M.TECH

STRUCTURAL ENGINEERING

SCHEME OF INSTRUCTION AND SYLLABUS

M.Tech-23

(w.e.f 2023– 2024)

Department of Civil Engineering

VELAGAPUDI RAMAKRISHNA
SIDDHARTHA ENGINEERING COLLEGE

(An Autonomous Institution affiliated to Jawaharlal Nehru Technological University Kakinada, Kakinada
NBA Accredited & ISO 9001:2015 Certified)
(Sponsored by Siddhartha Academy of General & Technical Education)
Kanuru, Vijayawada-520007, A.P. India
www.vrsiddhartha.ac.in

INSTITUTE VISION

To nurture excellence in various fields of engineering by imparting timeless core values to the learners and to mould the institution into a centre of academic excellence and advanced research.

INSTITUTE MISSION

To impart high quality technical education in order to mould the learners into globally competitive technocrats who are professionally deft, intellectually adept and socially responsible. The institution strives to make the learners inculcate and imbibe pragmatic perception and pro-active nature so as to enable them to acquire a vision for exploration and an insight for advanced enquiry.

DEPARTMENT VISION

To impart teaching, research and develop consultancy that serves thesociety and to strive continuously for excellence in education.

DEPARTMENT MISSION

To provide quality education for successful career and higher studies in Civil Engineering that emphasizes academic and technical competence in profession and research, effective communication, team work and leadership to meet the challenges of the society.

PROGRAM OUTCOMES

PO1. An ability to independently carry out research/investigation and development work to solve practical problems

PO2. An ability to write and present a substantial technical report/document

PO3. Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

PO4. Use different software tools to analyze and design of various structural components

PO 5. Develop the ability to work both independently and collaboratively, cultivate an entrepreneurial mindset and engage in projects that prioritize sustainability and social responsibility while maintaining high ethical standards.

VELAGAPUDI RAMAKRISHNA

SIDDHARTHA ENGINEERING COLLEGE

SCHEME OF INSTRUCTION FOR TWO YEAR PG PROGRAMME [M.TECH23]

M.TECH IN (Structural Engineering)

SCHEME OF INSTRUCTIONS

SEMESTER I **Contact Hours: 28**

S.No	Course Type	Course Code	Title of the Course	L	T	P	Credits
1.	Programme Core - I	**23CESE1001**	Computer Aided Advanced Structural Analysis (*Integrated Course)	2	0	2	3
2.	Programme Core – II	**23CESE1002**	Soil Structure Interaction (Can be opted from NPTEL)*	3	0	0	3
3.	Programme Core – III	**23CESE1003**	Retrofitting and Rehabilitation of Structures (Can be opted from NPTEL)*	3	0	0	3
4.	Programme Elective – I	**23CESE1014**	A. Pre-Engineered Steel Buildings (*Integrated Course) B. Theory of Plates & Shells C. Fracture Mechanics of Concrete Structures D. Probability Methods in Civil Engineering (Can be opted from NPTEL)* E. Characterization of Construction Materials (Can be opted from NPTEL)*	2 3 3 3 3	0 0 0 0 0	2 0 0 0 0	3 3 3 3 3
5.	Programme Elective – II	**23CESE1015**	A. Design of Prestressed Concrete Structures B. Prefabricated structures C. Energy Efficiency, Acoustics and Day lighting in Building (Can be opted from NPTEL)* D. Advanced Foundation Engineering (Can be opted from NPTEL)* E. Industry Oriented Subject	3	0	0	3
6.	Mandatory Learning Course	**23MTMC1026**	Research Methodology and IPR	2	0	0	0
7.	Laboratory - 1	**23CESE1051**	Computer Aided Construction Management Lab	0	0	3	1.5
8.	Laboratory - 2	**23CESE1052**	Computer Applications in Numerical Analysis Lab	0	0	3	1.5
9.	Project	**23CESE1063**	CAPSTONE PORJECT-1	0	0	2	1
			Total	**16**	**0**	**12**	19

SEMESTER II **Contact Hours: 30**

S.No	Course Type	Course Code	Title of the Course	L	T	P	Credits
1.	Programme Core–IV	**23CESE2001**	Finite Element Method (Can be opted from NPTEL)*	3	0	0	3
2.	Programme Core – V	**23CESE2002**	Computer Aided Reinforced Concrete Design (*Integrated Course)	2	0	2	3
3.	Programme Core – VI	**23CESE2003**	Dynamics of Structures (Can be opted from NPTEL)*	3	0	0	3
4.	Programme Elective – III	**23CESE2014**	A. Advanced Pre-Engineered Steel Buildings (*Integrated Course) B. Design of High-Rise Structures C. Stability of Structures D. Bridge Engineering (Can be opted from NPTEL)* E. Reliability Based Structural Design(Can be opted from NPTEL)*	2 3 3 3 3	0 0 0 0 0	2 0 0 0 0	3 3 3 3 3
5.	Programme Elective – IV	**23CESE2015**	A. Earthquake Resistant Design of Structures B. Design of Formwork C. Admixtures and Special Concrete (Can be opted from NPTEL)* D. Optimization methods for Civil Engineering (Can be opted from NPTEL)* E. Industry Oriented Subject	3	0	0	3
6.	Audit Course	**23CESE2036**	Technical Report Writing	2	0	0	-
7.	Term Paper	**23CESE2067**	Term Paper seminar – Literature Review for the proposed problem#	0	0	2	1
8.	Laboratory – 1	**23CESE2051**	Building Information Modeling (BIM) lab	0	0	3	1.5
9.	Laboratory – 2	**23CESE2052**	Concrete 3D Printing Lab	0	0	3	1.5
10.	Project	**23CESE2063**	CAPSTONE PORJECT-2	0	0	2	1
			Total	**16**	**0**	**14**	20

L – Lecture, T – Tutorial, P – Practical, C – Credits

***Students to be encouraged to go industrial training for at least Six weeks during semester break**

 # Students should conduct the Literature Survey for the proposed research topic and they need to develop a prototype or simulation based (must be outcome oriented) – the same to be presented in any conference (national or international)

Semester III **Contact Hours:23**

S.No	Course Type	Course Code	Title of the Course	L	T	P	Credits
1.	ProgrammeElective - V	**23CESE3011**	Choice for students to complete course in any MOOCS Platform(NPTEL)*	0	0	0	3
2.	Project(Part-A)	**23CESE3062**	Dissertation*/ Project/ Research Organization	0	0	20	10
3.	Internship	**23CESE3051**	Internship/Summer Training in Research Organizations/ Institutions of Higher Learning (After II Sem)	0	0	4	2
			Total	**0**	**0**	**24**	**15**

L – Lecture, T – Tutorial, P – Practical, C – Credits

***To be continued in the IV Semester Program Elective V may be completed in semester I or II by satisfying the pre-requisites those who are going for industrial project**

Semester IV **Contact Hours:32**

S.No	Course Type	Course Code	Title of the Course	L	T	P	Credits
1.	Project (Part-B)	**23CESE4061**	Dissertation/ Industrial Project	0	0	32	16
			Total	**0**	**0**	**32**	**16**

L – Lecture, T – Tutorial, P – Practical, C – Credits

Semester	Credits
1	**19**
2	**20**
3	**15**
4	**16**
Total	**70**

Note:

1. Student has to carry out a project applying the knowledge and hands on technical skills they have gained through course work and lab sessions in **Semester-I** under **Capstone Project 1**
2. Student should carry out literature survey of the selected problem and present it in a Seminar for the yearlong Project Work under Term Paper.
3. Student has to carry out a project applying the knowledge and hands on technical skills they have gained through course work and lab sessions in **Semester-II** under **Capstone Project 2**
4. At least one theory course in **I** & **II** semesters can be made as integrated course (Theory coupled with Laboratory).
5. Maximum of three theory courses (40% of courses) can be offered as self-learning courses in each of the First and Second semesters.

SEMESTER I

23CESE1001	COMPUTER AIDED ADVANCED STRUCTURAL ANALYSIS (*INTEGRATED COURSE)

Course Category:	Programme Core - I	**Credits:**	3
Course Type:	Theory cum Practice	**Lecture - Tutorial - Practice:**	2-0-2
Prerequisites:	Structural analysis	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	analyse Statically determinate and indeterminate structures with modeling and manual calculations with different concepts.				
	CO 2	model the frame and analyse Structural components using Staad Pro and compare with manual calculations.				
	CO 3	analyse of Plane Truss, Continuous Beam, Plane Frame, Grid, Space Frame by theoretically and using software				
	CO 4	analyse the structures subjected to seismic load				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	3	1	3	3	2
	CO 2	3	2	3	3	3
	CO 3	3	2	3	3	2
	CO 4	3	2	3	3	2
Course Content	**UNIT – I** **INTRODUCTION -BASIC CONCEPTS** Analysis of Statically determinate structures, Principle of Virtual work, Energy methods, Force methods, statically indeterminate structures, Displacement methods, Kinematically Indeterminate Structures **PRACTICE SESSIONS** Introduction to Staad Pro, Tools in Staad Pro					
	UNIT – II Approximate Analysis of Building Frames 1.Vertical Loads (Substitute Frame Method) 2. Lateral Loads (Portal, Cantilever) **PRACTICE SESSIONS** Modelling the frame, applying Load, Structural components Analysis using Staad Pro					
	UNIT – III **STIFFNESS METHOD**					

	Steps in Stiffness Method, transformation Matrix, Overall Stiffness matrix, boundary Condition, Equivalent joint load, calculation of results, Analysis of Plane Truss, Continuous Beam, Plane Frame, Grid, Space Frame. **PRACTICE SESSIONS** Computer Analysis of Plane Truss, Continuous Beam, Plane Frame, Grid, Space Frame
	UNIT – IV . Seismic Analysis by seismic co efficient Method as per IS 1893-Part 1-2016 and Response Spectrum Analysis, **PRACTICE SESSIONS** Seismic Analysis by seismic co efficient Method as per IS 1893-Part 1-2016 Response Spectrum Analysis of Multi storey building frames by using Software
Text Books	[T1] Devdas Menon, Advanced Structural Analysis, Narosa Publishing House Pvt Ltd [T2] Dr.R. Vaidyanathan, & D.P.Perumal, Structural Analysis Vol II, Laxmi Publications (P) Ltd, [T3] S.K. Duggal, Earthquake Resistant Design of Structures, Oxford University Press, [T4] Damodar Maity, Computer Analysis of Framed Structures, I.K. International Publishing House Pvt Ltd
Reference Books	[R1]Madhu B.Kanchi, Matrix Methods of Structural Analysis Wiley Eastern Limited, Second Edition [R2] A.Ghali, A.M.Neville and T.G.Brown, Structural Analysis A Unified classical and Matrix approach, Sixth Edition
E-resources and other digital material	https://www.injntu.com/e-learn/civil-engineering-1/staad-pro-v8i-from-basics-to-advanced-37/iit-staad-pro-tutorials-design-of-rcc-building-part1-day-9-1646

