Prof. Ram Meghe Institute Of Technology And Research Badnera -444701

An Autonomus College Affiliated to Sant Gadge Baba Amravati University, Amravati, Maharashtra (India)

PROGRAMME SCHEME & SYLLABI

2023-2024

M. Tech.

(Structural Engineering)

Published By
Dr. G.R. Bamnote
Principal
Prof. Ram Meghe Institute Of Technology And Research, Badnera - Amravati.

Department Vision :

To become a pace-setting center of excellence acclaimed across the region & imitated as a role model by its peers

Department Mission :

1. To elevate technical, entrepreneurial and communication skills of students so as to scale up their employability potential and encourage the spirits of enterprise

2. To elevate moral ethics and values in students so as to help them in shaping their attitude and belief towards varied aspect of life and provide them with unique prospective.

Program Educational Objectives :

1. **Preparation:** To strive for overall personality development of students so as to nurture not only quintessential technocrats but also responsible citizens.
2. **Core Competence:** To make the students apply the necessary problem-solving, design, and application skills for successful careers in Civil Engineering.
3. **Breadth:** To provide the educational foundation and communication skills that prepare the students for diverse career paths.
4. **Professionalism:** To inculcate the value systems & ethics, leadership and team work skills, bring holistic development of personality and to promote entrepreneurial thinking among students.
5. **Learning environment:** To provide students with an environment that develops confidence andstimulates innovative thinking for successful professional career.

Program Outcomes :

- **Engineering Graduate will be able to :**

1. **Engineering Knowledge**: Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identity, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

3. **Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning:** Recognize the need for and have the preparation and ability to Engage in independent and life- long learning in the broadest context of technological Change.

Program Specific Outcomes :

1. **Computer Based Civil and Structural Engineering Design:** Design Civil end Structural engineering systems using contemporary software used by design and analysis firms.

2. **Entrepreneurial spirit:** Demonstrate ability to organize activities, work with and lead teams, understand prevalent trade practices, understand site culture.

Prof. Ram Meghe Institute of Technology and Research, Badnera-Amravati
(An Autonomous Institute)
Two Year Post Graduate Degree Program in Master of Technology
Choice Based Credit System (Semester Pattern)
Branch : Structural Engineering

SEMESTER: I

Sr. No.	Subject Code	Subject	Teaching Scheme					Examination Scheme										
			Hours/ Week			Total Hours/ Week	Credits	THEORY							PRACTICAL			
			Lecture	Tutorial	P/D			Duration of paper (Hrs)	Max. Marks ESE/ ESSE	Internal Marks		Total	Min. Passing Marks in ESE/ ESSE	Overall Min Passing Marks	Max. Marks		Total	Min. Passing Marks
										Max. Marks MSE/ MSIE	Max. Marks TA				Int.	Ext.		
Theory																		
01	1SMTCS01	Compulsory Course 1 (Matrix Methods of Structural Analysis)	3	--	--	3	3	3	60	30	10	100	24	50	--	--	--	--
02	1SMTCS02	Compulsory Course 2 (Structural Dynamics)	3	--	--	3	3	3	60	30	10	100	24	50	--	--	--	--
03	1SMTCS03	Compulsory Course 3 (Earthquake Resistant Design of Reinforced Concrete Structures)	3	--	--	3	3	4	60	30	10	100	24	50	--	--	--	--
04	1SMTCS04	Professional Elective 1	3	--	--	3	3	3	60	30	10	100	24	50	--	--	--	--
05	1SMTCS05	Professional Elective 2	3	--	--	3	3	3	60	30	10	100	24	50	--	--	--	--
06	1SMTCS06	Research Methodology	2	--	--	2	2	3	60	30	10	100	24	50	--	--	--	--
Practicals																		
07	1SMTCS07	Lab 1 (Structural Dynamics - Lab)	--	--	2	2	1	--	--	--	--	--	--	--	25	25	50	25
08	1SMTCS08	Lab 2 (Earthquake Resistant Design of Reinforced Concrete Structures - Lab)	--	--	2	2	1	--	--	--	--	--	--	--	25	25	50	25
09	1SMTCS09	Lab 3 (Computer Aided Analysis & Design of Structures – Lab)	--	--	2	2	1	--	--	--	--	--	--	--	25	25	50	25
		Total	**17**	**..**	**6**	**23**	**20**					**600**					**150**	
																Total	**750**	

