ROYAL GLOBAL UNIVERSITY
GUWAHATI

ROYAL SCHOOL OF ENGINEERING & TECHNOLOGY (RSET)

SYLLABUS
&
COURSE STRUCTURE

M. TECH. (CE)

Specialisation: Structural Engineering

Scheme of Evaluation

Theory Papers (T):

- **Continuous Evaluation: 15%** (Assignment, Class Test, Viva, Seminar, Quiz: Any Three)
- **Mid-term examination:** 10%
- **Attendance: 5%**
- **End Term Examination:** 70%

Practical Papers (P):

- **Continuous Evaluation: 25%** (Skill Test, lab copy, viva, lab involvement: Any Three)
- **Attendance: 5**%
- **End term examination:** 70 %

Combined Theory & Practical Papers (TP):

- **Continuous Evaluation: 15%** (Assignment. Class Test, Lab Experiment, Lab Copy, Viva: Any Three)
- **Mid-term examination:** 10%
- **Attendance: 5%**
- **End term examination:** 70 %

Table of Contents –

1. Introduction

Structural engineering is a sub-discipline of Civil engineering in which structural engineers are trained to design the "bones and muscles" that create the form and shape of man-made structures. Structural engineering is a professional discipline that deals with the calculation of stability, strength, rigidity and earthquake resistivity of a structure. The structural designs are integrated with other design plans of architecture and other building service engineering. Structural engineering is intimately associated with the private and public sectors, including the individual homeowners and international enterprises. Structural engineering is a discipline that spans both in theory and practice and it requires thinking both in abstract and in concrete terms. The function of structural engineering commences with the start of the day when we take a shower, as the primary step in a project execution is the design and detailing of the project. The network of roads on which we drive while proceeding to school or work, the huge structural bridges we come across and the tall buildings where we work, all have been designed by structural engineers. Even the benefits of electricity we use are available to us through the contribution of structural engineers who will analyze the stability and rigidity of the proposed towers and prepare a structural drawing of the tower for transmission lines. In fact, no sphere of life may be identified that does not include the contribution of structural engineering. Thus, the importance of structural engineering may be determined according to its usefulness in our daily life

The shifting of focus from teacher centric to learner centric has been the main focus of new education policy framed by Government. With this moto, UGC has recommended to frame the course curriculum for UG and PG focusing on learning outcomes- based curriculum framework (LOCF). The learning outcomes-based curriculum framework for M. Tech. in Structural Engineering is prepared keeping focus on learner centric curriculum. The present framework aims to provide a student with knowledge and skills in subject-specific and generic field including transferable global skills and competencies which help in personal development and prepare students for further study in the global world to enhance the chances of employability. This framework would certainly encourage students to involve in discussions, problem-solving and out of box thinking about various concepts of mathematics and their applicability to solve real world problems, which may lead to empowerment and enhancement of the social welfare at large.

2. Learning Outcomes based approach to Curriculum Planning

The Course Curriculum for Master's Degree in Structural Engineering for the postgraduate students are to attain skills and knowledge require for employment. Framing and implementation of curricula and syllabi is envisaged to provide an understanding of the basic connection between theory and experiment and its importance in understanding the foundation of computing. This is very critical in developing a scientific temperament and to venture a career which a wide spectrum of applications as well as theoretical investigations. The curriculum provides students with theoretical foundations and practical experience in engineering. The course learning outcomes are aimed at facilitating the learners to acquire knowledge, skills understanding, values, attributes, and academic standards. A student is awarded with M. Tech in Structural Engineering on the basis of the attainment of these outcomes at the end of the programme.

Nature and extent of the M. Tech. in Structural Engineering

M.Tech. in Structural engineering is a two-year degree program which develops advanced theoretical and research skills in the field of structural engineering. This programme helps in building an advanced professional or academic career. M. Tech SE follows CBCS structure as mandated by UGC. In accordance with CBCS guidelines the courses are categorized into compulsory courses, elective courses, ability enhancement courses. These categories of courses are discussed later on.

Aims of Master's Program in Structural Engineering

The main aim of this Master's degree is to deliver a modern curriculum that will equip graduates with strong theoretical and practical backgrounds to enable them to excel in the workplace and to be lifelong learners. The purpose of this program in structural engineering is twofold:
(1) To prepare the student for a position involved in analysis, design, implementation and skillful execution of structural engineering knowledge in practical solutions.
(2) To prepare the student for entry to research and innovation in Structural Engineering.

3. Learner's Attributes

Learner's Attributes (LA) are the qualities, skills and understandings that students should develop during their time with the HEI. These are qualities that also prepare graduates as agents of social good in future. Graduate Attributes can be viewed as qualities in following subcategories.

- Knowledge of the Discipline
- Creativity
- Intellectual Rigor
- Problem Solving and Design
- Ethical Practices
- Lifelong Learning
- Communication and Social Skills

Among these attributes, categories attributes under Knowledge of the Discipline are specific to a programme of study.

Knowledge of Discipline of Structural Engineering

Knowledge of a discipline is defined as "command of a discipline to enable a smooth transition and contribution to professional and community settings. This Learner's Attribute describes the capability of demonstrating comprehensive and considered knowledge of Structural Engineering. It enables students to evaluate and utilize information and apply their knowledge and their professional skills in the workplace.

Creativity

Creativity is a skill that underpins most activities likewise in the context of construction sector. Students are required to apply innovative and reflective thinking to optimize the construction cost coupled with increased safety and efficiency. Students are encouraged to look at the design issues from safety and economy point of view through differing and novel perspectives. Creativity allows

the possibility of a powerful shift in outlook and enables students to be open to thinking about different concepts and ideas.

Intellectual Consistency

Intellectual consistency is the commitment to excellence in all scholarly and intellectual activities, including critical judgment. The students are expected in having clarity in thinking. This capability involves engaging constructively and methodically when exploring ideas, theories, and philosophies. It also relates to the ability to analyses and construct knowledge with depth, insight, and intellectual maturity.

Problem Solving and Design

Problem solving skills empower students not only within the context of their programmers, but also in their personal and professional lives. Many employers cite good problem-solving skills as a desired attribute that they would like graduates to bring to the workplace. With an ability to seek out and identify problems, effective problem solvers are able to actively engage with a situation, think creatively, to consider different perspectives to address identified challenge, to try out possible solutions and subsequently evaluate results as a way to make decisions. Through this process they can consolidate new and emergent knowledge and develop a deeper understanding of their subject discipline.

Ethical Practices

Ethical practice is a key component of professionalism and needs to be instilled in curricula across courses. When operating ethically, graduates are aware that we live in a diverse society with many competing points of view. Ethical behavior involves tolerance and responsibility. It includes being open-minded about cultural diversity, linguistic difference, and the complex nature of our world. It also means behaving appropriately towards colleagues and the community and being sensitive to local and global social justice issues.

Life-Long Learning

The skill of being a lifelong learner means a graduate is open, curious, willing to investigate, and consider new knowledge and ways of thinking. This flexibility of mind means they are always amenable to new ideas and actively seek out new ways of learning or understanding the world.

Communication and Social Skills

The ability to communicate clearly and to work well in a team setting is critical to sustained and successful employment. Good communication skill is necessary to convey different technical aspects of projects clearly and precisely. And social skills involve the ability to listen to, as well as clearly express, information back to others in a variety of ways - oral, written, and visual - using a range of technologies.

4. Qualification Descriptor

Qualification descriptors are generic statements of the outcomes of study. Qualification descriptors are a statement of outcomes, achievement of which a student should be able to demonstrate for the award of the M. Tech Structural Engineering Degree. It also states different capabilities a student could be expected to have developed which will be of assistance to employers and others with an interest in the general capabilities of holders of the qualification.