23CESE1002	SOIL STRUCTURE INTERACTION

Course Category:	Programme Core- II	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:	Soil Mechanics	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	apply subgrade modulus concept to beam problems in interaction with soil.				
	CO 2	analyse of infinite beams, semi-infinite and finite beams in interaction with soil.				
	CO 3	analyse beam problems under different soil layers in continuity.				
	CO 4	analyse plates on soils with interaction using Classical and Numerical techniques.				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	2		3		1
	CO 2	2		3		1
	CO 3	2		3		1
	CO 4	2		3		2
Course Content	**UNIT-I** Introduction, critical study of conventional methods of shallow foundation design Critical study of conventional methods of shallow foundation design (continued), Determination of subgrade modulus and parameters influencing subgrade modulus (continued)					
	UNIT-II Time-dependent response, Beams on Elastic Foundation, infinite beam. Infinite beam (continued), Semi-infinite beam (continued)					
	UNIT-III Beams with finite length and various end conditions Continuity among the foundation soil layers Plates on Elastic Foundation (rectangular and circular)					
	UNIT-IV Use of Finite Difference Method (FDM) for soil structure interaction problems Group action of pile, Elastic Analysis, settlement of pile group under compressive load by Interaction Factor Approach, negative skin friction. Laterally loaded piles, Reese and Matlock's generalized solution, displacement of pile group under lateral load by Interaction Factor Approach, Uplift capacity of piles and anchors.					
Text Books	[T1] Analytical and Computer Methods in Foundation, Bowels J.E,. McGraw Hill Book Co., New York					

	[T2] Numerical Methods in Geotechnical Engineering, Desai C.S. and Christain J.T., McGraw Hill Book Co., New York [T3] Selvaduraim A. P. S., 'Elastic Analysis of Soil-Foundation Interaction', Elsevier Scientific, Amsterdam
Reference Books	[R1] Hetenyi, "Beams on Elastic Foundation" The University of Michigan Press [R2] woodward, J. and Tomlinson, M., "Pile Design and Construction Practice" Chapman & Hall [R3] Poulos, H.G. and Davis, E.H. "Pile Foundation Analysis and Design" Rainbow-Bridge Book Co./ John Wiley & Sons
E-resources and other digital material	https://archive.nptel.ac.in/courses/105/105/105105200/

23CESE1003	RETROFITTING AND REHABILITATION OF STRUCTURES

Course Category:	Programme Core-III	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:	Buidling materials and construction technology	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	apply the various methods of repair, retrofitting and rehabilitation techniques for masonry and concrete structures.				
	CO 2	evaluate the existing condition of infrastructure, the materials for repair and retrofitting, the maintenance and strengthening techniques .				
	CO 3	evaluate suitable technique and materials for Seismic retrofitting and design of retrofitted structural components.				
	CO 4	apply efficient retrofitting and rehabilitation in order to extend the durability of existing structure in a sustainable manner.				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	1		3		3
	CO 2	1		3		3
	CO 3	1		3		3
	CO 4	1	1	3		3
Course Content	**UNIT –I** Overview of Retrofitting and Rehabilitation of Civil Infrastructure Condition Evaluation and Testing General Repair and Strengthening of Concrete Structures					
	UNIT –II Fiber Reinforced Polymer Composites (FRPC) and its Characteristics Retrofitting by FRP Composites					
	UNIT –III Concrete Overlay for Pavement Rehabilitation Retrofitting of Masonry Structures					
	UNIT –IV Retrofitting of Building structures damaged due to seismic event Retrofitting of Special structures damaged due to seismic events Retrofitting of Steel Structures					
Text Books	[T1] Concrete Technology, by Neville, A. M. and Brooks, J. J., Prentice Hall [T2] Concrete Durability, by Thomas Dyer, CRC Press, Taylor & Francis Group [T3] Handbook on Non Destrucive Testing of Concrete; Edited by Malhotra, V. M. and Carino, N. J., CRC Press					
Reference Books	[R1] Composites for Construction, by L. C. Bank, John Wiley & Sons, Inc. [R2] ACI 440.2R-08. Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures, American Concrete Institute					
E-resources and other digital material	NPTEL:: Civil Engineering - NOC: Retrofitting and Rehabilitation of Civil Infrastructure					

23CESE1014/A	PRE-ENGINEERED STEEL BUILDINGS (*INTEGRATED COURSE)

Course Category:	Program Elective - I	**Credits:**	3
Course Type:	Theory cum Practice	**Lecture - Tutorial - Practice:**	2 – 0 - 2
Prerequisites:	Design of steel structures	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	identify the various materials used for PEB, their merits and demerits over conventional steel buildings and PEB applications.				
	CO 2	classify the functions of primary and secondary frames, bracing, cladding systems and accessories used in PEB.				
	CO 3	analyse Pre- Engineered building elements for various loads.				
	CO 4	apply PEB design methodology to the design of various structural elements, connections and check their structural stability.				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	1		2		
	CO 2	1		3	1	
	CO 3	3	2	3	3	1
	CO 4	3	2	3	3	2
Course Content	**UNIT – I** **INTRODUCTION TO PRE-ENGINEERED BUILDINGS** Introduction – History - Advantages of PEB - Applications of PEB – Materials used for manufacturing of PEB. Difference between Conventional Steel Buildings and Pre - Engineered buildings.					
	UNIT-II: **PRE - ENGINEERED BUILDING COMPONENTS** Primary System: Main frames, Gable End Frame - Secondary frame system: Sizes and Properties of Purlins & Girts – Bracing System: Rod, angle, Portal, Pipe bracing – Sheeting and Cladding: Roof Sheeting and Wall sheeting –Accessories: Turbo Ventilators, Ridge vents, Sky Lights, Louvers, Insulation and Staircases. **PRACTICE SESSIONS** • Introduction to STAAD PRO. • Create steel structural models					
	UNIT-III: **DESIGN LOADS ON PRE - ENGINEERED BUILDINGS** Design of PEB frame under the influence of Dead, Live, Collateral, Wind, Seismic and Other applicable Loads. Serviceability Limits as per code. **PRACTICE SESSIONS** • Create rigid frame in STAAD Pro. • Analyze the frame for various loads applied on frame					

	• Compare the output with manual calculations
	UNIT-IV: **PEB DESIGN METHODOLOGY** Design Parameters of PEB Frames - Depth of the section, Depth to Flange width ratios, Thickness of Flange to thickness of Web ratio. d/ t_w, b_f/ t_f ratios of sections as per IS code. Section Sizes as per Manufacturing Limitations. Analysis and Design of Rigid Frames. Rigid Frame Moment Connection, Shear Connection-Anchor bolt and base plate design (Pinned and Fixed). **PRACTICE SESSIONS** • Create rigid frame in STAAD Pro • Analyze the frame for various loads applied on frame • Check the cross section properties of the PEB elements • Compare the output with manual calculations
Text Books	[T1] Alexander Newman, "Metal Building Systems: Design and Specifications", 3rd Edition, MC Graw Hill Education. [T2] S. Vivek & P.Vaishavi, "Pre Engineered Steel Buildings" ,LAPL ambert Academic Publishing
Reference Books	[R1] Design of Steel structures limit states method, 2 Ed by Subramanian, Oxford University press. [R2] IS 800: 2007 – General Construction In Steel – Code of Practice [R3] IS 875 (PART 1 & 2) : 1987 Code of Practice for Design Loads (other than Earthquake) for Buildings and Structures. [R4] IS 875 - Part3: 2015 Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures - Part 3: Wind Loads. [R5] IS 1893 (Part 1) :2016 Criteria for Earthquake Resistant Design of Structures Part 1 General Provisions and Buildings(Sixth Revision).
E-resources and other digital material	Open web

23CESE1014/B	THEORYOF PLATES AND SHELLS

Course Category:	Programme Elective-I	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:	Engineering Mathematics, Strength of materials	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	identify the concept to thin plates using various approaches.				
	CO 2	analyse the thin plates subjected to different loading and boundary conditions.				
	CO 3	discuss the behaviour of shells and their classifications and stress – strain and force – displacement relationship.				
	CO 4	analyse different types of shells subjected to different loading criterion and boundary conditions				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	3		3		
	CO 2	3		3		1
	CO 3	3		3		
	CO 4	3		3		1
Course Content	**UNIT – I** **INTRODUCTION TO THIN PLATES:** Small deflection theory, plate equation. Isotropic and orthotropic plates, bending and twisting of plates, Navier's solution, Levy's solution and energy method.					
	UNIT – II **ANALYSIS OF PLATES:** Rectangular, circular plates with variable rigidity in Cartesian and polar co-ordinates, Numerical solutions. Plastic analysis of plates, yield-line theory, Introducing to stability of plates.					
	UNIT – III **SHELL BEHAVIOR:** Shell behavior , shell surfaces and characteristics, classification of shells, equilibrium equations in curvilinear co-ordinates. Stress-strain & force displacement relations. Membrane analysis of shells of revolution.					
	UNIT – IV **ANALYSES OF SHELLS:** Cylindrical shells under different loads. Shallow shells, membrane solution of elliptic paraboloids and hyperboloids. Solution of some typical problems. Introducing to stability of shells.					