Professional Elective 1	1) Theory of Elasticity, Elastic Stability, Plates & Shells; 2) Soil Structure Interaction; 3) Analysis and Design of Machine Foundations.
Professional Elective 2	1) Seismic Evaluation, Repair and Retrofitting of structures; 2) Structural Health Monitoring; 3)Earthquake Resistant Design of Masonry Structures; 4) Earthquake Resistant Design of Bridges and Dams

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SEMESTER: II

Sr. No.	Subject Code	Subject	Teaching Scheme					Examination Scheme										
			Hours/ Week			Total Hours/ Week	Credits	THEORY							PRACTICAL			
			Lecture	Tutorial	P/D			Duration of paper (Hrs)	Max. Marks ESE/ ESSE	Internal Marks		Total	Min. Passing Marks in ESE/ ESSE	Overall Min Passing Marks	Max. Marks		Total	Min. Passing Marks
										Max. Marks MSE/ MSIE	Max. Marks TA				Int.	Ext.		
Theory																		
01	2SMTCS01	Compulsory Course 4 (Advanced Computational Analysis of Structure)	3	--	--	3	3	3	60	30	10	100	24	50	--	--	--	--
02	2SMTCS02	Compulsory Course 5 (Advanced Design of Steel Structures)	3	--	--	3	3	4	60	30	10	100	24	50	--	--	--	--
03	2SMTCS03	Compulsory Course 6 (Design of Prestressed Concrete structures)	3	--	--	3	3	4	60	30	10	100	24	50	--	--	--	--
04	2SMTCS04	Professional Elective 3	3	--	--	3	3	3	60	30	10	100	24	50	--	--	--	--
05	2SMTCS05	Professional Elective 4	3	--	--	3	3	4	60	30	10	100	24	50	--	--	--	--
Practicals																		
06	2SMTCS06	Lab based 4 (Advanced Computational Analysis of Structure - Lab)	--	--	2	2	1	--	--	--	--	--	--	--	25	25	50	25
07	2SMTCS07	Lab 5 (Advanced Design of Steel Structures- Lab)	--	--	2	2	1	--	--	--	--	--	--	--	25	25	50	25
08	2SMTCS08	Lab 6 (Design of Prestressed Concrete structures)	--	--	2	2	1	--	--	--	--	--	--	--	25	25	50	25
09	2SMTCS09	Mini- Project & Seminar -1	--	--	4	4	2	--	--	--	--	--	--	--	50	50	100	50
		Total	**15**		**10**	**25**	**20**					**500**					**250**	
																Total	**750**	

Mini-Project & Seminar -1 : Project shhould be relevant to current technology and must include innovative element, Seminar1: It will be based on Mini-Project	
Professional Elective 3	1) Finite Element Method ; 2) Advanced Structural Analysis; 3) Computer Programming and Numerical Methods
Professional Elective 4	1) Advance Design of RC Structure; 2) Design of Environmental Structures; 3) Analysis and Design of Multistoried Buildings

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SEMESTER: III																			
Sr. No.	Subject Code	Subject	Teaching Scheme					Examination Scheme											
			Hours/ Week			Total Hours/ Week	Credits	THEORY							PRACTICAL				
			Lecture	Tutorial	P/D			Duration of paper (Hrs)	Max. Marks ESE/ ESSE	Internal Marks		Total	Min. Passing Marks in ESE/ ESSE	Overall Min Passing Marks	Max. Marks		Total	Min. Passing Marks	
										Max. Marks MSE/ MSIE	Max. Marks TA				Int.	Ext.			
Practicals																			
01	3SMTCS01	Compulsary Internship Two months (After complition of 1st year)	--	--	--	--	6	--	--	--	--	--	--	--	--	200	200	100	
02	3SMTCS02	Seminar & Dissertation Phase -I	--	8	--	8	4	--	--	--	--	--	--	--	100		100	50	
		Total		**8**		**8**	**10**								**100**	**200**	**300**	--	
																Total	**300**		

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SEMESTER: IV																				
Sr. No.	Subject Code	Subject	Teaching Scheme					Examination Scheme												
			Hours/ Week			Total Hours/ Week	Credits	THEORY									PRACTICAL			
			Lecture	Tutorial	P/D			Duration of paper (Hrs)	Max. Marks ESE/ ESSE	Internal Marks		Total	Min. Passing Marks in ESE/ ESSE	Overall Min Passing Marks	Max. Marks		Total	Min. Passing Marks
										Max. Marks MSE/ MSIE	Max. Marks TA				Int.	Ext.		
Practicals																				
01	4SMTCS01	Seminar & Dissertation Phase -II	--	--	20	20	10	--	--	--	--	--	--	--	100	200	300	150
		Total			20	20	10									..	**300**	..
																Total	**300**	

