure for strengthening. • Apply appropriate strengthening technique for different disaster and perform qualification test. • Apply modern materials for disaster reduction. • Describe the use of modern analysis, design and construction techniques for performance. • Discuss the damage surveys and modifications to improve hazard resistance. • Describes the different types of foundations and its on safety and ground improvement techniques.							

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

Behaviour of Life-Line Structures

Philosophy for design to resist earthquake, cyclone and flood, tsunami, National and International codes of practice, By-Law of urban and semi-urban areas – Traditional and modern structures. [9]

Community Structures

Response of dams, bridges, buildings ,Strengthening measures , Safety analysis and rating – Reliability assessment [9]

Rehabilitation and Retrofitting

Testing and evaluation - Classification of structures for safety point of view – methods of strengthening for different disasters - qualification test – different techniques [9]

Detailing of Structures and Components

Use of modern materials and their impact on disaster reduction, Use of modern analysis, design and construction techniques optimization for performance. [9]

Damage Assessment of Structures

Damage surveys - Maintenance and modifications to improve hazard resistance - Different types of foundation and its impact on safety - Ground improvement techniques. [9]

Total Hours:45

Text book (s) :

1. Allen R.T and Edwards S.C., “Repair of Concrete Structures”, Blakie and Sons, U.K 1987.

Reference(s) :

1. Raiker R.N., “Learning from failures - Deficiencies in Design, Construction and Service”, R & D Center (SDCPL) Raiker Bhavan, Bombay, 1987.
2. Santhakumar A .R “Concrete Technology”, Oxford Higher Education , New Delhi,2007.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E44 - INDUSTRIAL STEEL STRUCTURES								
M.E. STRUCTURAL ENGINEERING								
Elective IV								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the student will be able to • Classification, planning and functional requirements of industrial structures • Design of pre-engineered structures, different towers and testing of towers.							
Course Outcomes	1. Classify the different types of industrial structures based on planning and functional requirements. 2. Assess the general behaviour of steel shell roofs and design of gantry girders and gantry coloumns. 3. Evaluate the various forces acting on Bunkers, silos, chimney's, cooling towers steel storage tanks and design them. 4. Calculate the different types of forces acting on towers and design the tower foundations. 5. Analysis and design of pre-engineered structures							

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

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. [9]

Industrial, Building

Roofs for Industrial Buildings- Steel shell roofs- Gantry Girders- Design of gantry columns [9]

Industrial Appurtenances

Bunkers and Silos - Chimney and cooling Towers – Design of steel storage tanks [9]

Design of Lattice Towers

Micro wave towers - Transmission Line Towers – pipe track structures- Tower Foundations – Testing towers. [9]

Design of Pre Engineered Structures

Introduction-section specification-Types of assemblies –analysis and design of pre engineered structure-connection details [9]

Total Hours:45

Text book (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.

Reference(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.

K.S.Rangasamy College of Technology - Autonomous R2018

50 PSE E45 - CORROSION ENGINEERING

M.E. STRUCTURAL ENGINEERING

Elective IV

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	50	50	100

Objective(s)	The demand for corrosion engineering course has dramatically, environment and applying the knowledge of corrosion prevention.
Course Outcomes	01. Define the basic concepts on corrosion. 02. Discuss the testing and evaluation of forms of corrosion 03. Describes the different types of corrosive environments. 04. Illustrate the concepts of corrosion testing. 05. Apply the corrosion prevention.

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

INTRODUCTION:

Cost of Corrosion – Corrosion Engineering – Definition of Corrosion – Environments – Corrosion Damage – Classification of Corrosion. Corrosion Principles : Introduction – Corrosion Rate Expressions. Electrochemical Aspects : Electrochemical Reactions – Polarisation – passivity, Environmental Effects: Effect of oxygen and oxidizers – Effect of Velocity – Effect of temperature – Effects of Corrosive concentration – Effect of Galvanic Coupling – Metallurgical Aspects. [9]

FORMS OF CORROSION

Galvanic Corrosion : EMF and Galvanic Series – Environmental Effects – Distance Effect – Area Effect – Prevention. Crevice Corrosion: Environmental Factors – Mechanism – Combating Crevice Corrosion – Filiform Corrosion. Pitting – Solution composition – Velocity – Metallurgical Variables – Evaluation & Prevention of pitting damage. Intergranular corrosion . Austentic Stainless Steels – Weld Decay – Knife Line Attack.

Selective Leaching: Dezincification Characteristics, Mechanism, prevention – Graphitization – Other Alloy systems. Erosion Corrosion: Surface Films – Velocity – Turbulence – Impingement - Galvanic Effect – Combating Erosion corrosion. Stress corrosion: crack morphology – Stress effects – time to cracking – Environmental & Metallurgical factors – Mechanism – methods of prevention – corrosion Factors – Hydrogen Blistering – Hydrogen Embrittlement – Prevention. [9]

CORROSIVE ENVIRONMENTS

Mineral Acids: Sulfuric Acid – Nitric Acid – Hydrochloric Acid – Hydrofluoric Acid – Phosphoric Acid. Organic Acids – Alkalies – Atmosphere Corrosion – Sea water – Fresh water – High purity water – soils – Aerospace – Biological corrosion – Human body – Corrosion of metals by halogens – Liquid metals and fused salts – sewage and plant – waste treatment – Dew point corrosion – liquid metal embrittlement of cracking – Hydrogen peroxide – Rebar corrosion. [9]

CORROSION TESTING

Introduction – Classification – Purpose – Materials and specimens – surface preparation – Measuring & Weighing – Exposure Techniques – Duration – Planned Interval Tests Aeration – Cleaning specimens after exposure – temperature – Standard expressions for corrosion rate – Galvanic corrosion high temperature and pressure – Erosion – Intergranular corrosion – pitting & stress corrosion – NACE Test methods – Linear polarization – paint Tests – Sea water tests – Miscellaneous tests of metals. [9]

CORROSION PREVENTION

Materials Selection: Metals & Alloys – Metal purification. Alteration of Environment: changing mediums – Inhibitors. Design: Wall Thickness – Design Rules. Cathodic & Anodic protection – comparison. Coatings: Metallic & other Inorganic coatings – Organic coatings – corrosion control standards – Failure Analysis. [9]

Total Hours:45

Text book (s) :

1 Mars G. Fontana, corrosion Engineering Third Edition Mc. Graw – Hill Book Company, New York 1988.

Reference(s) :

1 J. H. Brophy, R. M.Rose and J. Wulf, “The structure and properties of materials,” wiley interscience Inc., New York, 1994