Text Books	[T1]Theory of plates and shells by S.P. Timoshenko and S. Woinowsky -Krieger, McGraw-Hill [T2]N. K. Bairagi, "Shell Analysis" ,Khanna Publishers.
Reference Books	[R1]R. Szilard, "Theory & Analysis of Plate - Classical & Numerical Methods" ,John Wiley & Sons Publishing Company. [R2]Ramaswamy, G. S., "Design & Construction of Concrete ShellRoofs", McGraw-Hill Publishing Company.
E-resources and other digital material	http://nptel.ac.in/video.php?subjectId=112101095

23CESE1014/C	FRACTURE MECHANICS OF CONCRETE STRUCTURES

Course Category:	Programme Elective-I	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:	Concrete Technology	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	apply the principles of linear elastic fracture mechanics				
	CO 2	apply the principles of non-linear fracture mechanics				
	CO 3	evaluate the fracture process of concrete				
	CO 4	apply the fracture mechanics to concrete structures				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	2		2		
	CO 2	2		3		
	CO 3	2		2		
	CO 4	3		3		
Course Content	**UNIT - I** **Introduction to fracture mechanics of concrete and Principles of linear elastic fracture mechanics** Need for fracture mechanics in design, Micromechanics of various types of fracture, Mode I, II and III cracks, Crack detection methods. Concepts of linear elastic fracture mechanics; Fracture mechanics of concrete. Airy stress functions for problems in elasticity; Complex stress function; Elastic stress and displacement fields at crack tip; Stress intensity factors and crack opening displacements for useful geometries; Superposition of stress intensity factors; Plastic zone at crack tip; Griffith's fracture theory; Strain energy release rate for crack propagation; Relationship between stress intensity factor and strain energy release rate.					
	UNIT-II **Principles of non-linear fracture mechanics** Energy principles for crack propagation in non – linear materials; J-integral for non-linear elastic materials; Fracture resistance (R curve); Crack tip opening displacement.					
	UNIT-III **Structure and fracture process of concrete**					

	Constituents and microstructure of concrete; Fracture behavior and strain localization of concrete; fracture process zone and toughening mechanisms; Influence of fracture process zone on fracture behavior of concrete.
	UNIT-IV **Applications of fracture mechanics to concrete structures.** Behavior of concrete structures and fracture mechanics; Size effect on nominal strength of plain concrete specimens; Tension of reinforced concrete members; Bending of reinforced concrete beams; Minimum reinforced ratios of concrete members.
Text Books	[T1] Shah, Surendra P., Stuart E. Swartz, and Chengsheng Ouyang. Fracture mechanics of concrete: applications of fracture mechanics to concrete, rock and other quasi-brittle materials. John Wiley & Sons [T2] Kumar, Prashant. Elements of fracture mechanics. McGraw-Hill Education LLC [T3] Victor, Li C., Bazant Z. P. "Fracture Mechanics – Applications to Concrete", ACI Detroit.
Reference Books	[R1] Analysis of Concrete Structures by Fracture Mechanics by L. Elfgren, Publisher: Routledge [R2] Fracture Mechanics of Concrete Structures edited by ZDENEK P. BAZANT Walter P. Murphy Professor of Civil Engineering, Northwestern University, Evanston, Illinois, USA [R3] Suri C. T. and Jin Z.H., " Fracture Mechanics", 1st Edition, Elsevier Academic Press.
E-resources and other digital material	https://archive.nptel.ac.in/courses/112/106/112106065/ https://imechanica.org/node/7448

23CESE1014/D	PROBABILITY METHODS IN CIVIL ENGINEERING

Course Category:	Programme Elective-I	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:		**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	understand the concept of probability and statistics by studying Axioms of Probability and introduce random variables				
	CO 2	apply discrete probability distribution functions in civil engineering field.				
	CO 3	apply continuous probability distribution functions in different fields of civil engineering.				
	CO 4	evaluate the Hypothesis testing and Analyse regression				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	3		1		
	CO 2	3		2		1
	CO 3	3		2		1
	CO 4	3		1		2
Course Content	**UNIT-I** Random events, Probability, Set Theory, Axioms of Probability, Random Variables, Probability Distribution Functions					
	UNIT-II Cumulative Distribution Functions, Descriptors of random variables, Probability Distribution of discrete and continuous random variables, Probability Distribution of continuous random variables					
	UNIT-III Functions of Random Variables, Common Probability Models, Normal, Log Normal and exponential distributions, Gamma and Extreme value distributions					
	UNIT-IV Sampling distribution, Parameter Estimation, Hypothesis testing, Goodness-of-fit tests, Regression Analysis					
Text Books	[T1]Ang A H-S. and W. H. Tang, Probability Concepts in Engineering Planning and Design: Volume I Basic principles, John Wiley & Sons, Inc., USA [T2]Kottegoda N T. and R Rosso, Applied Statistics for Civil and Environmental Engineers, 2nd Edition, Wiley-Blackwell, United Kingdom					
Reference Books	[R1]Papoulis, A, and S. U. Pillai, Probability, Random Variables and Stochastic Processes, McGraw-Hill, USA [R2]Jonson R A. and C. B. Gupta, Miller and Freund's Probability and Statistics for Engineers, Pearson Education, Inc., USA					
E-resources and other digital material	Probability Methods in Civil Engineering - Course (nptel.ac.in)					

23CESE1014/E	CHARACTERIZATION OF CONSTRUCTION MATERIALS

Course Category:	Programme Elective-I	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:	Building materials	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	describe characterization of construction materials and their behavior, with X-ray diffraction, Thermal analysis.				
	CO 2	identify the characteristics of construction materials and their behavior. Surface area measurement 5. Microscopy				
	CO 3	recognize the characteristics of construction materials and their behavior Image analysis ,Spectroscopic techniques				
	CO 4	analyse the characteristics of construction materials and their behavior Mercury intrusion porosimetry , Impedance analysis and ultrasonic methods				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	1	2	1	3	2
	CO 2	1	2	1	3	2
	CO 3	1	2	1	3	2
	CO 4	1	2	1	3	2
Course Content	**UNIT-I** Introduction to course; Structure of Construction Materials – An Overview, Calorimetry , X-ray diffraction					
	UNIT-II X-ray diffraction, Thermal analysis, Surface area measurement					
	UNIT-III Optical microscopy, Scanning electron microscopy, Image analysis					
	UNIT-IV Spectroscopic techniques, Mercury intrusion porosimetry, Impedance analysis and ultrasonic methods					
Text Books	[T1] Karen Scrivener, Ruben Snellings, Barbara Lothenbach, A Practical Guide to Microstructural Analysis of Cementitious Materials, CRC Press [T2] V. S. Ramachandran and James J. Beaudoin, Eds., Handbook of Analytical Techniques in Concrete Science and Technology, William Andrew Publishing, New York, [T3] D A St. John, A. W. Poole, and I. Sims, Concrete Petrography – A Handbook of Investigative Techniques, Arnold Publishing. London, [T4] William D. Callister, Materials Science and Engineering: An Introduction, Sixth Edition, John Wiley and Sons					
Reference Books	[R1] J. M. Illston and P. L. J. Domone, Construction Materials – Their Nature and Behaviour , Third Edition, Spon Press, [R2] Jan Skalny, Editor, Materials Science of Concrete, Volumes I – VII, American Ceramic Society [R3] J.F. Young, S. Mindess, R.J. Gray and A. Bentur, The Science and Technology of Civil Engineering Materials, Prentice Hall,					
E-resources and other digital material	Characterization of Construction Materials - Course (nptel.ac.in)					

23CESE1015/A	DESIGN OF PRESTRESSED CONCRETE STRUCTURES

Course Category:	Programme Elective-II	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:	Concrete technology	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	Evaluate the losses in prestressed concrete.				
	CO 2	Analyze and design the anchor systems and pipes in prestressed concrete.				
	CO 3	Analyze and design the indeterminate structures and tanks in prestressed concrete.				
	CO 4	analyze and design the slabs and piles in prestressed concrete.				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	1		3		1
	CO 2	2		3		2
	CO 3	2		3		2
	CO 4	2		3		2
Course Content	**UNIT-I** **INTRODUCTION AND LOSSES IN PRESTRESSED CONCRETE** History of prestressed concrete, advantages of prestressed concrete over reinforced concrete, pre tensioning Vs post tensioning; systems in pre stressed concrete, resultant stresses at extreme fibers by pressure line concept; load balancing concept. Introduction to losses of pre stressed concrete; Losses in pre tensioned concrete and post tensioned concrete.					
	UNIT-II **ANCHORAGE SYSTEM IN PRESTRESSED CONCRETE AND DESIGN OF PRESTRESSED CONCRETE PIPES** Bond strength, End block reinforcement in anchorages, Design of Anchorages in pre stressed concrete by IS code method. Circular pre stressing; Types of prestressed concrete pipes; Advantages of prestressed concrete pipes, Design of prestressed concrete pipes (cylinder, Non cylinder);					
	UNIT-III **STATICALLY INDETERMINATE PRE-STRESSED CONCRETE STRUCTURES AND DESIGN OF PRESTRESSED CONCRETE TANKS**					

	Design of continuous beams; Cable profile – Concordant cable and linear transformation. Sketching of pressure lines for continuous beams General features of prestressed concrete tanks; Analysis of prestressed concrete tanks; Design of circular pre-stressed concrete tanks(fixed, hinged).
	UNIT-IV **DESIGN OF PRE-STRESSED CONCRETE SLABS AND CONCRETE PILES** Types of pre-stressed concrete floor slabs; Design of pre-stressed concrete two-way slabs; Design of pre-stressed concrete simple flat slabs; Advantages of prestressed concrete piles, Types of prestressed concrete piles, Design considerations of prestressed concrete piles.
Text Books	[T1] Pre-stressed concrete by N.Krishna Raju, Tata-McGraw-Hill, [T2] Pre-stressed concrete by N.Rajagopalan, Narosa Publishing House
Reference Books	[R1] Pre-stressed concrete by T.Y.Lin&N.H.Burns, John Wiley & Sons [R2]Design of Prestressed Concrete *R. I. Gilbert* ,CRC Press;
E-resources and other digital material	https://archive.nptel.ac.in/courses/105/106/105106118/

23CESE1015/B	PREFABRICATED STRUCTURES

Course Category:	Program Elective-II	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:	Structural analysis	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO 1	identify and explain design principles and IS code specifications involved in prefabrication.
	CO 2	analyze and Design Shear walls.
	CO 3	analyze and Design different types of floors and roof slabs.
	CO 4	design industrial buildings.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	1		2		1
	CO 2	2	2	3		2
	CO 3	2	2	3		2
	CO 4		3	2		2

Course Content

UNIT-I

INTRODUCTION:

Need for prefabrication, Comparison with monolithic construction, Types of prefabrication, site and plant prefabrication, specific requirements for planning and layout of prefabricated plant, IS Code specifications. Design Principles Modular coordination, standardization, Disuniting, of Prefabricates, production, transportation, erection, stages of loading and codal provisions, safety factors, material properties, Deflection control.

UNIT-II

WALLS:

Types of wall panels, Blocks and large panels, Curtain, Partition and load bearing walls, Hoisting and placing, 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, Lateral load resistance, Location and types of shear walls, approximate design of shear walls.

UNIT-III

FLOORS, STAIRS AND ROOFS:

Types of floor slabs, analysis and design example of cored and panel types and two-way systems, 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.