- A systematic, extensive and coherent knowledge and understanding of Structural Engineering as a whole and its applications, and links to related disciplinary areas; including a critical understanding of the established theories, principles and concepts, and of a number of recent, advanced and emerging issues in the domain of Structural Engineering.
- Procedural knowledge that creates different types of professionals related to Structural Engineering, including research and development, teaching industry and government and public service.
- Skills in areas related to the broad domain of structural engineering and usage of tools and current developments, including a critical understanding of the latest developments in the area, and an ability to use established techniques of analysis and enquiry within the desired area.
- Demonstrate comprehensive knowledge, including current research, scholarly, and/or professional literature, relating to essential and advanced learning areas pertaining to the chosen disciplinary areas (s) and field of study, and techniques and skills required for identifying problems and issues relating to the disciplinary area and field of study.
- Demonstrate skills in identifying information needs, collection of relevant quantitative and/or qualitative data drawing on a wide range of sources, effective analysis, and interpretation of data.
- Use knowledge, understanding and skills for critical assessment of a wide range of ideas and complex problems and issues relating to the chosen field of study.
- Communicate the results of studies accurately in a range of different contexts using the main concepts, constructs, and techniques of the subject(s) of study.
- Apply structural engineering related knowledge and skills to identify and analyze problems and issues and seek solutions to real-life problems.

5. Programme Learning Outcomes

These outcomes describe what students are expected to know and be able to do by the time of post-graduation. They relate to the skills, knowledge, and behaviors that students acquire in their graduation through the program**.** The Master's Degree in Structural Engineering program enables students to attain, by the time of graduation are as follows:

- Ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- Ability to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions.
- Understand, analyze and design sub-structures and superstructures for residential and public buildings, industrial structures, powerhouses, docks and harbors.
- Focus on improving performance of structures with reference to safety & serviceability and sustainable green building technology.
- Make use of advanced software for creating modern avenues to succeed as an entrepreneur or to pursue higher studies.
- Ability to formulate, to model, to design solutions, procedure and to use software tools to solve real world problems and evaluate.

6. Programme Structure: M. Tech. in Structural Engineering

Programme Structure

1st semester							
S. N	**Subject Code**	**Names of subjects**	**L**	**T**	**P**	**C**	**TCP**
Core Courses (CC)							
1	CEE024C10S1	Advanced Structural Analysis	3	1	0	4	4
2	CEE024C10S2	Advanced Design of Reinforced Cement Concrete	3	1	0	4	4
3	CEE024C10S3	Analytical & Numerical Methods for Structural Engineering	3	1	0	4	4
4	CEE024C10S4	Modern Construction Technology	3	1	0	4	4
5	CEE024C10S5	Geotechnical Earthquake Engineering	3	1	0	4	4
6	CEE024C10S6	Research Methodology & IPR	2	0	0	2	2
7	CEE024C11S7	Structural Design Lab	0	0	4	2	4
8	CEE024C13S8	Seminar-I	0	0	2	2	2
Department Specific Elective (DSE)							
Ability Enhancement Elective Courses (AEEC)							
Ability Enhancement Compulsory Courses (AECC)							
9	CEN984A101	Communicative English-I	1	0	0	1	1
10	BHS982A104	Behavioral Science-I	1	0	0	1	1
		TOTAL	**19**	**5**	**6**	**28**	**30**

2nd semester							
SN	**Subject Code**	**Names of subjects**	**L**	**T**	**P**	**C**	**TCP**
Core Courses (CC)							
1	CEE024C20S1	FEM in Structural Engineering	3	1	0	4	4
2	CEE024C20S2	Structural Dynamics	3	1	0	4	4
3	CEE024C20S3	Advanced Design of Metal Structures	3	1	0	4	4
4	CEE024C20S4	Advanced Solid Mechanics	3	1	0	4	4
5	CEE024C20S5	Advanced Concrete Technology	3	0	0	3	3
6	CEE024C21S6	Advanced Concrete Technology Lab	0	0	2	1	2
7	CEE024C23S7	Seminar-II	0	0	2	2	2
Department Specific Elective (DSE)							
8	CEE024D20S1	Elective-I	4	0	0	4	4
Ability Enhancement Elective Courses (AEEC)							
9	CEE024S20S1	Disaster Management	2	0	0	2	2
Ability Enhancement Compulsory Courses (AECC)							
10	BHS982A204	Behavioral Science-II	1	0	0	1	1
11	CEN984A201	Communicative English-II	1	0	0	1	1
		TOTAL	**23**	**4**	**4**	**30**	**31**

3rd semester							
SN	**Subject Code**	**Names of subjects**	**L**	**T**	**P**	**C**	**TCP**
Core Courses (CC)							
1	CEE024C30S1	Construction Project Management	3	1	0	4	4
2	CEE024C32S2	Dissertation (Phase-I) & Presentation	0	0	24	12	24
3	CEE024C33S3	Summer Training (At the end of Sem-II)	0	0	0	1	0
Department Specific Elective (DSE)							
4	CEE024D30S1	Elective-II	4	0	0	4	4
Ability Enhancement Elective Courses (AEEC)							
5	CEE024S30S1	Forensic, Rehabilitation and Structural Health Monitoring	2	0	0	2	2
Ability Enhancement Compulsory Courses (AECC)							
7	CEN982A301	Communicative English-III	1	0	0	1	1
		TOTAL	**10**	**1**	**24**	**24**	**35**

4th semester							
SN	**Subject Code**	**Names of subjects**	**L**	**T**	**P**	**C**	**TCP**
Core Courses (CC)							
1	CEE024C42S1	Dissertation (Phase-II) & Presentation	0	0	36	18	36
2	CEE024C42S2	Publication of Technical Papers	0	0	0	1	0
Department Specific Elective (DSE)							
Ability Enhancement Elective Courses (AEEC)							
Ability Enhancement Compulsory Courses (AECC)							
5	CEN948A401	Communicative English-IV	1	0	0	1	1
		TOTAL	**1**	**0**	**36**	**20**	**37**

SEMESTER	CREDITS
I	**28**
II	**30**
III	**24**
IV	**20**

TOTAL CREDITS = 102

LIST OF DEPARTMENT SPECIFIC ELECTIVES			
Elective No	**Sl. No**	**Subject Code**	**Name of the Elective**
I	1	CEE024D20S1	Design of High Rise Structures
	2	CEE024D20S2	Design of Masonry Structures
II	1	CEE024D30S1	Design of Prestressed Concrete Structures
	2	CEE024D30S2	Plates, Shells and Composites

SUBJECTS UNDER AEEC			
AEEC No	**Sl. No**	**Subject Code**	**Name of the Elective**
I	1	CEE024S20S1	Disaster Management
II	2	CEE024S30S1	Forensic, Rehabilitation and Structural Health Monitoring

*****The list of Electives may vary from the following depending upon the recent trends, availability of faculty, resources, etc.**

SYLLABUS (1st SEMESTER)

Paper I: Advanced Structural Analysis		**Subject Code: CEE024C10S1**
L-T-P-C – 3-1-0-4	**Credit Units: 04**	**Scheme of Evaluation: T**

Objectives:

The objectives of the course are:

- The main objective is to enable the student to have a good grasp of all the fundamental issues in these advanced topics in structural analysis, besides enjoying the learning process, and developing analytical and intuitive skills.
- To impart concepts of advanced structural analysis
- To make the students learn the various concepts related to the development of structural analysis
- To make the students be able to understand the functioning of the software's which are based on the matrix concept of structural analysis

Module	Content	Hrs	Marks
I	**Influence Coefficients:** Physical Significance, Effects of Settlements, Temperature Change and Lack of Fit, Member Approach and Structure Approach. **Stiffness Method applied to Large Frames:** Local Coordinates and Global Co-ordinates.	**11**	**25**
II	**Stiffness Matrix Assembly of Structures:** Stiffness Matrix in Global Coordinates, Boundary Conditions, Solution of Stiffness Matrix Equations, Calculation of Reactions and Member Forces. **Applications to Simple Problems:** Beams, Plane Trusses, Plane Rigid Jointed Frames and Grids by Structure Approach and Member Approach.	**13**	**25**
III	**Boundary Value Problems** (BVP): Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional BVP, Matrix Formulation of the Modified Galerkin Method.	**11**	**25**
IV	**Linear Element:** Shape Functions, Solution for Poisson's Equation, General One Dimensional Equilibrium Problem.	**10**	**25**
	Total	**45**	**100**

Text Book:

1. *Matrix Analysis of Framed Structure*s, Weaver and Gere.