K.S.Rangasamy College of Technology - Autonomous R2018

50 PSE E46 - PRINCIPLES AND DESIGN OF BIOLOGICAL TREATMENT SYSTEM

M.E. STRUCTURAL ENGINEERING

Elective IV

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	50	50	100

Objective(s)	At the end of the course the student is expected to have learnt 1.Principles and design of Aerobic and anerobic treatment of waste water 2.Construction,operation and maintenance of waste water treatment units
Course Outcomes	01. Able to develop conceptual schematics required for biological treatment of wastewater 02. Ability to translate pertinent criteria into system requirements

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

Principles

Objectives of biological treatment – significance – aerobic and anaerobic treatment kinetics of biological growth – Factors affecting growth – attached and suspended growth Determination of Kinetic coefficients for organics removal – Biodegradability assessment -selection of process- reactors-batch-continuous type-kinetics [9]

Design of Aerobic Treatment Systems

Design of sewage treatment plant units –Activated Sludge process and variations, Sequencing Batch reactors, Membrane Biological Reactors-Trickling Filters-Bio Tower-RBC-Moving Bed Reactors-fluidized bed reactors, aerated lagoons, waste stabilization ponds – nutrient removal systems – natural treatment systems, constructed wet land – Disinfectant – disposal options – reclamation and reuse – Flow charts, layout, hydraulic profile, recent trends. [9]

Anaerobic Treatment of Wastewater

Attached and suspended growth, Design of units – UASB, up flow filters, Fluidized beds septic tank and disposal – Nutrient removal systems – Flow chart Layout and Hydraulic profile – Recent trends. [9]

Sludge Treatment and Disposal

Design of sludge management facilities, sludge thickening, sludge digestion, biogas generation, sludge dewatering (mechanical and gravity) Layout PID hydraulics profile – upgrading existing plants – ultimate residue disposal – recent advances. [9]

Construction Operations and Maintenance Aspects

Construction and Operational Maintenance problems – Trouble shooting – Planning, Organizing and Controlling of plant operations – capacity building, Case studies – sewage treatment plants – sludge management facilities. [9]

Total Hours:45

Text book (s) :

1. Arceivala, S.J., “Wastewater Treatment for Pollution Control”, TMH, New Delhi, Second Edition, 2000.

Reference(s) :

1. Manual on “Sewerage and Sewage Treatment” CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
2. Metcalf & Eddy, INC, ‘Wastewater Engineering – Treatment and Reuse”, Fourth Edition, Tata Mc Graw-Hill Publishing Company Limited, New Delhi, 2003.
3. Qasim, S.R. “Wastewater Treatment Plant, Planning, Design & Operation”, Technomic Publications, Newyork, 1994.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E47 - RESEARCH METHODOLOGY - ENGINEERING AND MANAGEMENT STUDIES								
M.E. STRUCTURAL ENGINEERING								
Elective IV								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
II	3	0	0	45	3	50	50	100
Objectives	At the end of the course the student is expected to have learnt 1. Research orientation among the scholars and to acquaint them with fundamentals of research methods. 2. Basic concepts used in research and to scientific social research methods and their approach. 3. Sampling techniques, research designs and techniques of analysis							
Course Outcomes	01. Apply a range of quantitative and qualitative research tools to business and management problems. 02. Conceptualize the data collection process. 03. Understand and apply the research approaches, techniques and strategies in the appropriate manner for sampling method. 04. Understand the concept of hypothesis testing and applying appropriate testing methods. 05. Conceptualize the various sample tests. 06.Demonstrate the knowledge and understanding of data analyze and report prepartion							

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

Research Methodology

Research methodology – definition, mathematical tools for analysis, Types of research, exploratory research, conclusive research, modeling research, algorithmic research, Research process- steps. Data collection methods- Primary data – observation method, personal interview, telephonic interview, mail survey, questionnaire design. Secondary data- internal sources of data, external sources of data. [9]

Scales and Measurements

Scales – measurement, Types of scale – Thurstone's Case V scale model, Osgood's Semantic Differential scale, Likert scale, Q- sort scale. Sampling methods- Probability sampling methods – simple random sampling with replacement, simple random sampling without replacement, stratified sampling, cluster sampling. Non-probability sampling method – convenience sampling, judgment sampling, quota sampling. [9]

Hypotheses Testing

Hypotheses testing – Testing of hypotheses concerning means (one mean and difference between two means - one tailed and two tailed tests), Concerning variance – one tailed Chi-square test. [9]

Sample Tests

Nonparametric tests- One sample tests – one sample sign test, Kolmogorov-Smirnov test, run test for randomness, Two sample tests – Two sample sign test, Mann-Whitney U test, K-sample test – Kruskal Wallis test (H-Test) [9]

Analysis and Report

Introduction to Disciminant analysis, Factor analysis, cluster analysis, multidimensional scaling, conjoint analysis. Report writing- Types of report, guidelines to review report, typing instructions, oral pesentation [9]

Total Hours:45

Reference(s):

1. Kothari, C.R., "Research Methodology –Methods and techniques", New Age Publications, New Delhi, 2009.
2. Panneerselvam, R., "Research Methodology", Prentice-Hall of India, New Delhi, 2004.

K.S.Rangasamy College of Technology - Autonomous R 2018								
50 PSE E51 - PRESTRESSED CONCRETE STRUCTURES								
M.E. STRUCTURAL ENGINEERING								
Elective V								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
III	3	0	0	45	3	50	50	100
OBJECTIVES	At the end of this course the student shall have a knowledge of 1. Methods of prestressing, advantages of prestressing concrete, the losses involved 2. Design methods for prestressed concrete elements under codal provisions.							
Course Outcomes	1. Evaluate the internal forces and deflection in prestressed concrete. 2. Design the pre-stressing layout and understand the behavior of pre-stressed concrete elements under practical loading conditions 3. Practice the Analysis and design of continuous beams and extend the knowledge on concept of linear transformation. 4. Outline the design of tension and compression members in prestressing. 5. Illustrates the design of composite members and partial prestressing.							

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

Principles of Prestressing

Principles of Prestressing - types and systems of prestressing, need for High Strength materials, Analysis methods losses, deflection (short-long term), camber, cable layouts. [9]

Design of Flexural Members

Behaviour of flexural members, determination of ultimate flexural strength – Codal provisions -Design of flexural members, Design for shear, bond and torsion. Design of end blocks. [9]

Design of Continuous Beams

Analysis and design of continuous beams - Methods of achieving continuity – concept of linear transformations, concordant cable profile and gap cables [9]

Design of Tension and Compression Members

Design of tension members - application in the design of prestressed pipes and prestressed concrete cylindrical water tanks - Design of compression members with and without flexure - its application in the design piles, flagmasts and similar structures. [9]

Design of Composite Members

Composite beams - analysis and design, ultimate strength - their applications. Partial prestressing - its advantages and applications. [9]

Total Hours:45

Text books:

1	Krishna Raju.N, “Prestressed Concrete”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018.
2	Lin, T.Y & Burns, “Design of Prestressed Concrete Structures” John Wiley & Sons, 1982.