	UNIT-IV **DESIGN OF INDUSTRIAL BUILDINGS:** 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, Design of shell roofs for Industrial sheds.
Text Books	[T1] Introduction of Precast Factory, Vijayakandeeban, [T2] Prefabricted Housing: Construction and Design Manual, Phillip Meuser,DOM Publishers, [T3] CBRI, Building materials and components, India,
Reference Books	[R1]Knowledge based process planning for construction and manufacturing, Gerostiza C.Z., Hendrikson C. and Rehat D.R., Academic Press Inc. [R2] Manual of precast concrete construction, Vols. I, II and III, Koncz T., Bauverlag, GMBH, [R3] Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag,
E-resources and other digital material	https://nptel.ac.in/courses/124/105/124105013/ https://www.youtube.com/watch?v=b9WQhnYq81s

23CESE1015/C	ENERGY EFFICIENCY ACOUSTICS AND DAY LIGHTING IN BUILDING

Course Category:	Programme Elective-III	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:	Construction technology	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	understand concepts functional design of building for thermal aspects especially in tropical climates i.e. in Indian context.				
	CO 2	describe the functional design of building for energy efficiency especially in tropical climates i.e. in Indian context.				
	CO 3	design fenestration for natural ventilation and day lighting				
	CO 4	perform fenestration design of space for external and internal noise control				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	1		2	1	2
	CO 2	1		2	1	2
	CO 3	1		2	1	2
	CO 4	1		2	1	2
Course Content	**UNIT- I** Environmental Factors: Factors and their representation, tropical environments and site environments, etc. Human response to environment: Factors affecting human comfort, Human response to thermal environment, noise, visual environment etc.; Comfort indices Response of building to thermal environment: Processes of heat exchange of building with environment; Effect of solar radiation; Thermal properties of material and sections and their influence					
	UNIT-II Steady and periodic heat transfer in buildings, Heat flow computations: Transmission matrix, Admittance method, etc.-1, Heat flow computations: Transmission matrix, Admittance method, etc.-2					
	UNIT-III Structural control and design for energy efficiency: Selection of envelope elements, Orientations, shape, Glasses and shading devices, Natural ventilation: Purpose of ventilation, Mechanisms, Fenestration Design for natural ventilation, Noise and Building: Basic acoustics and noise, Planning, Sound in free field, protection against external noise					
	UNIT-IV Internal noise sources and protection against air borne & structure borne noise, Day lighting: Lighting principles and fundamentals, Sky, Indian sky, daylight prediction and design of fenestration.					
Text Books	[T1]Bureau Of Indian Standards, " Hand Book Of Functional Requirements Of Buildings, (Sp-41 & Sp- 32)",.					

	[T2]Koenighsberger, O.H. Et Al, "Manual Of Tropical Housing And Building Part-I Climatic Design", Orient Longman. [T3]Markus,T.A.& Morris, E.N., "Building Climate And Energy" Pitman Publishing Limited.. [T4]Croome, J.D. &Roberts, B.M.,"Airconditioning And Ventilation Of Buildings Vol-1". Pergamon Press.
Reference Books	[R1]Croome, J.D. "Noise Building And People" Pergamon Press. [R2]Clarke, J.A., "Energy Simulation In List Of Reference Materials/Books/ Optional Use Of Open Source Free Software Such As "Equest", Energy Plus Etc. 2building Design" Adam Hilger Ltd.. [R3]Foreman, J.E.K.,"Sound Analysis And Noise Control". Van Nostrand Reinhold. [R4]Maekawa, Z. And Lord, P."Environmental And Architectural Acoustics" E&Fn Spon. 1994. Is 2526, Is 4954 And Nbc Etc.
E-resources and other digital material	Energy Efficiency Acoustics and Day lighting in Building - Course (nptel.ac.in)

23CESE1015/D	ADVANCED FOUNDATION ENGINEERING

Course Category:	Programme Elective-III	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:	Soil Mechanics	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	interpret data from soil exploration				
	CO 2	design of shallow foundations on sloping ground, layered soil and under inclined & eccentric loading conditions.				
	CO 3	design of pile foundations under different types of loading.				
	CO 4	design of various components of well foundations				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1		3	3		2
	CO 2	2		3	2	3
	CO 3	2		3	2	3
	CO 4	2		3	2	3
Course Content	**UNIT- I** Soil Exploration, Shallow foundation, Settlements					
	UNIT-II Beams on elastic foundation and shallow foundation					
	UNIT-III Pile foundation: compressive load, and under lateral load and upliftment					
	UNIT-IV Well foundation					
Text Books	[T1]Braja M. Das, “Principles of Foundation Engineering.” PWS Publishing, USA. [T2]Bowles, J.E., “Foundation Analysis and Design”, Fifth ed. McGraw-Hill, Singapore. [T3]Murthy, V.N.S. “Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering’, Marcel Dekker, Inc. New York.					
Reference Books	[R1]Ranjan, G. and Rao, A. S. R., “Basics and Applied Soil Mechanics”, New Age International. [R2]Woodward, J. and Tomlinson, M “Pile Design and Construction Practice” Chapman & Hall Poulos, H.G. and Davis, E.H. “Pile Foundation Analysis and Design” Wiley and Sons.					
E-resources and other digital material	https://archive.nptel.ac.in/courses/105/105/105105207/					

23CESE1015/E	INDUSTRY ORIENTED SUBJECT

Course Category:	Programme Elective- II	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:	Basic concepts in civil engineering	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

SYLLABUS IS AS PER INDUSTRY REQUIREMENTS

23MTMC1026	RESEARCH METHODOLOGY AND IPR

Course Category:	Mandatory Learning Course	**Credits:**	0
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2-0-0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	acquire an overview of the research methodology and techniques to define research problem				
	CO 2	review the literature and identify the problem				
	CO 3	analyze the optimum sampling techniques for collected data				
	CO 4	apply various forms of the intellectual properties for research work				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	2	2	2		3
	CO 2	1	2	2	2	2
	CO 3	1	1	2		2
	CO 4	1	1	1		2
Course Content	**UNIT-I** Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Research Approaches, Significance of Research, Research and Scientific Methods, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India. Research Problem: Defining the Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, an Illustration					
	UNIT-II Reviewing the literature: Place of the literature review in research, improving research methodology, broadening knowledge base in research area, enabling contextual findings. Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Basic Principles of experimental Designs, Important Experimental Designs.					
	UNIT-III Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, sources of error in measurement tools.					

	Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method Testing of Hypotheses: Hypothesis, Basic Concepts, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing.
	UNIT-IV Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, and Significance of Report Writing Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act,1970,Trade Mar k Act,1999, The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act 1999, Copyright Act, 1957, Trade Secrets, Utility Models WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered.
Text Books	[T1] Research methodology: Methods and Techniques, **C.R.Kothari, GauravGarg,** New Age International, 4thEdition,2018. [T2] Research Methodology a step-by-step guide for beginners. **Ranjit Kumar, SAGE Publications** Ltd.,3rd Edition,2011 [T3] Study Material, Professional Programme Intellectual Property Rights, Law and Practice, **The Institute of Company Secretaries of India**, Statutory Body under an Act of Parliament, September2013.
Reference Books	[R1] An introduction to Research Methodology, Garg B.L et al,RBSA Publishers2002 [R2] An Introduction to Multivariate Statistical Analysis Anderson T.W, Wiley 3rdEdition, [R3] Research Methodology, Sinha, S.C, Dhiman, Ess Ess Publications 2002 [R4] Research Methods: the concise knowledge base ,Trochim, Atomic Dog Publishing,2005 [R5] How to Write and Publish a Scientific Paper, Day R.A, Cambridge University Press1992 [R6] Conducting Research Literature Reviews: From the Internetto Paper, Fink A, Sage Publications, 2009 [R7] Proposal Writing, Coley S.M. Scheinberg, C.A, Sage Publications,1990 Intellectual Property Rights in the Global Economy, KeithEugene Maskus, Institute for International Economics
E-resources and other digital material	

23CESE1051	COMPUTER AIDED CONSTRUCTION MANAGEMENT LAB

Course Category:	Laboratory - I	**Credits:**	1.5
Course Type:	Practice	**Lecture - Tutorial - Practice:**	0-0-3
Prerequisites:	-----	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	understand the planning and scheduling. networking methods, resource optimization techniques in various construction projects				
	CO 2	model a project using Project Information tools and Create a Work Breakdown Structure (WBS)				
	CO 3	develop activities, define relationships, analyze Network Diagram				
	CO 4	Estimate cost by assigning various labor, non-labor, material resources and level resources				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	2	3	2	3	2
	CO 2	2	3	2	3	2
	CO 3	2	3	2	3	2
	CO 4	2	3	2	3	2

Course Content

UNIT – I

INTRODUCTION -BASIC CONCEPTS

Project, Project Management, Five Process Groups of Project Management, Schedule and its Importance, Project Management Through Networks, Critical Path Method, PERT for Scheduling, Understanding a Gantt Chart, Project Management Fundamentals Optimization of cost through networks, Resource Allocation Techniques

LABORATORY TESTS

INTRODUCTION TO MS PROJECT:

- Tools in MS Project,
- MS Project Interface and Preferences

UNIT – II

LABORATORY TESTS

PLANNING AND CREATING A NEW PROJECT

- Creating a New Project in MS Project
- Project Window Options
- Accessing Project Information
- Modifying Project Information
- Create a New Project
- Project Title and Start Date
- Enter Tasks, Task Details, Linking Tasks
- Setting Dependencies

WORK BREAKDOWN STRUCTURE

- Open Microsoft Project and Create a New Project

	• Set Up Project Information • Create Phases or Major Deliverables • Break Down Phases into Tasks • Define Task Dependencies • Set Task Durations and Resources • Outline Level and Indentation, • Work Breakdown Structure Column and WBS Code, • View the WBS in Gantt Chart
	UNIT – III **LABORATORY TESTS** **CALENDARS** • Role of Calendars in Scheduling • Adding and Assigning Calendars • Change Working Time • setting the default working hours, non-working days, and exceptions (holidays). **Network Diagram and FORMATTING** • Display the Network Diagram View • Arrange Tasks in a Hierarchy • Add Dependencies • Adjust Layout and Format, Customize Network Boxes • Input or modify activity times. • Float Analysis • Critical Path
	UNIT – IV **LABORATORY TESTS** **FORMULATING ACTIVITIES** • Change Task Color • Change Bar Shapes • Adjust Bar Text • Column Width , Add/Remove Columns • Gridline Options • Adding Activities • View Options • Import, Export & Print **RESOURCE ALLOCATION & COST ESTIMATION** • View the Resource Sheet • Add Resources Assign Resources to Tasks • Adjust Resource Units and Work • View Resource Allocation , Adjust Overallocations • Entering standard rates, assigning resources • Creating the baseline and tracking progress • Cost estimation: Assign Costs to Resources View Resource Costs, Project Costs