Reference Books:

1. Lewis P. E. and WardJ. P, *The Finite Element Method,* Addison-Wesley Publication Co.
2. Meek J. L., E and FN, *Computer Methods in Structural Analysis,* Span Publication.
3. Desai and Able, *The Finite Element Method*, CBS Publication.

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. Analyze the skeleton structures using stiffness analysis code. 2. Use direct stiffness and flexibility method understanding its limitations and area of application	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ❙❙ Assignments ❙❙ Class tests. ❙❙ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-II: Advanced Design of Reinforced Cement Concrete		Subject Code: CEE024C10S2
L-T-P-C – 3-1-0-4	Credit Units: 04	Scheme of Evaluation: T

Objectives:

The objectives of the course are:

- To introduce the student to the fundamentals of Structural design practiced in industrial field.
- The topics in the module will help the students to learn the basic as well as advanced design techniques used nowadays.

Prerequisites: Design of Structures, Structural Analysis, Concrete Technology

Modules	Topics/Course content	Hours	Marks
I	**Introduction**: Different methods of design of reinforced concrete structures Working stress method, Limit State Method, Limit state of collapse – flexure. **Design of beam**: Design of singly reinforced beam, Design of doubly reinforced beam, Limit state of collapse – shear, Design for shear, Limit state of serviceability	**10**	**25**
II	**Design of slab**: One-way slab, Two-way slab, Flat slab, Continuous slab, Circular slab.	**07**	**25**
III	**Design of Columns**: Design of compression members under axial, uniaxial and biaxial loading, Stress block parameters, Ultimate load, Eccentricity curve, Interaction diagram. **Design of staircase**: Function of stair cases, Classification of stairs, Risers, Winders, Landing, Nosing, Design of stairs spanning horizontally and longitudinally.	**12**	**25**
IV	**Design Retaining Walls**: Function of retaining wall, Classification, Stability conditions, Design principles, Design of different retaining walls. **Design of Footing**: General principles of design, Isolated footing, Combined footing. **Design of Shear Walls:** Design principles.	**16**	**25**
	Total	**45**	**100**

Text Books:

1. Ramamrutham S., Design of Reinforced Concrete Structures, Dhanpat Rai Publishing Company Ltd,2007.

Reference Books:

2. Krishnaraju N., Design of RCC, CBS publishers.

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. Mechanically design the different structural members as per Bureau of Indian Standard. 2. Understand basics about design philosophy used in industrial field.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ❙❙ Assignments ❙❙ Class tests. ❙❙ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-III: Analytical & Numerical Methods for Structural Engineering		Subject Code: CEE024C10S3
L-T-P-C – 3-1-0-4	Credit Units: 04	Scheme of Evaluation: T

Objectives:

The objectives of the course are:

- To impart knowledge to solve ordinary and partial differential equations in structural mechanics using numerical methods.

Module	Content	Hrs.	Marks
I	**Fundamentals of Numerical Methods:** Error Analysis, Polynomial Approximations and Interpolations, **Curve Fitting;** Interpolation and extrapolation.	11	25
II	**Solution of Non-linear Algebraic and Transcendental Equations** **Elements of Matrix Algebra**: Solution of Systems of Linear Equations, Eigen Value Problems.	10	25
III	**Numerical Differentiation & Integration:** Solution of Ordinary and Partial Differential Equations.	12	25
IV	**Finite Difference scheme**: Implicit & Explicit scheme. **Computer Algorithms:** Numerical Solutions for Different Structural Problems, Fuzzy Logic and Neural Network.	13	25
	Total	45	100

Text Book:

1. *An Introduction to Numerical Analysis,* Atkinson K.E., J. Wiley and Sons, 1989.

Reference:

1. *Theory and Problems of Numerical Analysis*, Scheid F, McGraw Hill Book Company, (Shaum Series),1988.
2. *Introductory Methods of Numerical Analysis*, Sastry S. S, Prentice Hall of India, 1998.

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. ve ordinary and partial differential equations in structural mechanics using numerical methods. 2. Write a program to solve a mathematical problem.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving ispart of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged togive short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks)(i)15 marks on Assignments Class tests, viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5marks (c) End-term examinations: 70 marks.

Paper-IV: Modern Construction Technology		**Subject Code: CEE024C10S4**
L-T-P-C – 3-1-0-4	**Credit Units: 04**	**Scheme of Evaluation: T**

Objective:

The objectives of the course are:

- To knowledge and understanding of modern construction materials, methods, and equipment
- Selection of materials, construction method and designing of construction process

Module	Content	Hrs.	Marks
I	**Construction Equipment and Management:** Identification, selection and planning of equipment, equipment management and maintenance, equipment operating cost and cost control of equipment. Earthwork Equipment- fundamentals of earthwork operations, Types of earthwork equipment; Tunneling- drilling, blasting equipment; Foundation and pile driving equipment; Concrete plants.	**11**	**25**
II	**Substructure Construction:** Box jacking, pipe jacking; Under water construction of basement; Tunneling techniques; piling techniques; Cable anchoring and grouting. **Superstructure Construction**: Vacuums dewatering of concrete flooring; Concrete paving technology; Techniques of construction of continuous concreting operation in tall buildings of various shapes and varying sections; Launching techniques; Suspended formwork; Erection technique of tall structures**.**	**10**	**25**
III	**Construction of Special Structures:** Construction sequence in cooling towers, silos, chimney, sky scrapers; Construction of bow string bridges, cable stayed bridges; Launching and pushing of box decks; Construction sequence and methods in domes; Support structures for heavy equipment and machinery in heavy industries; Erection of articulated structures and space decks.	**12**	**25**
IV	**Rehabilitation and Strengthening Techniques:** Seismic retrofitting; Strengthening of columns, strengthening of slab, Mud jacking and grouting for foundation, micro piling and underpinning for strengthening floor and shallow	**13**	**25**

	profile; Soil stabilization techniques **Demolition and Dismantling:** Demolition techniques- demolition by machines, demolition by explosives, advanced techniques using robotic machines; Safety precautions in demolition and dismantling		
	Total	**45**	**100**

Text Book:

1. *Construction Planning, Equipment and Methods*, Peurifoy R.L., Ledbetter W.B. and Schexnayder C., McGraw Hill, Singapore, 2006
2. *Ground Anchors and Anchored Structures*, Petros P. Xanthakos, A Wiley-Interscience Publication, New York, 1991

Reference:

1. *Concrete repair and maintenance illustrated,* Peter H.E., Galgotia Publications Pvt. Ltd, 2008
2. *Repair of Concrete Structures,* Allen R. T. and Edwards S. C., Blakie and Sons, UK, 1993

Learning Outcomes	**Teaching and Learning Activity**	**Assessment Tasks**
1. Discuss and compare different equipment and construction techniques adopted in the construction of substructures, super-structures, and special structures. 2. Discuss the retrofitting, dismantling and demolition procedures adopted for existing structures	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-V: Geotechnical Earthquake Engineering		Subject Code: CEE024C10S5
L-T-P-C – 3-1-0-4	Credit Units: 04	Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To introduce the student to the fundamentals of soil dynamics giving emphasis on the behaviour of soils under seismic and dynamic loading and on the effect of superficial geology on strong-motion.
- The coursework of the module will enable the student to perform an equivalent-linear site response analysis.