References:

1	Devadas Menon & A.K Sengupta, “Prestressed Concrete Structure (Web Course)”, NPTEL Course Notes, 2008.
2	Krishna Raju.N, “Problems & Solutions – Prestressed Concrete”, CBS Publishers & Distributors., New Delhi, 2015.
3	Rajagopalan.N “Prestressed Concrete”, Narosa Publishing House, 2005.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E52 – STEEL CONCRETE COMPOSITE STRUCTURES								
M.E. STRUCTURAL ENGINEERING								
Elective V								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
III	3	0	0	45	3	50	50	100

Objective(s)	At the end of the course the student is expected to have learnt 1. To understand the concept of steel - concrete composite member 2. To understand the behaviour of composite beams, columns 3. To design composite girder bridges and understand the seismic behaviour of composite structures 4. To know the design of connections 5. To study specific case studies
Course Outcomes	1.Retain knowledge of the composite behaviour of structures. 2.Design various composite structural elements such as beams, columns. 3.Analyse the connection behaviour and design. 4.identify different types of roof trusses and their connections. 5.Enumerate the behaviour of box girder bridges and the design concepts of the same.

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

Introduction

Introduction to Steel - Concrete Composite Construction - Theory of composite structures - Introduction to steel – Concrete – Properties of materials – Direct actions - Steel Sandwich Construction – Behavior of composite beams & columns. [9]

Design of Flexural Members

Behavior of composite beams - Design of Steel Concrete Composite beams – Shear connectors – Connections for shear and uplift – Continuous members – Check for limit state of serviceability. [9]

Design of Compression Members

Types of Composite columns – behavior – Design of steel concrete composite columns- Encased columns- Member subjected to axial compression – Uniaxial bending – Biaxial bending- Combined compression and Biaxial bending. [9]

Design of Roof Trusses And Connections

Introduction - Design of composite trusses. Types of Connections - Design of connections in the Composite Structures – Shear connections - Design of connections in Composite Trusses. [9]

Composite Box Girder Bridges

Introduction - Behavior of Box Girder Bridges - Design concepts. [9]

Total Hours:45

Text book (s) :

1	Johnson R.P., “Composite structures of steel and concrete”, Blackwell Scientific Publications, UK, 2004

Reference(s) :

1	Owens, G.W. and Knowels.P. “Steel Designers manual”, Steel Concrete Institute (UK), Oxford Blackwell Scientific Publications, 2003
2	Teaching resources for Structural Steel Design, INSDAG, Kolkatta.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E54 – ASEISMIC DESIGN OF STRUCTURES								
M.E. STRUCTURAL ENGINEERING								
Elective V								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
III	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt 1.Different element of engineering seismology, performance of structures under the past earth quake, theory of vibrations, soil performance under cyclic loading, concept of earth quake resistant design, provisions in the code books 2.The design of non engineered constructions, modern concepts like base isolation with some case studies							
Course Outcomes	1. Identify the causes and effects of earthquake and describe the terms related to earthquake. 2. Define the basic concepts of elements of vibration and behavior of structures under cyclic loading. 3. Practice the codal provisions for design and detailing of earthquake resistant structures. 4. Formulate the design principles for Non-engineered buildings and design provisions for bridges and dams. 5. Categorize the new concepts on different types of base isolation techniques.							
Note: The hours given against each topic are of indicative. The faculty have the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.								
Elements of Seismology Elements of Engineering Seismology, Characteristics of Earthquakes, History, Seismic Susceptibility of Indian Subcontinent, Performance of structures during past earthquakes, Lessons learnt from past earthquakes. [9] **Theory of Vibrations** Theory of vibrations ,Building Systems , Rigid Frames, Braced Frames, Shear Walls, Behavior of RC, Steel and Prestressed concrete elements under cyclic loading ,Soil liquefaction and prevention methods [9] **Codal Provisions for Design & Detailing** Concept of Earthquake Resistant Design, Response Spectrum ,Design Spectrum Provisions of Seismic Code IS 1893 (Part I) – 2002 ,Structural Configuration , 3 D computer analysis of building (Theory) ,Design and Detailing of Frames, Shear Walls and Framed Walls ,Provisions of IS-13920. [9] **Non Engineered Buildings** Design of Non Engineered construction, strengthening of buildings, Design Provisions for Bridges and Dams [9] **Base Isolation Techniques** Modern Concepts –Base Isolation, Adoptive systems and Case studies. [9]								
Total Hours:45								
Text book (s) :								
1	Dr.vinod hosur," Earthquake-resistant design of building structures", first edition-2013, rajkamal press,Delhi.							
2	Shashikant K.Duggal,Earthquake resistant design of structures oup india 2013,oxford higher education.							
3	Pankaj Agarwal & Manish Shrikhande, "Earthquake Resistant Design of Structures", PHI Learning Pvt Ltd, New Delhi, 2008.							
4	Damodarasamy S.R,"Basics of Structural Dynamics and Aseismic Design", PHI Learning Pvt Ltd, New Delhi, 2009.							
Reference(s) :								
1	Anil K Chopra, "Dynamics of structures – Theory and applications to Earthquake Engineering", Prentice Hall Inc., 2001.							
2	Minoru Wakabayashi, "Design of Earthquake Resistant Buildings", McGraw –Hill Book Company, Newyork, 1986							
3	Clough R.W. and Penzien J., 'Dynamics of Structures', McGraw-Hill, 2nd edition,1992							
4	Newmark N.M. and Rosenblueth E., 'Fundamentals of Earthquake Engineering", Prentice Hall, 1971.							
5	Wiegel R.L., 'Earthquake Engineering", Prentice Hall, 1970.							

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E55 – PREFABRICATED STRUCTURES								
M.E. STRUCTURAL ENGINEERING								
Elective V								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
III	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt 1.Requirements for planning and manufacturing of different R.C.C prefabricated structural components 2.Design of industry buildings along with shell roofs							
Course Outcomes	1. Infer the basic concepts of prefabrication and their needs in construction industry. 2. Know the behavior of prefabricated structures. 3. Design of prefabricated building elements including wall, floors and roofs. 4. Understand the concepts of industrial buildings and crane-gantry systems. 5. Design of floors, stairs and roofs of prefabricated structural elements. 6. Classify the types of joints of prefabricated units. 7. Know the types of prefabricated wall panels. 8. Understand the load transfer mechanism from floor to wall panels. 9. Adopt the prefabrication techniques of various industrial structures.							