Text Books	[T1] Feigenbaum, L., "Construction Scheduling with MS Project Project Planner" Prentice Hall Inc., [T2] Software Project Management, 6th Edition, Bob Hughes, Mike Cotterel, Rajib Mall, McGraw-Hill, [T3] Seetharaman. S, Construction Engineering and Management, Umesh, NDLS, 2006 [T4] Peurifoy R Construction Planning, Equipment & Methods;McGraw Hill, LN, UK
Reference Books	[R1] Bhattacharjee, S.K.Fundamentals of PERT/CPM and Project Management, Khanna, NDLS [R2] Paulson, B.R., "Computer Applications in Construction", Mc Graw Hill,
E-resources and other digital material	https://onlinecourses.nptel.ac.in/noc23_mg124/preview

23CESE1052	COMPUTER APPLICATIONS IN NUMERICAL ANALYSIS LAB

Course Category:	Laboratory –II	**Credits:**	1.5
Course Type:	Practical	**Lecture - Tutorial - Practice:**	0-0-3
Prerequisites:	-----	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	find real root of algebraic and transcendental equations				
	CO 2	fit a curve for given data				
	CO 3	solve system of linear equations and calculate definite integrals				
	CO 4	evaluate numerical solution of 1st and 2nd order IVPs				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	2	1	1	2	
	CO 2	2	1	1	2	
	CO 3	2	1	1	2	
	CO 4	2	1	1	2	
Course Content	**1.** Matlab basics and plotting. **2.** Find a real root of Non-linear equation using Newton-Raphson method. **3.** Curve fitting by Least Square Approximations. **4.** Solve system of linear equations using Gauss-Elimination method. **5.** Integrate numerically using Trapezoidal rule. **6.** Integrate numerically using Simpson's rules. **7.** Solution of 1st order IVP by Runge- Kutta method of order four. **8.** Solution of system of 1st order IVPs by Runge- Kutta method of order four. **9.** Solution of 1st order IVP by Finite difference method. **10.** Solution of 2nd order IVP by Finite difference method					

23CESE1063	CAPSTONE PROJECT-1

Course Category:	Programme Core	**Credits:**	1
Course Type:	Project	**Lecture - Tutorial - Practice:**	0-0-2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO 1	demonstrate advanced proficiency in applying structural analysis and design principles to address complex engineering problems.
	CO 2	enhance their professional communication skills by preparing comprehensive technical reports and delivering effective presentations.
	CO 3	develop the ability to propose innovative and creative solutions to engineering challenges within the field of structural engineering.
	CO 4	showcase advanced proficiency in utilizing specialized structural engineering software tools for analysis, design, and simulation.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	3				2
	CO 2		3			2
	CO 3			3		2
	CO 4				3	2

Course Content	Student can carry out any one of the projects in the themes listed below • Computer Aided Advanced Structural Analysis • Soil Structure Interaction • Retrofitting and Rehabilitation of Structures • Pre-Engineered Steel Buildings • Theory of Plates & Shells • Fracture Mechanics of Concrete Structures • Probability Methods in Civil Engineering • Characterization of Construction Materials • Design of Prestressed Concrete Structures • Prefabricated structures • Energy Efficiency, Acoustics and Day lighting in Building • Advanced Foundation Engineering • Computer Aided Construction Management Lab • Computer Applications in Numerical Analysis Lab
E-resources and other digital material	Open web

SEMESTER II

23CESE2001	FINITE ELEMENT METHOD		
Course Category:	Programme Core-IV	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:	Basic course in Mathematics	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	model and analyse one dimensional elements using approximate solutions.				
	CO 2	Formulate and analyse beams,plane trusses and frames				
	CO 3	solve two dimensional problems in linear elasticity.				
	CO 4	apply Gaussian quadrature to numerical solutions.				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	2		3		
	CO 2	2		3		
	CO 3	2		2		
	CO 4	2		2		
Course Content	**UNIT-I** Introduction, Boundary value problems and solution methods, Direct approach – example, advantage and limitations. Elements of calculus of variation, Strong form and weak form, equivalence between strong and weak forms, Rayleigh-Ritz method. Method of weighted residuals – Galerkin and Petrov-Galerkin approach; Axially loaded bar, governing equations, discretization, derivation of element equation, assembly, imposition of boundary condition and solution, examples					
	UNIT-II Finite element formulation for Euler-Bernoulli beams. Finite element formulation for Timoshenko beams. Finite element formulation for plane trusses and frames formulation and analysis with examples					
	UNIT-III Finite element formulation for two-dimensional problems - completeness and continuity, different elements (triangular, rectangular, quadrilateral etc.), shape functions, Gauss quadrature technique for numerical integration. Finite element formulation for two-dimensional scalar field problems; Iso-parametric formulation Application to Heat conduction and torsion problems. Finite element formulation for two-dimensional problems in linear elasticity.					
	UNIT-IV Finite element formulation for two-dimensional problems in linear elasticity; Examples. Implementation issues, locking, reduced integration, B-Bar method. Finite element formulation for three-dimensional problems; Different elements, shape functions, Gauss quadrature in three dimension, examples.					
Text Books	[T1] An Introduction to Finite Element Method by J. N. Reddy. [T2] A First Course in Finite Elements by Jacob Fish and Ted Belytschko.					

Reference Books	[R1]Concept and Applications of Finite Element Analysis by Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt. [R2]The Finite Element Method: Linear Static and Dynamic Finite Element Analysis by Thomas J. R. Hughes.
E-resources and other digital material	Open web

23CESE2002	COMPUTER AIDED REINFORCED CONCRETE DESIGN (*INTEGRATED COURSE)

Course Category:	Programme Core – V	**Credits:**	3
Course Type:	Theory cum Practice	**Lecture - Tutorial - Practice:**	2-0-2
Prerequisites:	Design of concrete structures	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	analyse and design deep beams				
	CO 2	analyse and design shear walls in high rise buildings using Staad Pro				
	CO 3	analyse and design simple slab using Yield line theory and grid slab using approximate method.				
	CO 4	design ground+5 upper floor R.C framed building including detailing				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	2	2	3	3	2
	CO 2	2	2	3	3	2
	CO 3	2	2	3	3	2
	CO 4	2	2	3	3	2
Course Content	**UNIT-I** **REINFORCED CONCRETE DEEP BEAMS** Introduction; Minimum thickness; Steps of designing of deep beams; Design by IS456; Checking for local failures; Detailing of deep beams. **PRACTICE SESSIONS:** Analysis and Design of RC deep beams by Staad.Pro as per IS456					
	UNIT – II **DESIGN OF SHEAR WALLS** Introduction; Classification of shear walls; Classification according to behavior; Loads on shear walls; Design of rectangular **PRACTICE SESSIONS:** Analysis and Design of Shear walls in High rise building using Software Staad Pro					
	UNIT – III **DESIGN OF SLABS:** Design of ribbed slabs and grid floors by approximate methods and check for ultimate capacity and serviceability **PRACTICE SESSIONS:** Analysis and Design of Typical RC Buildings involving ribbed slab and grid slabs using Staad Pro.					

	UNIT – IV **DESIGN OF TALL BUILDING:** Introduction to Tall Buildings, Gravity loading: Dead and Live load calculation;; Wind loading: Static approach, Structural Forms: Braced-frame structures, Rigid-frame structures **PRACTICE SESSIONS:** Application of STAAD PRO/ ETABS software for analysis and design Braced-frame structures, Rigid-frame structures
Text Books	[T1]P.C. Varghese., "Advanced reinforced concrete design", PHI Learning Pvt.Ltd., Technology& Engineering Series, New Delhi, 2nd edition . [T2]S.Unnikrishna Pillai & Devadas Menon.," Reinforced Concrete Design", TMH, New Delhi, 3rd Edition
Reference Books	[R1]H J Shah. Reinforced concrete, Vol. 2, Charotar Publishing House Ltd.,Anand, 6th edition [R2]James K. Wright, James Grierson, MacGregor., "Reinforced Concrete mechanics and design", Pearson Education, 7th edition.
E-resources and other digital material	https://onlinecourses.nptel.ac.in/noc23_ce109/preview

23CESE2003	DYNAMICS OF STRUCTURES

Course Category:	Programme Core-VI	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	determine the characteristics and understand the behavior of structures subject to dynamic loads.				
	CO 2	assess the appropriate response spectra.				
	CO 3	analyse the response under free vibration of MDOF systems.				
	CO 4	evaluate the response under forced vibration of MDOF systems.				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	3				
	CO 2	3	2	2		1
	CO 3	3	2	2		2
	CO 4	3		3		2
Course Content	**UNIT-I** Introduction to Dynamics of Structures, Free Vibration, Forced Harmonic Vibrations					
	UNIT-II Forced Harmonic Vibrations, Non-periodic Excitations, Numerical Response Evaluations & Earthquake Response Spectra					
	UNIT-III Generalized SDOF systems, Multi-Degree-of-Freedom Systems, Free Vibration of MDOF Systems					
	UNIT-IV Forced Vibration and Seismic Analysis of MDOF Systems, Seismic isolation					
Text Books	[T1] Chopra, A. K, "Dynamics of structures: Theory and applications to earthquake engineering." 5th Edition, Prentice Hall, NJ, USA. [T2] Craig, Roy R., and Andrew J. Kurdila, "Fundamentals of structural dynamics." John Wiley & Sons. [T3] T.Biggs, J. M.. "Introduction to structural dynamics." Edition, McGraw Hill, New York, NY.					
Reference Books	[R1] Clough, R. W., and Penzien, J., "Dynamics of structures." 2nd Edition, McGraw Hill, New York. [R2] Den Hartog, J. P. "Mechanical Vibrations." Dover Publications, New York.					
E-resources and other digital material	https://onlinecourses.nptel.ac.in/noc21_ce64/preview					

23CESE2014/A	ADVANCED PRE ENGINEERED STEEL BUILDINGS (*Integrated Course)

Course Category:	Program Elective – III	**Credits:**	3
Course Type:	Theory cum Practice	**Lecture - Tutorial - Practice:**	2 – 0 - 2
Prerequisites:	Pre Engineered Steel Buildings	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	classify structural stability system of pre-engineered steel buildings and design of bracings.				
	CO 2	design of crane system with and without top channels and crane bracket systems used in pre-engineered steel buildings.				
	CO 3	design of mezzanine Beams, columns and joists; different types of mezzanine floor and decking systems adopted in PEB.				
	CO 4	analyse 3D modeling of frames and design of Cold Formed Sections, Roof Sheeting, ,and choose the techniques of optimization ,welding, erection process.				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	2	2	3	3	2
	CO 2	2	2	3	3	2
	CO 3	2	2	3	3	2
	CO 4	2	2	3	3	2
Course Content	**UNIT – I** **STRUCTURAL STABILITY SYSTEM OF PEB** Shear buckling effect (d/t ratio exceeding 67ε), Effective Cross-sectional area concept for Compression Members d/t ratio exceeding 42ε; Effect of d/t ratio for flexural members according to section classifications, Lateral Torsional Restraint system: Flange Bracing and design considerations. Global and Local behavior of Frame system depending on Slenderness ratio, d/t and b/t ratio. Bracing system: Rod Bracing, Angle Bracing and Portal Bracing. **PRACTICE SESSIONS** • Create 3D modelling of frame in STAAD Pro. • Analyse and design of compression, flexural and bracing systems for various loads applied on frame. • Compare the output with manual calculations.					
	UNIT-II: **CRANE SYSTEM** Different types of Cranes – EOT Cranes, Monorail Cranes, Under slung and Wall mounted - Design of Crane beams with and Without Top Channels (Surge Beam), Design of Crane Brackets – Frame design with different types of Cranes using software. **PRACTICE SESSIONS** • Analyse and design of girders for crane loads					