Prerequisites: soil mechanics, structural dynamics**.**

Modules	Topics/Course content	Hours
I	**General Introduction to Geotechnical Earthquake Engineering** **Dynamics of discrete system;** vibrating systems, SDOF systems**,** equation of motion for SDOF system, response of linear SDOF systems, damping, response of nonlinear SDOF system, multiple degree of freedom systems.	**10**
II	**Liquifaction:** Introduction, liquifaction related phenomenon, evaluation of liquifaction hazards, liquifaction susceptibility, initiation of liquifaction, effect of liquifaction.	**10**
III	**Strong Ground Motion:** strong motion measurements, ground motion parameters, estimation of ground motion parameters, seismic hazard analysis.	**10**
IV	**Dynamic soil properties:** measurement of dynamic soil properties, field tests, laboratory tests, stress-strain behaviour of cyclically loaded soils. **Ground response analysis:** 1-D ground response analysis, introduction to soil structure interaction.	**15**
	Total	**45**

Text/Reference Books:

1. Kramer S.L., Geotechnical Earthquake Engineering, Prentice Hall, 1996.
2. Day, R.W., Geotechnical Earthquake Engineering Handbook, McGraw-Hill, 2002.
3. Seco e Pinto, P., Seismic behaviour of ground and Geotechnical structure, A. A. Balkema, 1997.
4. Naeim, F., The Seismic Design Handbook, Kluwer Academic Publication, 2nd Edition, 2001.
5. Bolt, B.A, Earthquakes, W. H. Freeman and Company, 4th Edition, 1999.
6. Lourie, W., Fundamentals of geophysics, Cambridge University press, 1997.
7. Wang J.G.Z.Q and Law, J.K.T., Siting in Earthquake zones, A. A. Balkema, 1994.
8. Ferrito, J.M, Seismic design criteria for soil liquefaction, Tech. Report of Naval Facilities service centre, Port Hueneme, 1997.

Learning Outcomes	**Teaching and Learning Activity**	**Assessment Tasks**
1. Understand the fundamental principles of wave propagation and apply them in engineering examples. 2. Understand basic facts of soil behaviour under dynamic loading. 3. Understand the role of soil deposits in modifying the seismic ground motion. 4. Perform a site response analysis using analytical and numerical approaches. 5. Evaluate the liquefaction potential using a range of simplified methodologies and understand the principles of mitigation measures.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-VI: Research Methodology & IPR		**Subject Code: CEE024C10S6**
L-T-P-C – 2-0-0-2	**Credit Units: 02**	**Scheme of Evaluation: T**

Objective: The main objective is to explain different aspects of research.

Module	Content	Hrs	Marks
I	**Introduction to Research:** 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	**5**	**25**
II	**Research Ethics & Proposals:** Effective literature studies approach, analysis of Plagiarism, Research ethics Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee	**3** **4**	**25**
III	**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.	**6**	**25**
IV	**Patent Rights:** Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. 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.	**2** **4**	**25**
	Total	**24**	**100**

Text Book:

1. "*Research Methodology: A Step by Step Guidefor beginners"* Ranjit Kumar, 2nd Edition.

Reference Books:

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

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. Understand research problem formulation and analyze research related information 2. Follow research ethics 3. Understand that tomorrow's world will be ruled by ideas, concept, and creativity	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-VII: Structural Design Lab		**Subject Code: CEE024C11S7**
L-T-P-C – 0-0-4-2	**Credit Units: 01**	**Scheme of Evaluation: P**

Objectives:

- Design and detailed Drawing of complete G+3 structures by individual student using latest relevant IS codes.

Learning Outcomes	**Teaching and Learning Activity**	**Assessment Tasks**
1. Design and detail all the Structural Components of Frame Buildings. 2. Design and Detail complete Multi-Storey Frame Buildings.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. -voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

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Paper-VIII: Seminar-I		**Subject Code: CEE024C13S8**
L-T-P-C – 0-0-2-2	**Credit Units: 02**	**Scheme of Evaluation: P**

Objectives:

Learning Outcomes	**Teaching and Learning Activity**	**Assessment Tasks**
1.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-IX: Communicative English-I		Subject Code: CEN984A101
L-T-P-C – 1-0-0-1	Credit Units: 01	Scheme of Evaluation: T

Objective: The course is intended to improve the writing skill of students

Modules	Topics/Course content	Hrs.	Marks
I	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	3	25
II	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	4	25
III	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	3	25
IV	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	4	25
		14	100

Text Books:

1. *Writing for Science*, Goldbort R (2006) Yale University Press (available on Google Books)

Reference Books:

1. Day R (2006) *How to Write and Publish a Scientific Paper*, Cambridge University Press
2. Highman N (1998), *Handbook of Writing for the Mathematical Sciences*, SIAM. Highman's book.
3. Adrian Wallwork, *English for Writing Research Papers*, Springer, New York Dordrecht Heidelberg London, 2011

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
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	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-X: Behavioural Science-I		Subject Code: BHS982A104
L-T-P-C – 1-0-0-1	Credit Units: 01	Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To make the students understand the various elements of behavioral science, the way it is conducted and applied in different research.

Modules	Topics/Course content	Hrs.	Marks
I	**Western Philosophy to present Behavioral Science:** Brief history Sources of knowledge The problem of reliable knowledge Dynamics of development in the behavioural and Social Sciences.	3	25
II	**Behavioral and Social Science Disciplines:** Understanding various behavioural and social science disciplines like Psychology, Sociology, Anthropology, Economics, Political Science, Geography, History and Statistics.	3	25
III	**Modes and Methods:** Experimentation Statistical control Statistically uncontrolled observation.	3	25
IV	**Applications:** Three fundamental features of basic research in Behavioural Sciences Exploring examples of behavioural science research.	3	25
		12	100

Text Books:

1. Adams, R. M., Smelser, N. J. & Treiman, D. J., *Behavioral and social science research: A national resource (Part I),*1982, Washington: National Academy Press.

Reference Books:

1. O'Grady, M. *An introduction to behavioural science,* 2001, Gill & Macmillan, London.

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. Understand the various elements of behavioral science, the way it is conducted and applied in different research.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

SYLLABUS (2nd SEMESTER)

Paper-I: Finite Element Method in Structural Engineering **Subject Code: CEE024C20S1**

L-T-P-C – 3-1-0-4 **Credit Units: 04** **Scheme of Evaluation: T**

Objective: The course is intended to impart knowledge about finite element method used for structural analysis and also to make students enable to operate FEA software/programme

Modules	Topics/Course content	Hrs.	Marks
I	**Introduction:** History and Applications. Spring and Bar Elements, Minimum Potential Energy Principle, Direct Stiffness Method, Nodal Equilibrium equations, Assembly of Global Stiffness Matrix, Element Strain and Stress.	**10**	**25**
II	**Beam Elements:** Flexure Element, Element Stiffness Matrix, Element Load Vector. **Method of Weighted Residuals**: Galerkin Finite Element Method, Application to Structural Elements, Interpolation Functions, Compatibility and Completeness Requirements, Polynomial Forms, Applications.	**13**	**25**
III	**Types:** Triangular Elements, Rectangular Elements, Three-Dimensional Elements, Isoparametric Formulation, Axi-Symmetric Elements, Numerical Integration, Gaussian Quadrature.	**10**	**25**
IV	**Application to Solid Mechanics**: Plane Stress, CST Element, Plane Strain Rectangular Element, Isoparametric Formulation of the Plane Quadrilateral Element, Axi- Symmetric Stress Analysis, Strain and Stress Computations. **Computer Implementation** of FEM procedure, Pre-Processing, Solution, Post-Processing, Use of Commercial FEA Software.	**12**	**25**
	Total	**45**	**100**

Text Book:

1. *Finite Element Analysis*, Seshu P., Prentice-Hall of India,2005.