Summary of Marks & Credits					
Year	**Semester**	**Sem Marks**	**Yearly Marks**	**Sem Credits**	**Yrly Credits**
First Year	**I**	750	1500	20	40
	II	750		20	
Second Year	**III**	300	600	10	20
	IV	300		10	
Total		2100		60	

Exit Option after complition of First Year.: Student has to complete 10 credit online courses (NPTEL/MOOCS/SWAYAM) suitable for structural engineering to qualify for the **Post-Graduate Diploma in Structural Engineering**

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Branch: Structural Engineering

Syllabus of Semester-I

1SMTCS01: MATRIX METHODS OF STRUCTURAL ANALYSIS

Lectures/week: 03 **Credits: 03**
Tutorials: Nil

Course Prerequisites: SA

Course Objectives:
Course objectives are -

1) To introduce students, matrix-based approach for linear elastic analysis of skeletal structure by using stiffness method/ flexibility method.
2) To form the bridge form basic subject like structural analysis to more advanced analysis subjects such as finite element method/analysis
3) To enable the student to have a good grasp of all the fundamental issues in structural analysis, besides enjoying the learning process, and developing analytical and intuitive skills.

Course outcomes: At the end of this course students will be able to-

1) Analyze simple structure using flexibility method,
2) Analyze simple structure using stiffness method (structure approach)
3) Analyze structure (truss, continuous beam, plane frame etc.) using stiffness method (member approach)
4) Understand basic programming/ flowchart aspects of structural analysis programs.
5) Provide economical and safe structural solutions as per the site situation
6) Understand structural analysis software, compare the desired output and validate the same with classical solution's.

SECTION A

UNIT I: **Flexibility method**

Flexibility method(structural approach), flexibility coefficients, generalized flexibility coefficients, static degree of indeterminacy, basic determinate structure, redundant, alternate choices of redundant and corresponding primary structures, matrix formulation, hand solution of simple problem on truss, beams, frames, grids up to three unknown.

UNIT II: **Stiffness method (structural approach)**

Stiffness method(structural approach), stiffness coefficient, generalized stiffness coefficients, kinematic degree of indeterminacy, unknown joint displacements for various structures, joint equilibrium equations, hand solution for simple problems of beams, frames, trusses up to three unknowns.

UNIT III: **Stiffness method (member approach)**

Stiffness method(member approach), general strategy, member and structure coordinate system, force-displacement relations in member coordinates, member stiffness matrix, transformation of displacements and forces from member to structure coordinates and vice-versa, stiffness matrix referred to structure coordinate system, joint equilibrium equations using assembly procedure, large structures, boundary conditions. Application to beams, plane trusses, plane frames and grids. Programming aspects, flow charts, solution of equations, member end forces, free body diagram of members

SECTION B

UNIT IV: **Software Storage Solutions**

Memory problems, in-core solution techniques, assembly of stiffness matrix in full form, half band form and sky line storage, half band width, column height, diagonal address.

UNIT V: **Data preparation for Software Analysis**

Data preparation for solution of structures by stiffness method (member approach), alternatives for data preparation, displacement codes, joint-displacement and element displacement code relations.

Reference Books:

1. Pandit G.S. and Gupta S.P., Structural Analysis A matrix approach, Tata Mc Graw Hill, New Delhi 1986
2. Gere J.M. and W.Weaver, Analysis of framed Structures, D.Van Nostrand com. Inc.,Affiliated East West Press, 1965
3. Meghre A.S. and Deshmukh S.K., Matrix Methods of Structural Analysis, Charotar Publishing, Anand, India 2003.

1SMTCS02 Structural Dynamics

Lectures/week: 03 **Credits: 03**
Tutorials: Nil
Course Prerequisites: SOM

Course Objectives:

Students will be taught -

1) Application of principles (Newton's laws/ D'Alembert's principle) of Dynamics to the SDOF system subjected to free and force vibrations.
2) Analysis of SDOF System subjected to Impulsive loading
3) Numerical Methods to find response of SDOF system
4) Different properties and Analysis of MDOF System
5) Response of Continuous Systems
6) Response spectrum design and IS code provisions.