	• Compare the output with manual calculations.
	UNIT-III: **MEZZANINE FLOOR SYSTEMS** Design of Mezzanine Beams, Columns and joists – Mezzanine decking, Different types of Mezzanine Floor systems – Grating, Chequered plate and Rigid floor System. **PRACTICE SESSIONS** • Analyse and design of beams, columns and mezzanine floor system • Compare the output with manual calculations.
	UNIT-IV: **ANALYSIS AND DESIGN OF PRE-ENGINEERED BUILDINGS** 3D Modelling of Portal Frames ,Optimization Techniques, Comparison of software output with manual calculations. Design of Cold Formed Sections i.e., Purlins and Girts, Design of Roof Sheeting, trapezoidal, Standing seam sheeting, Erection Procedures. Welding Technology and process for the PEB Sections **PRACTICE SESSIONS** • Analyse and design of Purlins, Girts and roof sheeting. • Compare the output with manual calculations.
Text Books	[T1] Alexander Newman, "Metal Building Systems: Design and Specifications", 3rd Edition, MC Graw Hill Education. [T2] S.Vivek & P.Vaishavi, "Pre Engineered Steel Buildings", LAP Lambert Academic Publishing
Reference Books	[R1] Design of Steel structures limit states method, 2 Ed by Subramanian, Oxford University press. [R2] IS 800: 2007 – General Construction In Steel – Code of Practice [R3] IS 875 (PART 1 & 2) : 1987 Code of Practice for Design Loads (other than Earthquake) for Buildings and Structures. [R4] IS 875 - Part3: 2015 Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures - Part 3: Wind Loads. [R5] IS 1893 (Part 1) :2016 Criteria for Earthquake Resistant Design of Structures Part 1 General Provisions and Buildings(Sixth Revision).
E-resources and other digital material	Open web

23CESE2014/B	DESIGN OF HIGH RISE STRUCTURES

Course Category:	Programme Elective - III	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 – 0 – 0
Prerequisites:	Design of Reinforced Concrete Structure.	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	assess various factors considered for designing high rise structures				
	CO 2	analyse the different loads acting on high rise structures				
	CO 3	assess structural systems, floor systems and their behavior				
	CO 4	evaluate the stability of various systems and design components in a high-rise structure				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	1		2		1
	CO 2	1		2		1
	CO 3	1		2		2
	CO 4	1		3		2

Course Content

UNIT – I

INTRODUCTION

History, Need for tall buildings, factors affecting height, growth and structural form; Design criteria: Loading, Strength & stability, Stiffness & Drift limitations; Human comfort criteria; Creep, Shrinkage & Temperature effects; Fire; Foundation settlement and soil structure interaction.

UNIT – II

LOADS

Gravity loading: Dead and Live load calculation; Impact and Construction loads; Wind loading: Static approach, Dynamic approach - Analytical and wind tunnel experimental method; Earthquake loading: Equivalent lateral force, Modal analysis; Combination of loading in various design philosophies.

UNIT – III

STRUCTURAL SYSTEMS& FLOORING SYSTEMS

Structural Forms: Braced-frame structures, Rigid-frame structures, In filled -frame structures, Shear wall structures, Wall-frame structures, Framed-tube structures, Outrigger braced structures, Core Structures and Hybrid Structures, Introduction to various flooring systems in concrete and steel. Structures.

UNIT – IV

ANALYSIS & DESIGN

Approaches to analysis; Modeling for approximate analysis; modeling for accurate analysis – Plane frames, Plane Shear walls, 3D Frame and wall structures; Stability analysis: overall buckling analysis of frames, overall

	buckling analysis of wall frames; Design of In filled frame; IS 16700 Code provisions.
Text Books	[T1]Tall Building Structures by B.S. Smith and A. Coull, John Wiley & sons. [T2]Structural Analysis and Design of Tall Buildings by B.S. Taranath, Mc Graw Hill Co.
Reference Books	[R1]Structural Concepts and Systems for Architects and Engineers" by Lyn T.Y. and Burry D. Stotes, John Wiley. [R2]High Rise Building Structures" by Sehuller .W.G, John Wiley & sons.
E-resources and other digital material	https://www.youtube.com/watch?v=Af01fIIlmhU https://www.youtube.com/watch?v=-syqppgcoVE https://www.youtube.com/watch?v=7NEfZXFOvxU

23CESE2014/C	STABILITY OF STRUCTURES

Course Category:	Program Elective - III	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3- 0 - 0
Prerequisites:	Structural Analysis.	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	analyse the buckling of columns, beam-columns and find critical loads using energy and non-energy methods.				
	CO 2	evaluate the lateral buckling of beams by energy and non-energy methods.				
	CO 3	analyse the buckling of rectangular plates and find critical compressive loads for various boundary conditions.				
	CO 4	assess the buckling of axially loaded cylindrical shells.				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	1		3		
	CO 2	1		3		
	CO 3	1		3		
	CO 4	1		3		

Course Content

UNIT – I

BUCKLING OF COLUMNS AND BEAM COLUMNS:
Introduction; Methods of finding critical loads; Critical loads for straight columns with different end conditions and loading; Inelastic buckling of axially loaded columns; Energy methods; Prismatic and non-prismatic columns under discrete and distributed loads. Theory of Beam column – Stability analysis of beam column with different types of loads

UNIT-II

LATERAL BUCKLING OF BEAMS:
Beams under pure bending; Cantilever and simply supported beams of rectangular and I sections; Beams under transverse loading; Energy methods; Solution of simple problems.

UNIT-III

BUCKLING OF RECTANGULAR PLATES:
Plates simply supported on all edges and subjected to constant compression in one or two directions; Plates simply supported along two opposite sides perpendicular to the direction of compression and having various edge conditions along the other two sides

UNIT-IV

BUCKLING OF SHELLS:

	Introduction to buckling of axially compressed cylindrical shells, Linear theory of cylindrical shells- donnell equations, critical load of an axially loaded cylinder, failure of axially compressed cylindrical shells.
Text Books	[T1] Theory of elastic stability by Timoshenko &Gere, Mc GrawHill. [T2] Principles of Structural stability theory by Alexandar Chajes
Reference Books	[R1]Elastic stability of structural elements by N.G.R. Iyengar, Mac millan India Ltd. [R2]Background to buckling by Allen and Bulson, McGraw-Hill.
E-resources and other digital material	https://nptel.ac.in/courses/105/105/105105108/

23CESE2014/D	BRIDGE ENGINEERING

Course Category:	Programme Elective-III	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:	Design of Steel Structures	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	analyse and design R.C slab bridge decks, box culverts and pipe culverts.				
	CO 2	analyse and design truss bridges, plate girder bridges, cable-stayed and balanced cantilever bridges.				
	CO 3	analyse and design PCS, composite, rigid frame and continuous girder bridges.				
	CO 4	analyse and design bridge bearing foundations and rehabilitation of bridge.				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	3	2	3	3	2
	CO 2	2	2	3	2	2
	CO 3	2	2	3	3	2
	CO 4	2	2	3	2	3
Course Content	**UNIT-I** Introduction, Reinforced Concrete Slab Bridge Decks, Box Culverts and Pipe Culverts					
	UNIT-II Steel Truss Bridges, Plate Girder Bridges, Arch Bridges, Suspension Bridges, Cable-Stayed Bridges, Balanced Cantilever Bridges					
	UNIT-III Pre stressed Concrete Bridges and Composite Bridges, Rigid Frame Bridges and Continuous Girder Bridges, Piers, Abutments and Foundations					
	UNIT-IV Bridge Bearings, Joints and Appurtenances, Construction, Maintenance and Rehabilitation of Bridges, Advanced Topics in Bridge Engineering					
Text Books	[T1] N. Krishna Raju, Design of Bridges, Oxford & IBH Publishing Co. Pvt. Ltd. [T2] D.J. Victor, Essentials of Bridge Engineering, Oxford & IBH Publishing Co. Pvt. Ltd. [T3] S. Ponnu swamy, Bridge Engineering, McGraw Hill Education.					
Reference Books	[R1]T.R. Jagadeesh and M.A. Jayaram, Design of Bridge Structures, PHI Learning Pvt. Ltd. [R2]W.F. Chen, and L. Duan, Bridge Engineering Handbook, CRC Press, Taylor & Francis Group. [R3]G. Parke and N. Hewson, ICE manual of Bridge Engineering, Thomas Telford Publishing.					
E-resources and other digital material	https://onlinecourses.nptel.ac.in/noc22_ce63/preview					

3CESE2014/E	RELIABILITY BASED STRUCTURAL DESIGN

Course Category:	Programme Elective- III	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:	Basic mathematics	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	the course introduces basic concepts of probability theory at the beginning, which is followed by the Level-2 reliability methods.				
	CO 2	the readers are then introduced to the intricacies of Monte-Carlo simulation and its advanced versions for variance reduction and subset simulation.				
	CO 3	the treatment of implicit limit states using RSM and recently developed SRSM techniques are explained separately with examples.				
	CO 4	with this knowledge of reliability analysis in hand, the course then aims to explain the applications of these methods for code calibrations and reliability analysis under multiple failure modes.				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	3		1		2
	CO 2	3		2		2
	CO 3	3		2		2
	CO 4	3		1		2
Course Content	**UNIT- I** Theory of Probability-I: Probability Distributions (Discrete and Continuous), one-dimensional Random Variables (Discrete and Continuous) PDF & CDF, Probability Theory-II: Functions of Random Variable, Algebra of Variance, Expectations, and moments, Multi-dimensional Random Variables- Joint distributions, Conditional & Marginal PDF and PMF, Expectation Operator in Two dimensions, Covariance, and Correlation.					
	UNIT- II Reliability Levels: Level-2 Reliability Methods, Concept of Reliability Index, Cornell´s Reliability Index, Hasofer-Lind Reliability Index, First Order Reliability Methods- Mean Value First Order Second Moment (MVFOSM) method, First Order Reliability Method (FORM), Rackwitz-Fiessler Algorithm. Iso-probabilistic transformation of random variables: Morgenstern & NATAF Transformation, Rosenblatt Transformation: JPDF & JCDF. Application in FORM.					
	UNIT- III Introduction to Second Order Reliability Method (SORM): Breitung´s approximation, Tvedt´s Three Term approximation. Examples, Simulation-Based Reliability Analysis- Monte-Carlo Simulation, Variance Reduction Technique, Importance Sampling method, Metamodel-Based Reliability					