Reference Books:

1. Cook R. D.,*Concepts and Applications of Finite Element Analysis,*Wiley J., New York, 1995.
2. Hutton David,*Fundamentals of Finite Element Analysis*, Mc-Graw Hill, 2004.
3. Zienkiewicz O.C. & Taylor R.L., *Finite Element Method*, Vol. I, II & III, Elsevier, 2000.

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. Use Finite Element Method for structural analysis. 2. Execute the Finite Elements Program/Software. 3. Solve continuum problems using finite elements analysis.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ❙❙ Assignments ❙❙ Class tests. ❙❙ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-II: Structural Dynamics		Subject Code: CEE024C20S2
L-T-P-C – 3-1-0-4	Credit Units: 04	Scheme of Evaluation: T

Objective:

The objectives of the course are:

- Analyze and study dynamics response of single and multi-degree freedom system
- To make the students understand the concepts behind dynamic analysis of structures

Modules	Topics/Course content	Hrs.	Marks
I	**Introduction:** Objectives, Importance of Vibration Analysis, Nature of Exciting Forces, Mathematical Modeling of Dynamic Systems. **Single Degree of Freedom System:** Free and Forced Vibration with and without Damping, Response to Harmonic Loading, Response to General Dynamic Loading using Duhamel's Integral, Fourier Analysis for Periodic Loading, State Space Solution for Response.	**12**	**25**
II	**Numerical Solution: T**o Response using Newmark &Wilson Method, Numerical Solution for State Space Response using Direct Integration. **Multiple Degree of Freedom System (Lumped parameter):** Two Degree of Freedom System, Multiple Degree of Freedom System, Inverse Iteration Method for Determination of Natural Frequencies and Mode Shapes, Dynamic Response by Modal Superposition Method, Direct Integration of Equation of Motion.	**13**	**25**
III	**Multiple Degree of Freedom System (Distributed Mass and Load):** Single Span Beams, Free and Forced Vibration, Generalized Single Degree of Freedom System.	**10**	**25**
IV	**Special Topics in Structural Dynamics (Concepts only):** Dynamic Effects of Wind Loading, Moving Loads, Vibrations caused by Traffic, Blasting and Pile Driving, Foundations for Industrial Machinery, Base Isolation.	**10**	**25**
	Total	**45**	**100**

Text Book:

1. *Dynamics of Structures,* Clough R. W. and Penzien J., Mc-Graw Hill.

Reference Books:

1. Chopra A. K., *Structural Dynamics and Introduction to Earthquake Engineering,*
2. Smith J. W., *Vibration of Structures - Application in Civil Engineering Design,* Chapman andHall.
3. Humar J. L., *Dynamics of Structures*., Prentice Hall.

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. Analyze and study dynamics response of single degree freedom system using fundamental Theory and equation of motion. 2. Analyze and study dynamics response of Multi degree freedom system using fundamental theory and equation of motion. 3. Use the available software for dynamic analysis.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-III: Advanced Design of Metal Structures		Subject Code: CEE024C20S3
L-T-P-C – 3-1-0-4	**Credit Units: 04**	**Scheme of Evaluation: T**

Objective:

- Knowledge and understand metal structural systems
- Design structural systems

Modules	Topics/Course content	Hrs.	Marks
I	**Metal Structures:** Introduction, Plastic methods of analysis and design, plastic behavior under static and cyclic loading, static, kinematic and uniqueness theorems, shape factors, moment redistribution, analysis of single and two bay portal frames.	**10**	**25**
II	**Design of Connections:** Bolted connections, failure modes of a joint, high strength bolts, HSFG bolts, moment resistant connections. Welded connections, stiffened beam seat connection, moment resistant joint, advance types of welded connections.	**12**	**25**
III	**Design of Storage Structures and Tall Structures:** Design of liquid retaining structures, silos, bunkers, and chimneys.	**12**	**25**
IV	**Design of Industrial Buildings:** Design of members subjected to lateral loads and axial loads, sway and non-sway frames, bracings and bents, rigid frame joints, knees for rectangular frames and pitched roofs, knees with curved flanges, valley joints, rigid joints in multistorey buildings.	**11**	**25**
		45	**100**

Text/ Reference Books:

1. *Design of Steel Structures*, Gaylord, McGraw Hill, New York, 2010
2. *Design of Steel Structures*, S K Duggal, 3rd edition.
3. *Design of Steel Structures*, Ram Chandra, Volume 2

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. Illustrate codal provisions and their application on different types of structures. 2. Design of metal structures based on codal provisions and produce working structural drawings. 3. Analyze and design steel structures like tubular connections, transmission tower, light gauge steel structures, industrial building	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-IV: Advanced Solid Mechanics		Subject Code: CEE024C20S4
L-T-P-C – 3-1-0-4	**Credit Units: 04**	**Scheme of Evaluation: T**

Objective:

The objectives of the course are:

- To inculcate in the reader some of the available tools to analyze a structure and to elucidate the simplifying assumptions made to make the structure analyzable.
- To impart knowledge on simple problems of elasticity and plasticity
- To make the students understand the various forces acting on a structure and its effects

Module	Content	Hrs	Marks
I	**Introduction to Elasticity:** Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity. **Strain and Stress Field:** Elementary Concept of Strain, Stain at a Point, Principal Strains and Principal Axes, Compatibility Conditions, Stress at a Point, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Hydrostatic and Deviatoric Components.	**13**	**25**
II	**Equations of Elasticity:** Equations of Equilibrium, Stress- Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems, Co-axiality of the Principal Directions.	**10**	**25**
III	**Two-Dimensional Problems of Elasticity:** Plane Stress and Plane Strain Problems, Airy's stress Function, Two-Dimensional Problems in Polar Coordinates. **Torsion of Prismatic Bars:** Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, Torsion of Thin Tubes.	**12**	**25**
IV	**Plastic Deformation:** Strain Hardening, Idealized Stress- Strain curve, Yield Criteria, von Mises Yield Criterion, Tresca Yield Criterion, Plastic Stress-Strain Relations, Principle of Normality and Plastic Potential, Isotropic Hardening.	**10**	**25**
	Total	**45**	**100**

Text Book:

1. Theory of Elasticity, Timoshenko S. andGoodierJ. N., McGraw Hill, 1961.

Reference Books:

1. Sadd M. H., Elsevier, *Elasticity*,,2005.
2. Ragab A.R., BayoumiS.E*;Engineering Solid Mechanics*., CRC Press,1999.
3. Kazimi S. M. A, *Solid Mechanics,* Tata McGraw Hill,1994.
4. Srinath L.S, *Advanced Mechanics of Solids*., Tata McGraw Hill,2000.