Course Outcomes:

At the end of course students will be able to –

1) Analyze the response of SDOF system subjected to free and force vibrations.
2) Analyze the response of SDOF System subjected to Impulsive loading
3) Analyze the response using Numerical Methods.
4) Understand the different properties of MDOF System and Analyze the MDOF System
5) Find the Response of Continuous Systems
6) Do response spectrum design of MDOF system.

SECTION A

UNIT I: **SDOF System**

Sources of vibration, types of excitations, Spring action and damping; Degrees of freedom; Application of Newton's laws, D'Alembert's principle, Single degree of freedom systems; Mathematical model of physical systems; free vibrations, damped free vibrations, critical damping, and response, periodic loading expressed in harmonics, dynamic load factor.

UNIT II: **SDOF System subjected to Impulsive Loading**

Single degree freedom system, response to impulsive loading, rectangular, triangular pulses, Duhamel Integral. Response to general dynamic loading.

UNIT III: **Numerical schemes**

Numerical scheme of iteration method such as Wilson-Theta, Newmark-Beta, constant linear acceleration & time domain and frequency domain analysis.

SECTION B

UNIT IV: **Multi-degree freedom system**

Multi-degree freedom system, stiffness and flexibility approaches, Lumped-mass matrix, free vibrations fundamental Frequencies and mode shapes, orthogonality of, response to dynamic loading, Formulations of equations of motion, mode superposition method, modal matrix.

UNIT V: Continuous Systems

Vibration of Continuous Systems: Free vibrations of Continuous systems-axial and transverse vibration of bars / beams. Response of continuous systems to dynamic loads. Rayleigh-Ritz method.

UNIT VI: **Structural response to earthquake**

Structural response to earthquake, Response spectrum design earth quake, IS code provisions for multistory frames.

Text Books:

1 Chopra, A. K.; Dynamics of Structures; Prentice Hall; 1995
2 Clough, R.W.; & Penzin, J.; Dynamics of Structures; McGraw Hill; 1993

Reference Books:

1. Humar J. L.; Dynamics of Structures; Prentice Hall; 1990
2. Mario, Paz; Structural Dynamics; CBS Publ.; N-Delhi; 1995
3. Timoshenko, S.; Advanced Dynamics; McGraw Hill Book Co; NY; 1948
4. Meirovitch L.; Elements of Vibration Analysis; 2nd Edition; McGraw Hill International Edition; Singapore; 1986
5. Biggs, J.M.; Introduction to Structural Dynamics; McGraw Hill; NY; 1964

1SMTCS03 Earthquake Resistant Design of Reinforced Concrete Structures

Lectures/week: 03 **Credits: 03**

Tutorials/week: Nil **Course Prerequisites: Nil**

Course Objectives:

Students will be able to

1) Understand Basic seismology, earthquake phenomenon and its characteristic.
2) Understand Earthquake resistant design philosophy.
3) Understand IS code provision to find seismic forces and ductile detailing.
4) Know RCC beam and column design procedure.
5) Know shear wall design procedure.
6) Understand wind load on building.

Course Outcomes:

Students who successfully complete this course will be able to:

1) Explain Basic seismology, earthquake phenomenon and its characteristic.
2) Explain Earthquake resistant design philosophy.
3) Analyze seismic forces and ductile detailing as per IS Code
4) Design of RCC beam and column.
5) Design of shear wall.
6) Analyze wind load on building.

SECTION A

UNIT I: Seismology:

Interior of earth, Seismicity of the world, plate tectonics, Faults, earthquake waves, Terminology: Magnitude, Intensity, Epicenter, Epicenter distance, focal depth, etc. Measurements of earthquake (Accelerograph, Accelerogram). Factors affecting ground motions, horizontal & vertical shaking, Seismic Effects on Structures, inertia forces. Importance of Architectural and Structural guidelines/planning. Selection of sites, continuity and separation of construction, Crumble section, Projection & suspended parts, Stair case etc. Twisting of building.

UNIT II: Concept of earthquake Resistant design

Concept of earthquake Resistant design, design philosophy. Importance of flexibility, Stiffness, Strength, ductility in the structures. Redundancy & Over strength, Damping, Supplemental Damping, soft story, short column, P-Δ Effect. Behavior of masonry structure during earthquake, bands & reinforcement in masonry building, Importance of Shear wall, openings in wall.