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

Introduction and Design Principles

General Civil Engineering requirements, specific requirements for planning and I layout of prefabricates plant. IS Code specifications. Modular co-ordination, standardization, Disuniting of Prefabricates, production, transportation, erection, stages of loading and codal provisions, safety factors, material properties, Deflection control, Lateral load resistance, Location and types of shear walls [9]

Reinforced Concrete

Prefabricated structures - Long wall and cross-wall large panel buildings, one way and two way prefabricated slabs, Framed buildings with partial and curtain walls, single storey industrial buildings with trusses and shells, Crane-gantry systems. [9]

Floors, Stairs and Roofs

Types of floor slabs, analysis and design example of cored and panel types and two-way systems, staircase slab design, types of roof slabs and insulation requirements, Description of joints, their behaviour and reinforcement requirements, Deflection control for short term and long term loads, Ultimate strength calculations in shear and flexure. [9]

Walls

Types of wall panels, Blocks and large panels, Curtain, Partition and load bearing walls, load transfer from floor to wall panels, vertical loads, Eccentricity and stability of wall panels, Design Curves, types of wall joints, their behaviour and design, Leak prevention, joint sealants, sandwich wall panels, approximate design of shear walls. [9]

Design of Industrial Buildings and Shell Roofs

Components of single-storey industrial sheds with crane gantry systems, Design of R.C. Roof Trusses, Roof Panels, Design of R.C. crane-gantry girders, corbels and columns, wind bracing design. Cylindrical, Folded plate and hyper-prefabricated shells, Erection and jointing, joint design, hand book based design. [9]

Total Hours: 45

Text book (s) :

1	Gerostiza. C.Z., Hendrikson, C., Rehat D.R., "Knowledge Based Process Planning for Construction and Manufacturing", Academic Press, Inc., 2002.

Reference(s) :

1	Lewicki B., "Building with Large Prefabricates", Elsevier Publishing Company, Amsterdam / London / Newyork, 1966.
2	Koncz.T. "Manual of Precast Concrete Construction", Vol.I II, III and IV, Berlin, 1971.
3	Mokk L., "Prefabricated Concrete for Industrial and Public Structures", Publishing house of Hungarian Academy of sciences, Budapest, 1964.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E56 - TRANSPORTATION OF WATER AND WASTEWATER								
M.E. STRUCTURAL ENGINEERING								
Elective V								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
III	3	0	0	65	3	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt 1. Detailed design concepts related to water transmission mains, water distribution system, sewer networks and storm water drain, with emphasis on computer application. 2. Case studies on transportation of water and waste water							
Course Outcomes	01. Understand the general hydraulics and principles of flow measurements. 02. Describe the components of water transmission system. 03. Analyze the water distribution networks plan the wastewater collection from various sources. 04. Evaluate the conveyance of wastewater and various appurtenances. 05. Estimate the storm water drainage quantity by various methods. 06. Perform the software analyses related to transport of water and wastewater.							

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

General Hydraulics and Flow Measurement

Fluid properties; fluid flow – continuity principle, energy principle and momentum principle; frictional head loss in free and pressure flow, minor heads losses, Carrying Capacity–Flow measurement. [9]

Water Transmission and Distribution

Need for Transport of water and waste water-Planning of water system-Selection of pipe materials-Water transmission main design-gravity and pumping main, selection of pumps-characteristics-economics; specials, jointing and maintenance, water hammer analysis, water distribution pipe network design, analysis and optimization-appurtenances-corrosion prevention-minimization of water losses-leak detection, storage reservoir. [9]

Wastewater Collection and Conveyance

Planning factors – Design of sanitary sewer; partial flow in sewers, economics of sewer design; Wastewater pumps and pumping stations- sewer appurtenances; material, construction, inspection and maintenance of sewers; Design of sewer outfalls-mixing conditions; conveyance of corrosive wastewaters. [9]

Storm Water Drainage

Necessity- combined and separate system; Estimation of storm water run off Formulation of rainfall intensity duration and frequency relationships- Rational methods. [9]

Case Studies and Software Applications

Use of computer software in water transmission, water distribution and sewer design – LOOP version 4.0, SEWER, BRANCH, Canal ++ and GIS based soft ware's. [9]

Total Hours"45

Text book (s) :

1	Bajwa, G.S. "Practical Handbook on Public Health Engineering", Deep Publishers, Shimla, 2003

Reference(s) :

1	"Manual on water supply and Treatment", CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
2	"Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1993.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E57– DESIGN OF CONCRETE STRUCTURES								
M.E. STRUCTURAL ENGINEERING								
Elective V								
Semester	**Hours / Week`**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
III	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt • Over all review of concrete structures, Design of special RC Elements with principles, Different methods in flat slab and Grid floors designing. • Inelastic behaviour of RC beams design and detailing requirements as per the codal provisions.							
Course Outcomes	1. To understand structural behaviour of flexural members. 2. To design the special structures by understanding their behaviour. 3. To compute deflection of flat slab and grid floors. 4. To understand redistribution of moments. 5. Design and prepare detail structural drawings for execution citing relevant IS codes.							

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

Design of Beams and Columns

Design for Limit state of collapse- Design for limit state of serviceability- Calculation of deflection and crack width.-Design of beams for combined effect of shear, bending moment and torsion. Design of beams curved in plan and spandrel beams - Design of slender columns [9]

Design of Special RC Elements

Design of RC walls- Shear walls-Classification and Design principles.-Design of rectangular and flanged Shear walls- Design of Corbels- Design of Deep beams [9]

Design of Flat Slab and Grid Floors

Yield line theory of slabs – Hillerberg's method of design of slab – Design of flat Slab –shear in flat slab Approximate analysis and Design of grid floors. [9]

Inelastic Behaviour of RC Beams

Inelastic behaviour of concrete beams – Moment Rotation curves – Moment redistribution – Baker's method of analysis and design – Design of cast in situ joints in frame [9]

Detailing Requirements

Design and detailing of structural members - Reinforcement detailing as per SP: 34 & IS:5525 – Earthquake Resistant Design – Detailing requirements for Ductility as per IS:13920. [9]

Total Hours:45

Text book (s) :

1	KrishnaRaju .N. "Advanced Reinforced Concrete Design", CBS Publishers and Distributors, 2010.
2	Pillai and Menon, S Unnikrishna Pillai Menon Devadoss.S "Reinforced Concrete Design", Tata McGraw-Hill Education, 2003.