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. Solve simple problems of elasticity and plasticity understanding the basic concepts. 2. Apply numerical methods to solve continuum problems	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-V: Advanced Concrete Technology		Subject Code: CEE024C20S5
L-T-P-C – 3-0-0-3	**Credit Units: 03**	**Scheme of Evaluation: T**

Objective:

The objective of the course are:

- To understand the properties of ingredients of concrete
- To study the behaviour of concrete at its fresh and hardened state
- To study about the concrete design mix
- To know about the procedures in concreting
- To understand special concrete and their use

Prerequisites: Construction Materials, Concrete Technology

Modules	Topics/Course content	Hours
I	**Constituent Materials**: Cement, Different types, Chemical composition and Properties, Tests on cement, IS Specifications, Aggregates, Classification, Mechanical properties, and tests as per BIS Grading requirements, Water, Quality of water for use in concrete.	**7**
II	**Chemical & Mineral Admixtures**: Accelerators, Retarders, Plasticisers, Super plasticizers, Water proofers, Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaolin, Their effects on concrete properties	**9**
III	**Concrete Mix Design**: Principles of Mix Proportioning-Properties of concrete related to Mix Design Physical properties of materials required for Mix Design – Design Mix and Nominal Mix, BIS Method of Mix Design – Mix Design Examples	**9**
IV	**Special Concrete** : Lightweight and foam concrete, High performance concrete; Ultra high strength concrete; Ready mix concrete, Roller compacted concrete, fibre reinforced concrete, high density concrete, pumped concrete, Polymer modified concrete, Ferrocement, Mass concrete, Ready mix concrete, Self-compacting concrete, Quality control, Sampling and testing-Acceptance criteria	**7**
	Total	**32**

Text/Reference Books:

1. Shetty, M.S., Concrete Technology, Theory & Practice, S.Chand and Co, 2004.
2. Gambhir, M.L., Concrete Technology, Tata McGraw Hill, 2004.
3. Nevile, Properties of Concrete, Longman Publishers, 2004.
4. Santakumar A.R., Concrete Technology, Oxford University Press, New Delhi, 2007
5. Gupta.B.L., Amit Gupta, “Concrete Technology”, Jain Book Agency, 2010.

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. Test all the concrete materials as per IS code 2. Design the concrete mix using IS code methods 3. Determine the properties of fresh and hardened of concrete 4. Design special concretes and their specific applications 5. Ensure quality control while testing/ sampling and acceptance criteria	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper- VI: Advanced Concrete Technology Lab		Subject Code: CEE024C21S6
L-T-P-C –0-0-2-1	**Credit Units: 01**	**Scheme of Evaluation: P**

Experiments:

- Study of stress strain curve of high strength concrete, correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture.
- Effect of cyclic loading on steel
- Non-Destructive testing of existing concrete members
- Behavior of beams under flexure, shear and torsion

Text Books:

1. *Properties of Concrete*, Neville A.M., 5th Edition, Prentice Hall, 2012

Reference Books:

1. Shetty M. S., *Concrete Technology*., S. Chand and Co., 2006.

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. Design high grade concrete and study the parameters affecting its performance 2. Conduct Non-Destructive Tests on existing concrete structures 3. Apply engineering principles to understand behavior of structural elements	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-VIII: Seminar-II		**Subject Code: CEE024C23S7**
L-T-P-C – 0-0-2-2	**Credit Units: 02**	**Scheme of Evaluation: P**

Objectives:

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ❙❙ Assignments ❙❙ Class tests. ❙❙ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-VIII: Elective-I (Design of High Rise Structures)		**Subject Code: CEE024D20S1**
L-T-P-C – 4-0-0-4	**Credit Units: 04**	**Scheme of Evaluation: T**

Objective:

The objectives of the course are:

- To teach students to **a**nalyze, design and detail various types of high rise structure.
- To teach the students the various structural problems associated with high rise structures

Modules	Topics/Course content	Hrs.	Marks
I	**Design of:** Transmission/TV tower**,** Mast and trestles: Configuration, bracing system, analysis and design for vertical transverse and longitudinal loads.	**11**	**25**
II	**Analysis and Design of:** RC and Steel Chimney, Foundation design for varied soil strata.	**11**	**25**
III	**Tall Buildings**: Structural Concept, Configurations, various systems, Wind and Seismic loads, Dynamic approach, structural design considerations and IS code provisions. Firefighting design provisions.	**12**	**25**
IV	**Application** of software in analysis and design.	**11**	**25**
	Total	**45**	**100**

Text Book:

1. *Structural Design of Multi-storeyed Buildings*, Varyani U. H., 2nd Ed., South Asian Publishers, New Delhi, 2002.

Reference Books:

1. Taranath B. S*, Structural Analysis and Design of Tall Buildings*,. S., Mc-Graw Hill, 1988.
2. Shah V. L. &Karve S. R*, Illustrated Design of Reinforced Concrete Buildings (GF+3storeyed),*, Structures Publications, Pune, 2013.
3. *Design of Multi Storeyed Buildings*, Vol. 1 & 2, CPWD Publications, 1976.

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. Analyse, design and detail Transmission/ TV tower, Mast and Trestles with different loading conditions. 2. Analyse, design and detail the RC and Steel Chimney. 3. Analyse. design and detail the tall buildings subjected to different loading conditions using relevant codes.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-VIII: Elective-1 (Design of Masonry Structures)		Subject Code: CEE024D20S2
L-T-P-C – 4-0-0-4	**Credit Units: 04**	**Scheme of Evaluation: T**

Objective:

The objectives of the course are:

- To enable students, understand masonry design approaches and analyze Reinforced Masonry Members.

Modules	Topics/Course content	Hrs.	Marks
I	**Introduction:** Historical Perspective, Masonry Materials, Masonry Design Approaches, Overview of Load Conditions, Compression Behaviour of Masonry, Masonry Wall Configurations, Distribution of Lateral Forces.	**10**	**25**
II	**Flexural Strength:** Of Reinforced Masonry Members: In plane and Out-of-plane Loading. **Interactions**: Structural Wall, Columns and Pilasters, Retaining Wall, Pier and Foundation.	**12**	**25**
III	**Shear Strength:** Land Ductility of Reinforced Masonry Members. **Prestressed Masonry:** Stability of Walls, Coupling of Masonry Walls, Openings, Columns, Beams.	**12**	**25**
IV	**Elastic and Inelastic Analysis:** Modeling Techniques, Static Push Over Analysis and use of Capacity Design Spectra.	**11**	**25**
	Total	**45**	**100**

Text Book:

1. *Masonry Structures: Behavior and Design*, Hamid Ahmad A. and Drysdale Robert G., 1994.

References:

1. *Mechanics of Masonry Structures*, Editor: Maurizio Angelillo, 2014.
2. *Earthquake-resistant Design of Masonry Buildings*, Toma_evi_Miha, Imperial College Press, 1999.

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. Understand the masonry design approaches and analyze Reinforced Masonry Members. 2. Determine interactions between members. 3. Determine shear strength and ductility of Reinforced Masonry members. 4. Check the stability of walls 5. Perform elastic and Inelastic analysis of masonry walls.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-IX: Disaster Management		Subject Code: CEE024S20S1
L-T-P-C – 2-0-0-2	Credit Units: 02	Scheme of Evaluation: T

Objectives:

The objectives of the course are:

- To teach students key concepts in disaster risk reduction and humanitarian response.

Module	Content	Hrs	Marks
I	**Introduction:** Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude. **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	2 2	25
II	**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.	3	25
III	**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.	4	25
IV	**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.	3 2	25
	Total	**16**	**100**

Text Book:

1. *Disaster Management in India: Perspectives, issues and strategies*, R. Nishith, Singh AK, New Royal Book Company.

Reference Books:

1. Sahni, PardeepEt.Al. (Eds.)," *Disaster Mitigation Experiences and Reflections*", Prentice Hall Of India, New Delhi.
2. Goel S. L., *Disaster Administration and Management: Text and Case Studies*", Deep & Deep Publication Pvt. Ltd., New Delhi.