UNIT III: Codal Provision

Codal Provision. Introduction to IS:1893 (2016),Design Horizontal Acceleration, Zone factor, Importance factor, Response Reduction Factor, Natural Time Period, Base Shear, Earthquake eccentricity, Earthquake load combination, Diaphragm, Centre of mass & rigidity, Seismic mass & weight etc. Calculation of nodal loads due to earthquake using Equivalent lateral force method. Ductile detailing considerations as per IS:13920 (2016) for flexural member, axial member and joints of frame. Confinement of concrete,

SECTION B

UNIT IV: Column Beam Design

Seismic behaviour of Column, Beams and beam-column joint. Review of Limit State Design of RC members. Design of Uni-axial and biaxial Column (Axial, shear and moments). Design of flexural member (Beam).

UNIT V: Shear wall

Design of shear wall. Preliminary sizing and Mathematical modeling of buildings with different structural systems with and without diaphragms. soil-structure interaction, Base Isolation.

UNIT VI: Wind Load

Wind load calculations as per IS 875 part III 2015 on structure.

Reference Books:

1. Wakabayshi M.; Design of Earthquake Resistant Buildings, McGraw Hill Books Company; 1986
2. Okamoto, S.; Introduction to Earthquake Engineering; University of Tokyo press; 2nd Edition; 1984
3. Kramer, S.L.; Geotechnical Earthquake Engineering; Prentice Hall; New Jersey; 1996
4. Bolt, B.A.; Earthquakes; W. H. Freeman & Company; NY; 1988
5. Amita Sinhal, Understanding Earthquake Disasters,Tata Mcraw-Hill Publishing Company Ltd.
6. P. N. Agrawal, Engineering Seismology ,Oxford & IBH Publishing Co Pvt .Ltd
7. Pankaj Agrawal & Manish Shrikhande, Earthquake Resistant Design of Structures, Prentice Hall India.
8. Duggal S. K., Earthquake Resistant Design of Structures, Oxford University Press 2007
9. Paulay T. and Prestiley M.J.N.; Seismic design of R C & Masonry Buildings; John Willey & Sons; 2nd Edition; 1999
10. Booth, E.; Concrete Structures in Earthquake Regions; Longman Higher Education; 1994
11. Park and Paulay; Reinforced Concrete Structures, John Wiley and Sons

PROFESSIONAL ELECTIVE 1

PE1: 1SMTCS04-i Theory of Elasticity, Elastic Stability, Plates & Shells
Lectures/week: 03 **Credits: 03**
Tutorials: Nil

Course Objectives: The main objective of studying this course is to understand the theoretical concepts of material behavior with particular emphasis on their elastic properties.

1) To enhance the basic knowledge on structural analysis of 2 dimensional & 3 dimensional problem in different coordinate system.
2) To enable students to understand the stress & strain at a point.
3) To assimilate knowledge to students to for secondary stress in structures.
4) To understand the basic concept, mathematical modeling, behavior and analysis of plate and shell structures.

Course Outcomes: At the completion of this course, the student shall acquire knowledge and ability,

1) To define state of stress and strains, equilibrium and compatibility.
2) To derive the governing equations and their solutions for application to problems in plane stress state, plane strain state, torsion, bending.
3) To make students understand the principles of elasticity and basic equations.
4) To understand the simple bending of Plates and Different Boundary Conditions for plates.
5) Analyze circular plates subjected to different kinds of loads.
6) To apply differential equations for the calculation of response of two dimensional problems.

SECTION A

UNIT I: 2D-cartesian:

Plane stress and plane strain conditions, stress-strain relations, strain displacement relations, strain-compatibility condition, stress-compatibility condition, bi-harmonic equilibrium equation, Airy stress function, principal stresses and strains. Governing differential equations of thin rectangular Plates with various boundary conditions and loadings.

UNIT II: 3D-cartesian:

Elastic structure subjected to loads, body forces, surface forces, components of displacement, strain and stress at a point of 3D structure, Generalized Hooke's law, isotropic, orthotropic material, stresses in terms of strains and vice-versa, stress equilibrium equations, boundary conditions, strain-displacement relations, principal stresses and principal planes, elastic constants.

UNIT III: Plate Analysis

Saint-Venant principle, solution of simple problems in tension, bending, torsion, plate with small circular hole under tension.

SECTION B

UNIT IV: Stability analysis

Concept of stability, stable, unstable and neutral equilibrium, energy criteria, method of stability analysis.