Reference(s) :

1	Varghese, P.C. " Advanced Reinforced Concrete Design", Prentice Hall of India,2005
2	Karves.R, Dr.Shah,V.L "Illustreated Design Of Reinforced Concrete Buildings Structures", Structure Publications, Pune , 2001.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E61 - ADVANCED CONCRETE TECHNOLOGY								
M.E. STRUCTURAL ENGINEERING								
Elective VI								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
III	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the students is expected to 1.Learnt the basics of concrete technology, mix design methods, different types of concrete, durability of the concrete, different type of from works, 2.Learnt concreting under special circumstances and also testing methods for the concrete							
Course Outcomes	01.Discuss about the methods of concrete mix design 02.Describe the special concretes 03.Outline the durability of concrete. 04.Identify the concepts form work and quality control 05.Illustrate the behaviour of concreting under special circumstances.							

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

Introduction

Concrete: Past, Present and Future- Constituent Materials --Strength of Concrete- Dimensional Stability of Concrete - Chemical and Mineral Admixtures-Properties of Fresh and hardened Concrete - Principles of Concrete Mix Design-Methods of Concrete mix design. [9]

Special Concretes

Lightweight and Heavy Weight Concrete-High Strength Concrete-High Performance Concrete-Polymers in Concrete-Steel fiber Reinforced Concrete-Ferrocement Concrete-Vaccum Concrete-Ready Mixed Concrete-SIFCON – SIMCON. [9]

Durability of Concrete

Permeability-chemical attack-sulphate attack-Quality of water - marine conditions- Thermal properties of concrete-fire resistance-methods of making durable concrete - Mass Concrete-Formwork-Structural Concrete Block Masonry -Quality Control of Concrete Construction. [9]

Formwork and Quality Control

Formwork Materials and Systems-Specifications-Design-Recommendations of IS 456- 2000 on Quality -Errors in Concrete Constructions-Quality Management. [9]

Concreting Under Special Circumstances

Underground Construction-Concreting in Marine Environment-Under water Construction-Hot weather and Cold weather concreting. Tests on Concrete: Evaluation of Strength of existing structures-investigation Techniques-Tests on Hardened Concrete-Non Destructive Testing-Semi destructive testing techniques-Tests on fresh Concrete. [9]

Total Hours:45

Text book (s) :

1	Shetty M.S., Concrete Technology, S.Chand and Company Ltd, New Delhi, 2011.
2	Santha Kumar A.R., Concrete Technology, Oxford Higher Education, New Delhi, 2009.

Reference(s) :

1	Neville, A.M., Properties of Concrete, Pitman Publishing Limited, London, 2010
2	Gambir,M.L. “Concrete Technology”, Tata McGraw Hill, Publishing Co,Ltd,NewDelhi,2011.
3	Krishnaraju.N, “Design of Concrete mixes”, Sehgal Educational ConsultantsPvt.Ltd.,Faridabad, 2010.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E62 - MAINTENANCE AND REHABILITATION OF STRUCTURES								
M.E. STRUCTURAL ENGINEERING								
Elective VI								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
III	3	0	0	45	3	50	50	100

Objective(s)	At the end of the course the student is expected to have learnt 1.Quality assurance for concrete construction, causes of deterioration of concrete structures, durability of the concrete structures, corrosion protection methods, definitions and strategies in maintenance and repair, repairing materials, 2.Different types of techniques for repair and rehabilitation of structure
Course Outcomes	**01.** Learn the properties related to durability of concrete. **02.** Evaluate the basic concepts about the quality assurance of the construction **03.** Point out various types of techniques to repair crack, wear, fire and leakage. **04.** Describe corrosion protection techniques and forensic engineering. **05.**Learn the terms related to maintenance of structures and repair and develop the Knowledge about assessment procedure for evaluating a damaged structures **06.** Study the various types and properties of repair materials. **07.** Point out various types of techniques to repair crack, wear, fire and leakage. **08.**.Describe the various demolition techniques and demolition methods.

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

Introduction

Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking. Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors. [9]

Durability of Structures

Corrosion mechanism – diagnosis- causes and effects - cover thickness and cracking, measurements for corrosion - methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection. [9]

Maintenance and Repair Strategies

Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects. Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques. [9]

Materials for Repair

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement concrete, fibre reinforced concrete, eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete. [9]

Techniques for Repair and rehabilitation of structures

Rust, Gunite and Shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning. Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure Engineered demolition techniques for Dilapilated structures - case studies [9]

Total Hours:45

Text book (s) :

1	Denison Campbell, Allen and Harold Roper, “Concrete Structures - Materials, Maintenance and Repair”, Longman Scientific and Technical UK, 2001.

Reference(s) :

1	Allen, R.T.and Edwards, S.C., “Repair of Concrete Structures”, Blakie and Sons, UK, 2000.
2	Vidivelli, B. “Repair and Rehabilitation of Structures”, Standard Publishers & Distributors, ND,2010.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E63 - MODERN CONSTRUCTION MATERIALS								
M.E. STRUCTURAL ENGINEERING								
Elective VI								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
III	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt 1. Properties of special concrete. 2. Properties and applications of smart and intelligent materials							
Course Outcomes	01. Understand the characterization and behaviour of special concretes. 02. Conceptalise the metals and its application. 03. Apply the basic knowledge in composites to get good quality construction. 04. Developed the skills for identification of suitable construction materials for building water proofing. 05. Able to apply theoretical and practical knowledge to best smart and intelligent material for various types of buildings. 06. Capacity of using relevant test for selecting modern construction materials.							

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

Special Concretes

Concretes, Behaviour of concretes - High Strength and High Performance Concrete – Fibre Reinforced Concrete, Self compacting concrete, Alternate Materials to concrete. [9]

Metals

Steels - New Alloy Steels – Aluminum and its Products –Coatings to reinforcement – Applications. [9]

Composites

Plastics –Reinforced Polymers – FRP – Applications [9]

Other Materials

Water Proofing Compounds – Non-weathering Materials – Flooring and Facade Materials [9]

Smart and Intelligent Materials

Smart and Intelligent Materials for intelligent buildings - Special features [9]

Total Hours:45

Reference(s) :

1	Santhakumar.A.R. “Concrete Technology”, Oxford University press, New Delhi. 2007.
2	Mamlouk, M.S. and Zaniewski, J.P., “Materials for Civil and Construction Engineers”, Prentice Hall Inc., 1999.
3	Ashby, M.F. and Jones.D.R.H.H. “Engineering Materials 1: An introduction to Properties, applications and designs”, Elsevier Publications, 2005.
4	Shan Somayaji, “Civil Engineering Materials”, Prentice Hall Inc., 2001
5	Aitkens , “High Performance Concrete”, McGraw Hill, 1999
6	Deucher, K.N, Korfiatis, G.P and Ezeldin, A.S, “Materials for civil and Highway Engineers”, Prentice Hall Inc., 1998.
7	Shetty M.S, “Concrete Technology: Theory and Practice”, S.Chand & Company Ltd., 2005.
8	ACI Report 440.2R-02, “Guide for the design and construction of externally bonded RP systems for strengthening concrete structures”, American Concrete Institute, 2002