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations. 2. 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.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-X: Behavioural Science-II		Subject Code: BHS982A204
L-T-P-C – 1-0-0-1	**Credit Units: 01**	**Scheme of Evaluation: T**

Objective:

The objectives of the course are:

- To provide students insight into the various aspects of self and how one perceives and comprehends other's behavior in the light of their present appearance

Modules	Topics/Course content	Hrs.	Marks
I	**Self and Identity:** Separated and Connected perspective Immersed and Distal perspective Self-concept, self-esteem and self-efficacy Personal and social identity	**3**	**25**
II	**Structure and Functions of Identity:** Continuity and differentiation Identity crisis: Erikson and Marcia Quarterlife crisis- a new concept of understanding young people's difficulties in transitioning to adulthood	**3**	**25**
III	**Social Perception:** Making sense and categorizing information from environment Person schemas and group stereotypes	**3**	**25**
IV	**Attribution:** Attribution theory Dispositional versus situational attributions Inferring dispositions from acts Co-variation model of attribution Attributions for success and failure Bias and error in attribution Over-attribution to dispositions Focus of attention bias Actor observer difference Motivational biases Cultural basis of attributions	**3**	**25**
	TOTAL	12	100

Text Books:

1. Baron, R. A.& Branscombe, N. R.,*Social Psychology*, 13th Edition, 2012, US Pearson.
2. Baumeister, R. F., *Self-concept, self-esteem and identity*., 1999 In Varerian, J. D., Barbara, W. A. & Warren, J. H. (Eds*), Personality: Contemporary Theory and Ethnicity,* (pp. 339-375). US: Nelson-Hall Publishers

Reference Books:

1. Leary, M.R. & Tangney, J. P., Handbook of Self and Identity, 2012, New York: The Guilford Press.

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. Get an insight into the various aspects of self and how one perceives and comprehends other's behavior in the light of their present appearance.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ❙❙ Assignments ❙❙ Class tests. ❙❙ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-XI: Communicative English-II		Subject Code: CEN984A201
L-T-P-C – 1-0-0-1	**Credit Units: 01**	**Scheme of Evaluation: T**

Objective:

Modules	Topics/Course content	Hrs.	Marks
I		**3**	**25**
II		**4**	**25**
III		**3**	**25**
IV		**4**	**25**
		14	**100**

Text Books:

Reference Books:

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

3RD SEMESTER

Paper-I: Construction Project Management **Subject Code: CEE024C30S1**

L-T-P-C – 3-1-0-4 **Credit Units: 04** **Scheme of Evaluation: T**

Objective:

The objectives of the course are:

- To deals with the importance of construction managers in management.
- To teach the theories of construction management, organizational theory, and practice of project management from both conceptual and pragmatic perspectives

Module	Content	Hrs.	Marks
I	**Introduction to Management:** Management and management careers, the history of management, the increasingly dynamic environment; new challenges for managers, managers versus leaders. Types of construction project in management, resources for construction industry. **Project Management:** Introduction, definitions, significance of construction management, objectives and functions of construction management; need for construction managers, corporate social responsibility and ethics of construction managers.	10	25
II	**Stages in Construction Management:** Construction planning, scheduling and controlling phases; Introduction to planning, types: pre-tender stage and contract stages; importance of scheduling; organization, types of organization, study of organizational structures suitable for building and construction projects; construction team: role of members of a typical construction organization, ethics in construction industry. **Construction Equipment:** The role of equipment machinery in construction industry, factors affecting selection of construction machinery, standard versus special equipment, understanding of various issues involved in owning, operating and maintaining of construction equipment; different types of construction equipment- earthmoving, spreading and compacting and concreting equipment.	12	25
III	**Construction Management Techniques:** Introduction, different types of management techniques; introduction to Bar chart and Milestone chat, limitations of bar charts; various types of network analysis, introduction to PERT and CPM, difference of PERT and CPM network analysis; network development; computation of expected time in PERT.	13	25
IV	**Cost Time Analysis in Network Planning:** Introduction to cost time analysis, its importance in network planning; project cost, concept of direct cost and indirect cost, characteristics of direct cost and indirect cost, concept of cost optimization. **Construction contracts and Tender documents:**	10	25

	Importance of contracts, different types of contract; briefing of tender document.		
	Total	**45**	**100**

Text Books:

1. *Construction Planning and Management*, P.S. Gahlot and B.M. Dhir, 2nd Edition, New Age International Publishers, 2018.
2. Project Planning and Control with PERT and CPM, B.C. Punmia and K.K. Khandelwal, 4th Edition, Laxmi Publications (P) Ltd., 2014.

Reference Books:

1. *Construction Planning, Equipment and Methods*, Peurifoy Schexnayder Shapira, 7th Edition, McGraw Hill Education, 2010.
2. *Management*, J.A.F. Stoner, Freeman R. E and Daniel R Gilbert, 6th Edition, Pearson Education, 2004.

Learning Outcomes	**Teaching and Learning Activity**	**Assessment Tasks**
1. Describe the value, scope, role, function, and leadership of effective construction managers for organizational success and goal setting. 2. Understand the five traditional management functions: planning, organizing, staffing, leading, and controlling.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-II: Dissertation (Phase-I) & Presentation	**Subject Code: CEE024C32S2**
L-T-P-C – 0-0-24-12	**Credit Units: 12**

Syllabus Contents:

Dissertation (Phase-I) will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available. End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection, and analysis of data, determining solutions and must bring out individual's contribution. Continuous assessment of Dissertation-I at Mid Sem and End Sem will be monitored by the departmental committee.

Learning Outcomes	**Teaching and Learning Activity**	**Assessment Tasks**
1. Identify structural engineering problems reviewing available literature. 2. Identify appropriate techniques to analyze complex structural systems. 3. Apply engineering and management principles through efficient handling of project	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-III: Summer Training Report		**Subject Code: CEE024C33S3**
L-T-P-C –0-0-0-1	**Credit Units: 01**	**Scheme of Evaluation: T**

Content:

The students will mandatorily undertake Summer Training during the summer break (at the end of Sem-II) in an area/topic having relevance to the course programme. This shall be decided by the Dissertation Guide (proposed) under whom the student will work for his/her Dissertation (Phase-I) during the Sem-III. The course being a credit course, the students shall prepare a Training Report and submit to the Head of the Department. Further, the report shall be presented during the departmental seminar before the faculty members of the department at the beginning of the Sem-III. The final training report (after due corrections, if any) shall be submitted to the departmental library.

Evaluation Pattern:

- Presentation before faculty members: 50%
- Submission of report : 50%

Paper-IV: Elective-II (Design of Prestressed Concrete Structures)		Subject Code: CEE024D30S1
L-T-P-C – 4-0-0-4	**Credit Units: 04**	**Scheme of Evaluation: T**

Objectives:

The objectives of the course are:

- To make the students understand the concepts relating to pre-stressed concrete

Module	Content	Hrs	Marks
I	**Introduction to prestressed concrete**: types of prestressing, systems and devices, materials, losses in prestress. Analysis of PSC flexural members: basic concepts, stresses at transfer and service loads, ultimate strength in flexure, code provisions	**10**	**25**
II	**Statically determinate PSC beams**: design for ultimate and serviceability limit states for flexure, analysis and design for shear and torsion, code provisions.	**9**	**25**
III	**Transmission of prestress**in pre-tensioned members; Anchorage zone stresses for posttensioned members. **Statically indeterminate structures** - Analysis and design - continuous beams and frames, choice of cable profile, linear transformation and concordancy.	**12**	**25**
IV	**Composite construction** with precast PSC beams and cast in-situ RC slab - Analysis and design, creep and shrinkage effects. Partial prestressing - principles, analysis and design concepts, crack width calculations **Analysis and design** of prestressed concrete pipes, columns with moments.	**14**	**25**
	TOTAL	**45**	**100**

Text Book:

1. *Design of Prestressed Concrete Structures*, Lin T.Y., Asia Publishing House, 1955.