UNIT V: Plates:

Introduction, Moment of curvature relation in pure bending, metrical bending of circular plates (Laterally loaded, uniformly loaded with clamped)

UNIT VI: Shells:

General shell geometry, classifications, stress resultants, equilibrium equation, Membrane theory for family of shells (Parabolic, Quaternary, Cycloid, Circular, Hyperbolic).

Reference Books:

1. Timoshenko S. P., Theory of Elasticity, Tata McGraw Hill.
2. Timoshenko S. P. and Gere J. N., Theory of Elastic stability Tata McGraw Hill.
3. Alexander Chajes, Principle of Structural Stability.
4. Timoshenko, S. P. & Kriegar, W.; Theory of Plates & Shells; McGraw Hill; NY; 1970
5. Szilard, R.; Theory and Analysis of Plates; Prentice Hall; 1974
6. Novozhilov, V.V.; Thin Shells; Noordho of Groningen; 1964
7. Ramaswamy G. S., Design of Concrete Shells; Krieger Publication Co.; 1984
8. Chandrasekhar K.; Theory of Plates; University Press India Ltd.; Hyderabad; 1st Edition; 2001
9. Timoshenko S. P., Theory of Elasticity, Tata McGraw Hill.
10. Timoshenko S. P. and Gere J. N., Theory of Elastic stability Tata McGraw Hill.
11. Alexander Chajes, Principle of Structural Stability.

PE1: 1SMTCS04-ii SOIL STRUCTURE INTERACTION

Lectures/week: 03 **Credits: 03**
Tutorials: Nil

Course Objectives:

1) To understand various principles governing soil-structure interaction effect.
2) 2. To familiarise the students with design and analysis of sub-structures incorporating with the effect of soil-structure interaction.
3) Provide guidance on the practical problems and their solutions, considering the complexity in soil parameters
4) Exposure to the students to various numerical methods available to solve soil-structure interaction problems with various examples and case studies**.**

Course Outcomes: After completion of this subject, student will be able to,

1) Understand the foundation behaviour
2) Analyze the beams resting on elastic foundation
3) Behaviour of plates on elastic foundation.
4) Have the knowledge of design of laterally loaded piles.
5) Understanding on behaviour of structure under different soil conditions
6) Correlate the results of structure behaviour with reference to critical situations

SECTION A

UNIT I: Introduction to Soil-structure interaction:

Importance of soil-structure interaction, factors affecting soil-structure interaction, examples of soil-structure interaction problems, concept of rigid and flexible foundations, contact pressure, settlement and differential settlement, theory of modulus of subgrade reaction

UNIT II: Soil-structure interaction problems:

Soil-rigid foundation interaction in clay and sand, soil-flexible foundation interaction in clay and sand, soil-pile interaction, soil-piled-raft interaction, earth pressure distribution on rigid wall, reinforced earth structure and sheet pile, braced excavation, arching in soil, soil-foundation interaction for special structures such as tanks, chimneys and silos

UNIT III: Soil-structure interaction models:

Winkler's model, beams and plates on elastic foundation, elastic continuum models,

SECTION B

UNIT IV: Analysis of Soil-structure interaction models:

Finite difference and finite element solutions for soil-structure interaction problems, laterally loaded piles supported one elastic medium

UNIT V: Dynamic soil-structure interaction:

Vibration of single and multiple degree of freedom systems, dynamic soil properties, wave propagation mechanism, seismic soil-foundation-structure interaction, examples of dynamic soil structure interaction problems, numerical modelling of dynamic soil-structure interaction

UNIT VI: Recent advancements:

Recent research advancements in soil structure interaction studies

Reference / Text Books

1. Bowles, J. E., Foundation Analysis and Design, McGraw Hill International Ed.
2. Desai C. S. and Christian J. T., Numerical Methods in Geotechnical Engineering, McGraw HillBook Co. New York.
3. Wolf J. P, Dynamic Soil structure interaction, Prentice – Hall
4. Potts D. M and Zdravkovic L., Finite Element Analysis in Geotechnical Engineering: Theory,Thomas Telford Publishers, London.
5. Potts D. M and Zdravkovic L., Finite Element Analysis in Geotechnical Engineering: Application, Thomas Telford Publishers, London.
6. Das, B.M., Principles of Foundation Engineering, Cengage Learning
7. Tomlinson M and Woodword J, Pile Design and Construction Practice, Taylor and Francis

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PE1: 1SMTCS04-iii Analysis and Design of Machine Foundations

Lectures/week: 03 **Credits: 03**

Tutorials: Nil

Course Objectives:

To understand the behavior and basic concepts for the design of foundation subjected to vibrations

Course Outcomes:

On completion of the course students

1) Developed skill in understanding the basics of vibration
2) Developed the understanding for type and principles for machine foundations
3) Get exposure to Dynamic soil properties and soil testing methods in laboratory and on field
4) Can understand the importance of huge machine foundations in power plants
5) Can understand codal requirements, construction aspects of machine foundations.
6) To understand including field measurements, of all types of machine foundations.