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E64 - REMOTE SENSING AND GIS FOR HYDROLOGY AND WATER RESOURCES								
M.E. STRUCTURAL ENGINEERING								
Elective VI								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
III	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt 1. The basics of hydrology 2. Various remote sensing and GIS applications in the field of hydrology and water resources.							
Course Outcomes	01. Understand about hydrological cycle and its various stages. 02. Acquired knowledge on remote sensing and GIS techniques effective usage in water resources application oriented data interpretation model creation. 03. Understand the fundamental procedure which are most necessary for water shed management. 04. Familiar to GIS mapping concept through which multiple levels of assessment could be done in the field of natural disasters. 05.Understand about thematic mapping preparation for groundwater related GIS analysis of spatial and temporal distribution. 06.Knowledge on effective management over the surface groundwater by creating model and artificial groundwater recharge structures.							

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

Basics of Hydrology

Hydrological cycle – estimation of various components of hydrology cycle – clouds –rainfall – runoff – evaporation – transpiration – evapo–transpiration – interception – depression storage – spectral properties of water – GIS application in surface water modeling – case studies. [9]

Drainage Basin

Watershed divide – stream networks – Delineation and codification of watersheds morphometric analysis – linear – areal – relief aspects – Rainfall- runoff modeling – urbanhydrology – case studies. [9]

Areal Assessment

Mapping of snow covered area – snow melt runoff – flood forecasting, risk mapping and flood damage assessment soil moisture area – drought forecasting and damage assessment – GIS application in aerial assessment – case studies [9]

Ground Water and Water Quality

Ground water prospects – surface water indicators – vegetation , geology, soil aquifer – aquifer parameters – well hydraulics – estimation of ground water potential – hydrologic budgeting – mathematical models – GIS application in ground water modeling – study on sea water intrusion – modeling of sea water intrusion – water quality parameters – physical, chemical, biological properties. Water quality mapping and monitoring – correlation model for pollution detection and suspended sediment concentration– case studies. [9]

Irrigation and Watershed Management

Project investigation, implementation, maintenance stage- location of storage/ diversion works – canal alignment –depth-area capacity curve generation, - conjunctive use of surface and ground water – Mapping and monitoring the catchment command area – artificial recharge of groundwater – water harvesting structures – sediment yield – modeling of reservoir siltation – prioritization of watershed –modeling of sustainable development – Development of information system for Natural resource management – case studies. [9]

Total Hours:45

Reference(s) :

1	Eric C. Barrett, Clare H.Power, “Satellite Remote Sensing for Hydrology and Water Management”, gordon @ Breach Science publications, Newyork 1990.
2	David Maidment, Dean Djokic, “Hydrologic and Hydraulic Modeling Support with Geographic Information Systems”, Esri Press 2000,
3	Wilfried Brutsaert, “Hydrology: An Introduction”, Cambridge University Press, 2005.
4	Andy D. Ward and Stanley W. Trimble, “Environmental Hydrology”, Lewis Publishers, 2004.
5	Shamsi U.M., “GIS Applications for Water, Wastewater”, and Stormwater Systems,CRC; 2005.

K.S.Rangasamy College of Technology - Autonomous R2018								
50 PSE E65 - PRINCIPLES AND DESIGN OF PHYSICO-CHEMICAL TREATMENT SYSTEMS								
M.E. STRUCTURAL ENGINEERING								
Elective VI								
Semester	**Hours / Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
III	3	0	0	45	3	50	50	100
Objective(s)	At the end of the course the student is expected to have learnt 1. The working principles and design of various physical and chemical treatment systems for water and wastewater. 2. Design of municipal water treatment plant							
Course Outcomes	01.Know about pollutant in water and wastewater 02.Able to develop conceptual schematics required for the physical treatment of water and wastewater 03.Ability to create the principles and applications of chemical treatment 04.Formulate the preliminary design of municipal water treatment plant 05.To gain knowledge about design of wastewater treatment plant							

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

Classification of Pollutants

Pollutants in water and wastewater – characteristics, Standards for performance Significance of physico-chemical treatment – Selection criteria-types of reactor- reactor selection-batch-continuous type-kinetics [9]

Physical Treatment Principles

Principles of Screening – Mixing, Equalization – Sedimentation – Filtration – Modeling back washing – Evaporation – Incineration – gas transfer – mass transfer coefficient Adsorption – Isotherms – Principles, kinetics, regeneration membrane separation, Reverse Osmosis, nano filtration, ultra filtration and hyper filtration electrodialysis, distillation – stripping and crystallization – Recent Advances. [9]

Chemical Treatment Principles

Principles of Chemical treatment – Coagulation flocculation – Precipitation – flotation solidification and stabilization – Disinfection, Ion exchange, Electrolytic methods, Solvent extraction – advanced oxidation /reduction – Recent Trends [9]

Design of Municipal Water Treatment Plant

Selection of Treatment – Design of municipal water treatment plant units – Aerators – chemical feeding – Flocculation – clarifies – tube settling – filters – Rapid sand filters slow sand filter, pressure filter, Dual media inlets Displacement and gaseous type. Design of Industrial Water Treatment Units- Selection of process – Design of softeners – Demineralisers – Reverse osmosis plants –flow charts – Layouts –Hydraulic Profile PID construction and O&M aspects – case studies, Residue management – Upgradation of existing plants – Recent Trends – Software application. [9]

Design of Wastewater Treatment Plants

Design of municipal wastewater treatment units-screens-detritors-grit chamber-settling tanks-sludge thickening-sludge dewatering systems-sludge drying beds - Design of Industrial Wastewater Treatment Units-Equalization- Neutralization-Chemical Feeding Devices-mixers-floatation units-oil skimmer- flow charts – Layouts –Hydraulic Profile PID construction and O&M aspects – case studies, Residue management – Upgradation of existing plants – Recent Trends – Software application. [9]

Total Hours:45

Text book (s) :

1	Metcalf and Eddy, “Wastewater Engineering”, Treatment and Reuse, Tata McGraw Hill, New Delhi, 2003.

Reference(s) :

1	Qasim, S.R., Motley, E.M. and Zhu.G. “Water works Engineering – Planning, Design and Operation”, Prentice Hall, New Delhi, 2002.
2	Lee, C.C. and Shun dar Lin, “Handbook of Environmental Engineering Calculations”, Mc Graw Hill, Newyork, 1999.
3	Hendricks, D. ‘Water Treatment Unit Processes – Physical and Chemical’ CRC Press, Newyork, 2006.