	Analysis-I: Implicit Performance Function, Polynomial Response Surface Method (RSM).
	UNIT- IV Metamodel-Based Reliability Analysis-II: Moving Least Square Methods in metamodeling. Applications of MLS in surrogate modelling. Case Studies, Code Calibration: Determination of partial safety factors, Optimal safety factors, Case Studies: FEM Modelling for reliability analysis, Applications. Introduction to Stochastic FEM
Text Books	[T1]Papoulis A. Probability, Random Variables and Stochastic Processes, Tata-McGraw-Hill, New Delhi, 2002. [T2]Ranganathan R. Structural Reliability Analysis & Design. Jaico Publishing House, Mumbai, 1999. [T3]Melchers R E. Structural Reliability: Analysis and Prediction, 2nd Edition, John Wiley, Chichester, 1999.
Reference Books	[R1]Ang A H S & Tang W H. Probability Concepts in Engineering Planning and Design, Vol II, John Wiley, New York, 1984. [R2]Haldar A & Mahadevan S. Probability, Reliability & Statistical Methods In Engineering Design. John Wiley and Sons, New York, 2000.
E-resources and other digital material	https://onlinecourses.nptel.ac.in/noc23_ce102/preview

Course Category:	Programme Elective- IV	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:	DDSS	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	design a good structural configuration for seismic resistance.				
	CO 2	analyse earthquake design forces on structures using appropriate methods as per IS1893-2002(Part-I).				
	CO 3	apply the concept of Ductility and Base isolation in designing earthquake resistant structures.				
	CO 4	design the structure using IS13920code provisions.				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	3		3		2
	CO 2	3		3	1	1
	CO 3	2		2		2
	CO 4	2		2		2

Course Content

UNIT-I

SEISMO – RESISTANT BUILDING ARCHITECTURE

Introduction; Lateral load resisting systems – moment resisting frame, Building with shear wall or bearing wall system, building with dual system; Building configuration –Problems and solutions; Building characteristics–Mode shape and fundamental period, building frequency and ground period, damping, ductility, seismic weight, hyperstaticity / redundancy ,non-structural elements, foundation soil /liquefaction. Foundations; Quality of construction and materials – quality of concrete, construction joints, general detailing requirements.

UNIT-II

DESIGN FOR CES FOR BUILDINGS

Introduction; Equivalent static method; Mode superposition technique; Dynamic inelastic-time history analysis; Advantages and disadvantages of these methods; Determination of lateral forces as perIS1893(Part1)– Equivalent static method, Model analysis using response spectrum, Estimate of deflection and drift , P-ΔEffects in frame structures, Torsional effects

UNIT-III

DUCTILITY

Ductility relationships; Ductility considerations in earthquake resistant design of RCC buildings Introduction; Impact of ductility; Requirements for ductility; Assessment of ductility–Member /element ductility, Structural ductility; Factor affecting ductility; Ductility factors; Ductility

	considerations as perIS13920::2016-Aspects of detailing-Detailing of columns for ductility-Transverse reinforcement for confinement, spacing of column vertical reinforcement; Bond and anchorage-Development of bar strength, lapped splices, Additional considerations for anchorages. Design and detailing of typical flexural member, typical column, footing and detailing of a exterior joint as per S13920:2016
	UNIT-IV **BASEISOLATION AND RETROFITTINGOFSTRUCTURES** Introduction; Isolation from seismic motion, Considerations for seismic isolation – Seismic isolation using flexible bearings-Seismic isolation using flexible piles and energy dissipators; Basic elements of seismic isolation; seismic – isolation design principle; Feasibility of seismic isolation; Seismic isolation configurations ; codal provisions for seismic isolation. Seismic evaluation of structures or condition appraisal; Seismic Retrofitting.
Text Books	[T1]Earthquake resistant design of structures by Pankaj Agarwal and Manish Shrikhande, Prentice-Hall of India [T2]Seismic design of reinforced concrete and masonry buildings by T.Paulay and M.J.N. Priestley, John Wiley &Sons. [T3]Earthquake-Resistant Design of Building Structures by Dr. Vinod Hosur, WILEY
Reference Books	[R1]Earthquake Resistant Design and Risk Reduction by David Dowrick, WILEY Student Edition. [R2]Earthquake Resistant Design of Structures by S.K. Duggal OXFORD Higher Education. [R3]Elements of Earthquake Engineering by Jai Krishna & Brijesh Chandra, South Asian Publishers Private Limited.
E-resources and other digital material	http://nptel.ac.in/courses/105102016/

Course Category:	Programme Elective- IV	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:	Design of Steel Structures, Building Materials	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	identify the right material for manufacturing false work and form work specific system suitable for project				
	CO 2	assess the pressure of concrete on form work				
	CO 3	design decking, form work and false work.				
	CO 4	evaluation of the sequence of construction of civil engineering structures and safety steps involved in the design of form work and false work.				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	2		1		
	CO 2		3	3		
	CO 3		3			2
	CO 4		2			2
Course Content	**UNIT-I** Introduction: Formwork and false work, Temporary work systems, Construction planning and site constraints, Materials and construction of the common formwork and false work systems, Special and proprietary forms.					
	UNIT-II **Formwork – Design:** Concrete pressure on forms, Design of timber and steel forms, Loading and moment of formwork.					
	UNIT-III Design of Decks and False works: Types of beam, decking and column formwork, Design of decking, False work design, Effects of wind load, Foundation and soil on false work design.					
	UNIT-IV Special Forms: The use and applications of special forms. Construction Sequence and Safety in use of Formwork: Sequence of construction, Safety use of formwork and false work.					
Text Books	[T1]Robert L. Peurifoy and Garold D. Oberiender, Formwork for Concrete Structures, McGraw-Hill.					

	[T2]Tudor Dinescu and Constantin Radulescu, Slip Form Techniques, Abacus Press, Turn Bridge Wells, Kent.
Reference Books	[R1]Austin, C.K., Formwork for concrete, Cleaver - Hume Press Ltd., London. [R2]Michael P. Hurst, Construction Press, London and New York.
E-resources and other digital material	Open Web

23CESE2015/C	**ADMIXTURES AND SPECIAL CONCRETE**

Course Category:	Programme Elective- IV	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:	Building Materials	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	understand the basics of construction materials,the mechanisms of action of chemical and mineral admixtures and their impact on the performance of concrete.				
	CO 2	describe the mechanisms of action of chemical admixtures and their impact on the performance of concrete.				
	CO 3	explain the mechanisms of action of mineral admixtures and their impact on the performance of concrete.				
	CO 4	outline the formulation and properties of special concretes that are increasingly being used nowadays in construction				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	3				2
	CO 2	3	2		2	2
	CO 3	3		1	2	2
	CO 4	3	2		2	2
Course Content	**UNIT - I** Cement chemistry and concrete performance - An overview , Chemical admixtures: Introduction & Water reducers, Chemical admixtures: Set controllers, Standards on chemical admixtures & Air entraining agents					
	UNIT - II Chemical admixtures: Understanding concrete rheology, Viscosity modifying agents, Shrinkage reducing admixtures, & Other specialty admixtures, Mineral Admixtures: Introduction, classification and pozzolanic activity, Mineral Admixtures: Fly ash and Silica fume					
	UNIT - III Mineral Admixtures: GGBFS, Metakaolin and LC3, Mineral Admixtures: Agricultural ashes, characterization techniques Life Cycle Assessment, Special Concretes: High strength concrete and ultra high performance concrete					
	UNIT - IV Special Concretes: Self compacting concrete and mass concreting, Special Concretes: Mass concreting and lightweight concrete, Special Concretes: High density concrete and concrete for 3D printing					
Text Books	[T1]Mehta, P. K., and Monteiro, P. J. M., Concrete: Microstructure, Properties, and Materials, Fourth Edition (Indian Edition), McGraw Hill. [T2] Neville, A. M., Properties of Concrete, Pitman Publishing, Inc.,MA.					

	[T3] Thomas M.D.A., Supplementary Cementing Materials in Concrete, CRC Press, Francis & Taylor Group, Florida, USA. [T4] Bentur, A., Diamond, S., and Berke, N.S., Steel Corrosion in Concrete, E&FN Spon, UK.
Reference Books	[R1]Taylor, H. W. F., Cement Chemistry, Academic Press, Inc., San Diego, CA. [R2] Lea, F. M., The Chemistry of Cement and Concrete, Chemical Publishing Company, Inc., New York. [R3] Mindess, S., and Young, J. F., Concrete, Prentice Hall, Inc., NJ. [R4] J. Newman and B. S. Choo, Eds., Advanced Concrete Technology, Four Volume Set, Elsevier.
E-resources and other digital material	Nptel

Course Category:	Programme elective-IV	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:	Engineering Mathematics	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	understand the fundamentals of optimization techniques and linear programming problem				
	CO 2	apply various classical and non-classical optimization techniques to solve Civil engineering problem.				
	CO 3	**Assess** the plan and work schedule of a project network in an optimal way.				
	CO 4	utilize Matlab and Excel solver to solve Structural Engineering Problems				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	2		2		1
	CO 2	2		2		1
	CO 3	2		2		1
	CO 4	2			2	1
Course Content	**UNIT- I** Introduction to optimization, Linear Programming Problem, Formulation of LP Problems (simple models), Graphical method, Simplex method, Artificial Variable Techniques, Big-M method, Two-Phase Method, Dual Simplex method.					
	UNIT- II Non Linear Programming, Single- Variable Optimization, Multivariable Optimization with No Constraints, Multi Variable Optimization With Inequality Constraints, Kuhn – Tucker Conditions, Unimodal Function, Fibonacci Method, Univariate Method					
	UNIT- III **Project Management:** Introduction, PERT and CPM , Rules for drawing network diagram, Time Estimates and critical path in network analysis, Forward pass computations, Backward pass computations, Determination of floats and stack times, Determination of critical path, Examples on optimum duration and minimum duration cost, Project evaluation and Review technique(PERT).					
	UNIT- IV Engineering application using Matlab and Excel solver, Civil Engineering Application					
Text Books	[T1].S. S. Rao, "Engineering Optimisation: Theory and Practice", Wiley, [T2].K. Deb, "Optimization for Engineering design algorithms and Examples", Prentice Hall,					
Reference Books	[R1]S. R. Komaragiri and N. Kumar, "Multicriterion Analysis in Engineering and Management", Prentice Hall,					