References:

1. .*Prestressed Concrete*, Krishnaraju N., Tata McGraw Hill, New Delhi, 1981.
2. Guyan Y., *Limited State Design of PrestressedConcrete*,, Applied Science Publishers, 1972.
3. IS: 1343- *Code of Practice for Prestressed Concrete*
4. IRC: 112

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. Find out losses in the prestressed concrete. 2. Understand the basic aspects of prestressed concrete, including pre and post-tensioning processes. 3. Analyze prestressed concrete deck slab and beam/ girders. 4. Design prestressed concrete deck slab and beam/ girders. 5. Design of end blocks for prestressed members.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ❙❙ Assignments ❙❙ Class tests. ❙❙ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-IV: Elective-II (Plates, Shells and Composites)		Subject Code: CEE024D30S2
L-T-P-C – 4-0-0-4	**Credit Units: 04**	**Scheme of Evaluation: T**

Objectives:

The objectives of the course are:

- To understand the concepts related to design of plates and shells.
- To discuss the concept of bending of plates and design of domes.

Module	Content	Hrs	Marks
I	**Plates:** Introduction to plates, Moment equation of plates; Equations for cylindrical bending of plates, Differential equations for symmetrical bending of laterally loaded circular plates; Analysis of circular plate for different boundary conditions of uniformly loaded circular plates; Equations for rectangular plates.	**10**	**25**
II	**Folded Plates:** Introduction to folded plates, behaviour of folded plate roof, advantages and disadvantages of folded plates, Whitney's and Simpson's method of analysis; Design and detailing of folded plates	**10**	**25**
III	**Shells:** Introduction, history of thin concrete shells, basic concepts of shell design, classification of shell surfaces, method of Analysis and design criteria; Analysis and design of cylindrical shells; Analysis and design of spherical domes,	**15**	**25**
IV	**Composites:** Introduction, definition of composites, classifications, properties of fibrous composites; Advantages and disadvantages of composite materials, fabrication processes of fibrous composites, factors affecting the fabrication process of fibrous composites.	**10**	**25**
	TOTAL	**45**	**100**

Text Book:

1. *Theory of Plates and Shells*, Timoshenko and Woinowsky-Krieger S., Tata Mc-Graw Hill Edition, 2010.
2. *Analysis and Performance of Fiber Composites*, Bhagwan D. Agaevalm and Lawrence J Brutman, John Willy and Sons, 2006.

References:

1. Ramaswamy G. S , *Design and Construction of Concrete Shell Roofs*, Ramaswamy G. S., 1st Ed., 2005.CBS Publishers & Distributors
2. Vargh ese P. C,*Design of Reinforced Concrete Shells & Folded Plate*., 1st Ed., PHI Learning Pvt. Ltd-New Delhi, 2011
3. Jawad Maan H*; Theory and Design of Plate and Shell Structures*., 1st Ed. 1994, Springer Science.
4. Robart M. Jones, *Mechanics of Composite Materials*, McGraw Hill Publishing Co, 1998.

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. Analyze and design prismatic folded plate systems. 2. Analyze and design shells using approximate solutions 3. Analyze and Design Cylindrical Shells. 4. Design Doubly Curved Shells using Approximate Solutions.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-V: Forensic, Rehabilitation and Structural Health Monitoring		Subject Code: CEE024S30S1
L-T-P-C – 2-0-0-2	Credit Units: 02	Scheme of Evaluation: T

Objectives:

The objectives of the course are:

- To discuss the scope of Forensics in Engineering and the role of Forensic Engineer.
- To discuss the various causes of structural failure and the application of retrofitting, repairs, and restoration of structures.
- To outline the applications of sensors in Structural Health Monitoring.
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Module	Content	Hrs	Marks
I	**Forensics in Engineering:** Definition of Forensic, Importance of Forensic in Civil Engineering, Role and duties of Forensic engineers	10	25
II	**Failure of Structures:** Types of failure, review of the construction theory, performance problems, caused of distress in structural members, design and material deficiencies over loading. **Environmental Problems and Natural Hazards**: Pollution and carbonation problems, durability of RCC structures, damage due to earthquake and flood, strengthening of buildings**.**	11	25
III	**Modern Techniques of Retrofitting:** Introduction, types- Guniting, jacketing, use of chemicals in repair, applications of polymers, ferrocement and fiber concretes as rehabilitation materials, foamed concrete, mortor repair for cracks, shoring and under pinning, strengthening by pre-stressing,	13	25
IV	Structural Health Monitoring: Introduction, Different systems in SHM, Objectives, Advantages, Types of SHM, Components, Instrumentations used in SHM; Types of Sensors and its characteristics in health monitoring, Diagnostic techniques- vibration signature analysis, neural network-based classification techniques.	11	25
	TOTAL	45	100

Text Book:

1. *Health Monitoring of Structural Materials and Components- Methods with Applications*, Douglas E. Adams, John Wiley & Sons Ltd., 2007.
2. *Structural Health Monitoring of Civil Infrastructure Systems*, Vistasp M.Karbhari and Farhad Ansari, Woodhead Publihing Limited, Oxford Cambridge, New Delhi, 2009.

References:

1. *Applications of metaheuristic Optimization Algorithms in Civil Engineering*, A.Kaveh, Springer Publications.

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. Discuss the scope of Forensic Engineering and define the role of Forensic Engineer. 2. Discuss various conventional retrofitting methods like Jacketting, Dampers, Base Isolators, chemicals in repairs, guniting, shotcreting and epoxy resins. 3. Analyze the factors affecting the Durability of concrete. Discuss the basic concept of Structural Health Monitoring.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-VI: Communicative English-III		Subject Code: CEN982A301
L-T-P-C – 1-0-0-1	Credit Units: 01	Scheme of Evaluation: T

Objective: The course is intended to improve the writing skill of students

Modules	Topics/Course content	Hrs.	Marks
I		3	25
II		4	25
III		3	25
IV		4	25
		14	100

Text Books:

Reference Books:

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1 .	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

4TH SEMESTER

Paper-I: Dissertation (Phase-II) & Presentation **Subject Code: CEE024C42S1**

L-T-P-C – 0-0-36-18 **Credit Units: 18**

Syllabus Contents:

Dissertation-II will be extension of the work on the topic identified in Dissertation-I. Continuous assessment should be done of the work done by adopting the methodology decided involving numerical analysis/ conduct experiments, collection and analysis of data, etc. Continuous assessment of Dissertation-II at Mid Sem and End Sem will be monitored by the departmental committee. There will be pre-submission seminar at the end of academic term. After the approval the student has to submit the detail report and external examiner is called for the viva-voce to assess along with the guide.

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. Solve complex structural problems by applying appropriate techniques and tools. 2. Exhibit good communication skill to the engineering community and society. 3. Demonstrate professional ethics and work culture.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper-II: Publication of Technical Papers	**Subject Code: CEE024C42S2**
L-T-P-C – 0-0-0-1	**Credit Units: 1**

Syllabus Contents:

Learning Outcomes	**Teaching and Learning Activity**	**Assessment Tasks**
	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ❙❙ Assignments ❙❙ Class tests. ❙❙ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

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Paper-III: Communicative English-IV		Subject Code: CEN948A401
L-T-P-C – 1-0-0-1	Credit Units: 01	Scheme of Evaluation: T

Objective: The course is intended to improve the writing skill of students

Modules	Topics/Course content	Hrs.	Marks
I		3	25
II		4	25
III		3	25
IV		4	25
		14	100

Text Books:

Reference Books:

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) Theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on Assignments Class tests. viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.