K.S.Rangasamy College of Technology - Autonomous R2018

50 PSE E66 - DESIGN OF WATER AND WASTEWATER RETAINING STRUCTURES

M.E. STRUCTURAL ENGINEERING

Elective VI

Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	50	50	100

Objective(s)	At the end of the course the student is expected to have learnt 1.Structural design of different types of pipes, advanced methods in pipe manufacturing, analysis and design of different types of water tanks 2. Design of underground water, storage structures, materials for construction of water tanks, repair and rehabilitation of water storage structures.
Course Outcomes	01. Execute the structural design of concrete and steel pipes required in Water and wastewater transportation. 02. Analyze the water tank structures with roofing systems. 03. Design the water retaining structures as per IS code provisions. 04. Identify the materials and design the special purpose structures. 05. Plan and design water and wastewater treatment plants including CETPs. 06. Assess the repairs and demonstrate the rehabilitation process for treatment plant structures.

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

Design of Pipes

Structural design of a) Concrete b) prestressed concrete c) steel and d) cast iron piping mains, sewage tanks design- anchorage for pipes- massive outfalls-structural design and laying hydrodynamic considerations. Advance in the manufacture of pipes [9]

Analysis and Design of Water Tanks

Analysis of a concrete roofing systems a)Cylindrical b)Spherical and c)conical shapes using membrane theory and design of various types of folded plates for roofing with concrete. IS Codes for the design of water retaining structures. Design of circular, rectangular, spherical and intze type of tanks using concrete. (excluding staging; underground overhead tank) Design of prestressed concrete cylindrical tanks - Economic analysis. [9]

Design of Special Purpose Structures

Under ground reservoirs and swimming pools, intake towers, Structural design including foundation for water retaining structures such as settling tanks, clarifloculators, aeration tanks etc., - effect of earth pressure and uplift considerations- selection of materials for construction [9]

Design of Treatment Plant Structures

Guidelines for Planning and Designing of Water and Wastewater Treatment Plants – Basic Processes of Water Treatment - Process design of water treatment plant – Filtration units – water treatment structures for Rural supplies – Waste water treatment structures – Advanced Wastewater Treatments - Design of Common Effluent Treatment Plant (CETP) – Design of UASB [9]

Repair and Rehabilitation of Structures

Diagnosing the cause and damage, identification of different types of structural and non-structural cracks- repair and rehabilitation methods for masonry, concrete and steel structures. Exposure on steel, lattice structures used in water and sewage Works [9]

Total Hours:45

Text book (s) :

1. Karia G.L and Christian R.A., “Wastewater Treatment concepts and Design Approach”, PHI Learing Pvt Ltd., New Delhi, 2009.
2. Metcalf and Eddy, “Waste Water Engineering – Treatment and reuse”, Tata McGraw-Hill, New Delhi, 2003.

Reference(s) :

1. Krishna Raju, “Prestressed Concrete”, Tata MCGraw Hill Publishing Co., 2004.
2. Ramaswamy, G.S., “Design and construction of concrete Shell Roofs” CBS Publishers, India, 1999.
3. Green, J.K., and Perkins, P.H., “Concrete Liquid Retaining Structures”, Applied Science Publishers, 1981.

K.S.Rangasamy College of Technology – Autonomous R2018								
50 AT 001 ENGLISH FOR RESEARCH PAPER WRITING								
Common to all Branches								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I/II	2	0	0	30	-	50	-	-
Objectives	**Students will be able to:** 1. Understand that how to improve your writing skills and level of readability 2. Learn about what to write in each section 3.Understand the skills needed when writing a Title							
Course Outcomes	**Students will be able to:** Gain an introductory knowledge of the some of the issues explored in influential works of the English-language tradition, and of some of the stylistic strategies writers have used to explore those issues. Read complex texts actively: recognize key passages; raise questions; appreciate complexity and ambiguity; comprehend the literal and figurative uses of language.							

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

3Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Text book:

1	Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2	Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3	Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4	Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

K.S. Rangasamy College of Technology – Autonomous R 2018								
50 AT 002 DISASTER MANAGEMENT								
Common to all Branches								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I/II	2	0	0	30	-	50	-	-

Objectives	**Students will be able to:** 1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response. 2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives. 3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations. 4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in
Course Outcomes	**Students will be able to:** • Understand the various hazards • Analyze the situation during hazards and take necessary steps for protection • Know the risks involved in natural disaster • Apply the knowledge of risk assessment and protect the public • Create awareness about disaster and its management techniques among public

Introduction

Disaster: Definition, Factors And Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Repercussions of Disasters and Hazards:

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks of Disease And Epidemics, War And Conflicts.

Disaster Prone Areas in India

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides and Avalanches; Areas Prone to Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

Disaster Preparedness and Management

Preparedness: Monitoring of Phenomena Triggering A Disaster Or Hazard; Evaluation of Risk: Application of Remote Sensing, Data From Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

Risk Assessment

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.

Disaster Mitigation

Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

Text book:

1	R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2	Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3	Goel S. L., Disaster Administration And Management Text And Case Studies",Deep &Deep Publication Pvt. Ltd., New Delhi.

Reference(s):

1	Damon Coppola, **Introduction to International Disaster Management 3rd Edition,** Butterworth-Heinemann , **Published Date:** 28th January 2015.

K.S.Rangasamy College of Technology – Autonomous R2018								
50 AT 003 - SANSKRIT FOR TECHNICAL KNOWLEDGE								
Common to all Branches								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I/II	2	0	0	30	-	50	-	-
Objective(s)	• To get a working knowledge in illustrious Sanskrit, the scientific language in the world. • To improve brain functioning • To develop the logic in mathematics, science & other subjects enhancing the memory power • To explore the huge knowledge from ancient literature							
Course Outcomes	**At the end of the course, the students will be able to** 1. Understanding basic Sanskrit language. 2. Understood an ancient Sanskrit literature about science & technology. 3. Develop logical skill among the group.							

Basics of Sanskrit
Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Sanskrit Literature
Order, Introduction of roots, Technical information about Sanskrit Literature.

Technical Concepts in Engineering
Technical concepts of Engineering-Electrical, Mechanical,Architecture, Mathematics.

Text book (s) :

1	Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi.
2	"Teach Yourself Sanskrit" PrathamaDeeksha-VempatiKutumbshastri, Rashtriya SanskritSansthanam, New Delhi Publication.