	[R2]F. Bennis, and R. K. Bhattacharjya, "Nature-Inspired Methods for Metaheuristics Optimization: Algorithms and Applications in Science and Engineering", Springer Inc. 5.A. D. Belegundu and T. R.Chandrupatla, "Optimization Concept and Applications in Engineering", Pearson Education Asia,
E-resources and other digital material	https://onlinecourses.nptel.ac.in/noc21_ce60/preview

23CESE2014/E	**INDUSTRY ORIENTED SUBJECT**

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3-0-0
Prerequisites:	Concepts of Civil Engineering	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

SYLLABUS IS AS PER INDUSTRY REQUIREMENTS

23CESE2036	TECHNICAL REPORT WRITING

Course Category:	Audit Course	**Credits:**	0
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2-0-0
Prerequisites:	Nil	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	Nil

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO 1	describe the significance of Technical Report Writing.
	CO 2	develop proficiency in writing technical reports.
	CO 3	apply the basic principles to prepare documentation using LATEX.
	CO 4	understanding the need of Bibliography and Reference Books for quality report writing

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1		3		2	1
	CO 2		3		2	1
	CO 3		3		2	1
	CO 4		3		2	1

Course Content	**UNIT – I** **WRITING SCIENTIFIC AND ENGINEERING PAPERS** Title, Abstract, Introduction, Materials And Methods, Result, Discussion, Conclusion, Reference Books, Acknowledgements, Appendices, Hedging and Criticizing, Paraphrasing and Plagiarism.
	UNIT – II **EFFECTIVE USE OF CHARTS, GRAPHS AND TABLES, WRITING TECHNICAL REPORTS** Bar Chart, Line Chart, Pie Chart, Area Chart, Cylindrical Chart, Column Bars, Bubble Chart, Flow Diagram, Screen Capture, Tables, Objectives Of Technical Report, Types Of Reports, Steps In Writing A Technical Report, Guidelines For Writing A Technical Report.
	UNIT – III **LATEX** Introduction, Document Structure – Creating a Title, Sections, Labeling, Table of Contents,Font Effects, Colored Text, Font Sizes, Lists, Comments & Spacing, Special Characters
	UNIT – IV Tables, Figures, Equations, Inserting Reference Books

	Inserting Equations, Mathematical Symbols, Practical, introduction, The Bib TeX file, Inserting the bibliography, Citing Reference Books, Styles, Practical.
Text Books	[T1]BarunKMitra,EffectiveTechnicalCommunication-AGuideforScientistsandEngineers,OxfordUniversityPress, ISBN:978019568291. [T2]LATEX for Beginners, Workbook Edition 5, Document Reference: 3722-2014.
Reference Books	[R1] Goldbort R, Writing for Science, Yale University Press (available on Google Books) [R2]Day R, How to Write and Publish a Scientific Paper, Cambridge University Press
E-resources and other digital material	"LaTeX Basics" https://www.overleaf.com/learn/latex/sections_and_chapters "Citation & Style Guide" – https://libguides.cu-portland.edu/citationstyles

23CESE2067	TERM PAPER

Course Category:	Term paper	**Credits:**	1
Course Type:	Term paper	**Lecture - Tutorial - Practice:**	0-0-2
Prerequisites:	NIL	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	identify real world problems related to Structural Engineering				
	CO 2	analyse the problems from its state of the art for arriving at feasible solutions				
	CO 3	prepare an organized report employing elements of technical writing & critical thinking				
	CO 4	summarize and communicate the content to audience in an effective manner				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	1		3		1
	CO 2	1		3		1
	CO 3		3			1
	CO 4		2			3
Course Content	Student shall collect the literature on the advanced topic in relevant fields and critically review the literature and submit it to the department in a form of report and shall make an oral presentation before the Academic Committee					

23CESE2051	BUILDING INFORMATION MODELING (BIM) LAB

Course Category:	Laboratory-1	**Credits:**	1.5
Course Type:	Practical	**Lecture - Tutorial - Practice:**	0-0-3
Prerequisites:	Engineering Drawing, Structural analysis and Design	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	convert 2D representation to 3D simulation by Autodesk Revit				
	CO 2	analyze 3D Structural elements using Autodesk Revit				
	CO 3	detail 3D Structural elements using Autodesk Revit				
	CO 4	Create a Drawing for a structure as per IS Code.				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	1	1	1	3	1
	CO 2	2	1	3	3	2
	CO 3	2	2	2	2	3
	CO 4		2	2	2	3
Course Content	1.Demonstrate the Skills and knowledge required to convert Autocadd 2D drawing to 3D model using Autodesk Rivet Structures 2. Modelling of Architectural Components for a structure using Revit Architecture. 3.Generating the walkthrough for the structure. 4. Modelling of Structural Components for a structure using Revit Structures. 5. Detailing of Structural Components for a structure using Revit Structures. 6. Detailing and creation of Drawings for a structure as per IS Code.					
Text Books	[T1] Auto desk Rivet structures manual. [T2] Exploring Autodesk Revit 2020 for structures, 10th edition, by Prof. Sham Tickoo, Purdue University Northwest, USA. [T3]Commercial Design using Autodesk Revit Architecture, Daniel John Stine, SDC Publications ISBN #: 978-1-58503-512-0					
Reference Books	[R1] Autodesk Revit 2021 Structure Fundamentals by ASCENT publications, ISBN: 978-1-63057-358-4 | ISBN 10: 1630573582					
E-resources and other digital material	https://www.coursera.org/learn/autodesk-revit-for-structural-design-exam-prep					

23CESE2052	CONCRETE 3D PRINTING LAB

Course Category:	Laboratory-2	**Credits:**	1.5
Course Type:	Practical	**Lecture - Tutorial - Practice:**	0-0-3
Prerequisites:	Concrete Technology	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	understand the fundamentals of Concrete 3D Printing Technology				
	CO 2	exhibit the printing process of 3D concrete elements from CAD 3D model.				
	CO 3	design a Mix for Concrete 3D Printing by considering Printability, Extrudability and Buildability Parameters.				
	CO 4	evaluate the fresh and hardened properties of the 3D concrete elements.				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	2	1	2	1	1
	CO 2	2	1	2	3	1
	CO 3	2	1	2		2
	CO 4	3	1	3		2
Course Content	1. Study of Concrete 3D printer Components and workflow. 2. Model Creation, Slicing, Generating Printing Path from 3D CAD Models. 3. Study on the basic properties of different materials used for 3D Printable Concrete. 4. Trail Mix Design of 3D Printable Concrete 5. Determining the fresh properties i.e., Printability, Extrudability and Buildability of 3D Printable Concrete. 6. Examine the Deformability and strength of fresh 3D Printable Concrete 7. Determining the hardened properties of 3D Printable Concrete.					
E-resources and other digital material	Open web.					

23CESE2063	CAPSTONE PROJECT-2

Course Category:	Project	**Credits:**	1
Course Type:	Project	**Lecture - Tutorial - Practice:**	0-0-2
Prerequisites:	Concepts of Civil Engineering	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	demonstrate advanced proficiency in applying structural analysis and design principles to address complex engineering problems.				
	CO 2	enhance their professional communication skills by preparing comprehensive technical reports and delivering effective presentations.				
	CO 3	develop the ability to propose innovative and creative solutions to engineering challenges within the field of structural engineering.				
	CO 4	showcase advanced proficiency in utilizing specialized structural engineering software tools for analysis, design, and simulation.				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	3				2
	CO 2		3			2
	CO 3			3		2
	CO 4				3	2
Course Content	**Student can carry out any one of the projects in the themes listed below** Finite Element Method and Computational Structural Dynamics Computer Aided Reinforced Concrete Design Dynamics of Structures Advanced Pre-Engineered Steel Buildings Design of High-Rise Structures Stability of Structures Bridge Engineering Reliability Based Structural Design Earthquake Resistant Design of Structures Design of Formwork Admixtures and Special Optimization methods for Civil Engineering Building Information Modeling (BIM) lab Concrete 3D Printing Lab					
E-resources and other digital material	Open web					

SEMESTER III

23CESE3011	SELF LEARNING (MOOCS COURSE)

Course Category:	Program Elective-V	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	0-0-0
Prerequisites:	Basic concepts of civil engineering	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	- - 100

The department will recommend the self-learning courses from the available open courseware. The self-learning courses shall be taken from the list of approved MOOCs providers (SWAYAM/NPTEL/EDX/Others). They must be approved/ratified in the respective Board of Studies

23CESE3062	PROJECTPART-A

Course Category:	Project Part-A	**Credits:**	10
Course Type:	Project	**Lecture - Tutorial - Practice:**	0-0-20
Prerequisites:	Term paper	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	identify a topic in relevant areas of Structural Engineering				
	CO 2	review literature to identify gaps and define objectives & scope of the project				
	CO 3	apply appropriate research methodology to provide a solution to the chosen problem				
	CO 4	prepare a technical report effectively using modern tools				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	3		3	3	2
	CO 2	2		3		2
	CO 3					2
	CO 4		3			2
Course Content	The project shall be carried out in the major areas pertaining to the program approved by Project Review Committee and may address the societal problems/issues related to the program.					

23CESE3051	INTERNSHIP

Course Category:	Internship	**Credits:**	2
Course Type:	Practical	**Lecture - Tutorial - Practice:**	0-0-4
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	apply theoretical and practical knowledge in accomplishing the tasks assigned in the industry.				
	CO 2	create designs for complex civil engineering structures by following certain specifications using advanced software's and tools.				
	CO 3	understand the work management system and develop the communication, writing, logical and creative skills.				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	2	2	2		2
	CO 2	1	2	2	3	2
	CO 3	1	2	2		3
Course Content	The students shall undergo Internship for a period of six weeks in Industry/Research organizations/ institute of higher learning approved by the Head of the Department during any time after the second semester					

SEMESTER IV

23CESE4061	PROJECTPART-B

Course Category:	Project Part-B	**Credits:**	16
Course Type:	Project	**Lecture - Tutorial - Practice:**	0-0-32
Prerequisites:	Project Part-A	**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:					
	CO 1	identify methods and resources to carry out analysis and experiments				
	CO 2	reorganize the procedures with a concern for society, environment and ethics				
	CO 3	generate possible alternative solutions to chosen problem, compare, Analyze the man derive performance metrics of the result				
	CO 4	prepare a comprehensive report of the project work and also explore possibility of publishing the work.				
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**
	CO 1	3	2	3	2	2
	CO 2		2	3	2	3
	CO 3	3	2	3	3	3
	CO 4		3	3	3	3
Course Content	Project Part B shall be the extension of project Part A.					