SECTION A

Unit I: Introduction to Foundation Vibration

Introduction to Foundation Vibration, Dynamic Soil Properties, Field Test and Laboratory Techniques, Elastic Modulus and Elastic Constants.

Unit II: Wave Propagation and Elastic Waves

Wave Propagation in Elastic Homogeneous and Isotropic Materials, Vibration of Elastic Media, Elastic Waves

Unit III: Machine Foundation

General Principle of Machine Foundation, Analysis and Design, Type of Machine Foundation, Block Type Foundation, Foundation for Impact Type Machine, Reciprocating Machine Framed Foundation

SECTION B

Unit IV: Design of Different Machine Foundations

Introduction to IS Codes, Design of Different Machine Foundations based on IS Code Method Elastic Half Space Method, Analysis based on Elastic Half Method, Different Methods based on Elastic Half Space.

Unit V: Shallow Foundation

Bearing Capacity of Shallow Foundation, Pile Foundation under Dynamic Load,

Unit VI: Vibration Isolation.

Vibration Isolation.

Reference Books/Material:

1. Krammer., "Earthquake Geotechnical Engineering".
2. Bowles, J. E., "Foundation Analysis & Design", McGraw Hill, 5th Edition, 1996.
3. Richart; F.E.; Hall, Jr. J.R. & Wood, R.D., "Vibrations of Soil & Foundations", Prentice Hall; New Jersey, 1970.
4. Prakash; S., "Soil Dynamics", McGraw-Hill Book Co.; New York, 1981.
5. Wolf, J.P., "Dynamic soil structure interaction", Prentice-Hall, Inc. Eaglewood Cliffs, N. J., 1985.
6. Swami Saran, "Soil Dynamics and Machine Foundations", Galgotia Publications (P) Ltd, New Delhi, 1999.
7. Bhatia K. A., "Foundation for Industrial Machine", D-CAD Publishers, New Delhi, 2008.

PE2: 1SMTCS05-i Seismic Evaluation, Repair And Retrofitting Of Structures

Lectures/week: 03 **Credits: 03**

Course Objectives: The objectives are to

1) Study various methods of seismic evaluation
2) applying seismic evaluation methods and identify present condition of structure
3) Study various methods of repair, retrofitting and rehabilitation techniques for masonry structures.
4) Study the various methods of repair, retrofitting and rehabilitation techniques for Reinforced Concrete Structures.
5) Understand and design modern technique of retrofitting like Base Isolation/Damper.
6) Re-evaluation of Buildings with Retrofitting Elements.

Course Outcomes: At the completion of this course, the student shall acquire knowledge and ability,

1) To understand various methods of seismic evaluation
2) To apply seismic evaluation method and identify present condition of structure
3) To decide the various methods of repair, retrofitting and rehabilitation techniques for masonry structures.
4) To decide the various methods of repair, retrofitting and rehabilitation techniques for Reinforced Concrete Structures.
5) To understand and design modern technique of retrofitting like Base Isolation/Damper.
6) To Re-evaluation of Buildings with Retrofitting Elements.

SECTION A

Unit I: Basic of Seismic Evaluation

Introduction: Terminology; Basic principles of seismic evaluation and retrofitting. Qualitative Methods of Seismic Evaluation: Rapid visual screening procedure (RVSP) and simplified evaluation of buildings; Visual inspection method and non-destructive testing (NDT) method, In-situ testing methods for RC and masonry structures;

Unit II: Methods of Seismic Evaluation

Quantitative Methods of Seismic Evaluation: Performance based method using Seismic evaluation of RC building-Demand capacity method, nonlinear static push-over analysis (NSP) and non linear dynamic method of analysis (NDP); Estimation of seismic capacity (strength and ductility).

Unit III: Repairs, Restoration, Strengthening and Retrofitting

Principles of Repairs and Retrofitting, Terminology in Repairs, Restoration, Strengthening and Rehabilitation, Criteria for Repairs, Restoration and Retrofitting; Repair Materials; Techniques of repair and retrofitting of masonry buildings; Techniques of Repair.