Reference(s) :

1	India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

K.S.Rangasamy College of Technology – Autonomous R2018								
50 AT 004 VALUE EDUCATION								
Common to all Branches								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I/II	2	0	0	30	-	50	-	-
Objectives	• Understand value of education and self- development • Imbibe good values in students • Let the should know about the importance of character							
Course Outcomes	**Students will be able to:** 1. Knowledge of self-development 2. Learn the importance of Human values 3. Developing the overall personality							

- Values and self-development –Social values and individual attitudes. Work ethics, Indian
- vision of humanism.
- Moral and non- moral valuation. Standards and principles.
- Value judgements

- Importance of cultivation of values.
- Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness.
- Honesty, Humanity. Power of faith, National Unity.
- Patriotism. Love for nature, Discipline

- Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking.
- Integrity and discipline.
- Punctuality, Love and Kindness.
- Avoid fault Thinking.
- Free from anger, Dignity of labour.
- Universal brotherhood and religious tolerance.
- True friendship.
- Happiness Vs suffering, love for truth.
- Aware of self-destructive habits.
- Association and Cooperation.
- Doing best for saving nature

- Character and Competence –Holy books vs Blind faith.
- Self-management and Good health.
- Science of reincarnation.
- Equality, Non violence, Humility, Role of Women.
- All religions and same message.
- Mind your Mind, Self-control.
- Honesty, Studying effectively

Text book:

1	1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

K.S.Rangasamy College of Technology – Autonomous R2018								
50 AT 005 PEDAGOGY STUDIES								
Common to all Branches								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I/II	2	0	0	30	-	50	-	-
Objectives	• Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers. • Identify critical evidence gaps to guide the development.							
Course Outcomes	**Students will be able to:** 1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries? 2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners? 3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?							

- **Introduction and Methodology:**
- Aims and rationale, Policy background, Conceptual framework and terminology
- Theories of learning, Curriculum, Teacher education.
- Conceptual framework, Research questions**.**
- Overview of methodology and Searching.
- Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.
- Curriculum, Teacher education.
- Evidence on the effectiveness of pedagogical practices
- Methodology for the in depth stage: quality assessment of included studies.
- How can teacher education (curriculum and practicum) and the school curriculum and
- guidance materials best support effective pedagogy?
- Theory of change.
- Strength and nature of the body of evidence for effective pedagogical practices.
- Pedagogic theory and pedagogical approaches.
- Teachers' attitudes and beliefs and Pedagogic strategies.
- Professional development: alignment with classroom practices and follow-up support
- Peer support
- Support from the head teacher and the community.
- Curriculum and assessment
- Barriers to learning: limited resources and large class sizes
- **Research gaps and future directions**
- Research design
- Contexts
- Pedagogy
- Teacher education
- Curriculum and assessment
- Dissemination and research impact.

Text book:

1	Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2):245-261.
2	Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal ofCurriculum Studies, 36 (3): 361-379.
3	Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4	Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5	Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6	Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7	www.pratham.org/images/resource%20working%20paper%202.pdf.

K.S.Rangasamy College of Technology – Autonomous R2018								
50 AT 006 - STRESS MANAGEMENT BY YOGA								
Common to all Branches								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I/II	2	0	0	30	-	50	-	-
Objective(s)	• To achieve overall health of body and mind. • To overcome stress.							
Course Outcomes	**At the end of the course, the students will be able to** 1. Develop healthy mind in a healthy body thus improving social health also 2. Improve efficiency							

1. Definitions of Eight parts of yoga. (Ashtanga)

2. Yam and Niyam.

Do`s and Don't's in life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha

ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

3. Asan and Pranayam

i) Various yog poses and their benefits for mind & body

ii) Regularization of breathing techniques and its effects-Types of pranayam

Reference(s) :

1	Yogic Asanas for Group Training-Part-I", Janardan Swami YogabhyasiMandal, Nagpur.
2	"Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama(Publication Department), Kolkata.

K.S.Rangasamy College of Technology – Autonomous R2018								
50 AT 007 - PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS								
Common to all Branches								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I/II	2	0	0	30	-	50	-	-
Objective(s)	• To learn to achieve the highest goal happily. • To become a person with stable mind, pleasing personality and determination. • To awaken wisdom in students.							
Course Outcomes	**At the end of the course, the students will be able to** 1. Develop versatile personality. 2. Achieve the highest goal in life by developing personality. 3. Lead the nation and mankind to peace and prosperity.							

Neetisatakam -Holistic development of personality

Verses- 19,20,21,22 (wisdom)
Verses- 29,31,32 (pride & heroism)
Verses- 26,28,63,65 (virtue)
Verses- 52,53,59 (dont's)
Verses- 71,73,75,78 (do's)

Approach to day to day work and duties.
ShrimadBhagwadGeeta : Chapter 2-Verses 41, 47,48,
Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
Chapter 18-Verses 45, 46, 48.

Statements of basic knowledge.
ShrimadBhagwadGeeta: Chapter2-Verses 56, 62, 68
Chapter 12 -Verses 13, 14, 15, 16,17, 18
Personality of Role model. ShrimadBhagwadGeeta:
Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
Chapter 4-Verses 18, 38,39
Chapter18 – Verses 37,38,63

Reference(s) :

1	"Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (PublicationDepartment), Kolkata
2	Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath,Rashtriya SanskritSansthanam, New Delhi.

K.S.Rangasamy College of Technology – Autonomous R2018								
50 AT 008 - CONSTITUTION OF INDIA								
Common to all Branches								
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
I/II	2	0	0	30	-	50	-	-

Objective(s)	• 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 of nationhood in the early years of Indian nationalism. • To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.
Course Outcomes	**At the end of the course, the students will be able to** 1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics. 2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India. 3. 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. 4. Discuss the passage of the Hindu Code Bill of 1956.

History of Making of the Indian Constitution:
History - Drafting Committee, (Composition & Working)
Philosophy of the Indian Constitution:
Preamble - Salient Features
Contours of Constitutional Rights & Duties:
Fundamental Rights - Right to Equality - Right to Freedom - Right against Exploitation -Right to Freedom of Religion - Cultural and Educational Rights - Right to Constitutional Remedies - Directive Principles of State Policy - Fundamental Duties.
Organs of Governance:
Parliament - Composition - Qualifications and Disqualifications - Powers and Functions Executive - President - Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions.
Local Administration:
District's Administration head: Role and Importance, - Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation - Pachayati raj: Introduction, PRI: Zila Pachayat - Elected officials and their roles, CEO Zila Pachayat: Position and role- Block level: Organizational Hierarchy (Different departments) -Village level: Role of Elected and Appointed officials - Importance of grass root democracy.
Election Commission:
Election Commission: Role and Functioning- Chief Election Commissioner and Election Commissioners- State Election Commission: Role and Functioning- Institute and Bodies for the welfare of SC/ST/OBC and women.

Reference(s) :	
1	The Constitution of India, 1950 (Bare Act), Government Publication
2	Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3	M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
Reference(s):	
1	D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.