SECTION B

Unit IV: Local and Global Methods of Seismic Retrofitting of RC Buildings

Local and Global Methods of Seismic Retrofitting of RC Buildings: System completion; Strengthening of existing components; RC, Steel and FRP Jacketing; Addition of new components – frames, shear walls and braced frames.

Unit V: Seismic Control using Instrument

Retrofitting of buildings by seismic base isolation and supplemental damping; One case study in retrofitting.

Unit VI: Re-evaluation of Buildings with Retrofitting Elements

Re-evaluation of Buildings with Retrofitting Elements: Linear and Non-linear modeling; Modeling of soil and foundations. Seismic Repair and Retrofitting of Earthquake Damaged RC Buildings: Schemes of temporary shuttering damages; Methods of repair and retrofitting.

Reference Books/Material

1. Comartin, C. D., Niewiarowski, R. W., &Rojahn, C. (1996). Seismic evaluation and retrofit of concrete buildings ATC-40. Applied Technology Council (ATC).: Report No. SSC, 96-01..

2. Priestley, M. N., Seible, F., &Calvi, G. M. (1996). Seismic design and retrofit of bridges. John Wiley & Sons.

3. Thomas, P., & Priestley, M. J. (1992). Seismic design of reinforced concrete and masonry buildings..

4. Kappos, A., &Penelis, G. G. (2010). Earthquake resistant concrete structures. CRC Press.

5. FEMA 154 Rapid Visual Screening of Buildings for Potential Seismic Hazards, A Handbook,.

6. FEMA273, F. (1996). NEHRP Commentary on the guidelines for the rehabilitation of building. Washington DC: Federal Emergency Management Agency.

7. FEMA-356. (2000). Commentary for the Seismic Rehabilitation of Buildings., Federal Emergency Management Agency, Washington, DC.

8. FEMA-440, A. (2005)., Improvement of nonlinear static seismic analysis procedures. FEMA-440, Redwood City.

9. FEMA, P-695 (2009). Quantification of Building Seismic Performance Factors, Federal Emergency Management Agency.

10. ASCE 41. (2006). Seismic Rehabilitation of Existing Buildings.

11. ASCE 7. (1994). Minimum design loads for buildings and other structures (Vol. 7). American Society of Civil Engineers.

PE2: 1SMTCS05-ii Structural Health Monitoring

Lectures/week: 03 **Credits: 03**

Tutorials: NA

Course Prerequisites:

Basic knowledge of different structures at degree level.

Course Objectives:

1) To provide knowledge regarding Structural health monitoring
2) To provide information about available technology for SHM

3) To improve damage identification of important structure.

Course Outcomes:

(1) Implement fundamental concepts in structural health monitoring,
(2) Demonstrate understanding of working principles of sensors and actuators made from smart materials,
(3) Describe and classify various diagnostic methods of structural health monitoring, with their associated advantages and disadvantages,
(4) Select a viable structural health monitoring methodology for a given application based on available technology,
(5) Describe the historical and current real-world applications of damage identification in the civil engineering.

SECTION A

Unit I: Introduction:

Definition of SHM, Classification, Types and Components of SHM. Advantages and Benefits of SHM.

Unit II: Sensing Technologies:

Strain Measurement, LVDT, Temperature Sensors, Fiber Optic Sensing Technology, DIC

Unit III: Methodology:

Sensors, Selection of Sensors, Installation and placement, Data acquisition, Communication, Processing and Analysis. Storage, Diagnostics and Prognostics, Retrieval of data

SECTION B

Unit IV: Testing:

Static Field Testing, Dynamic field testing, Stress history data, Dynamic load allowance tests, Ambient vibration tests, Forced Vibration Method, Dynamic response methods

Unit V: Data Acquisition:

Static data acquisition systems, Dynamic data acquisition systems, Components of Data acquisition system, Hardware for Remote data acquisition systems.

Unit VI: Remote Structural health monitoring:

Remote Structural Health Monitoring, Importance and Advantages, Methodology. IoT applications in SHM, Application Machine leaning Techniques in SHM

Reference Books:

1. Daniel Balageas, Claus-Peter Fritzen, Alfredo Güemes, "Structural Health Monitoring", John Wiley and Sons, 2006

2. Douglas E Adams, "Health Monitoring of Structural Materials and Components - Methods with Applications", John Wiley and Sons, 2007

3. J.P. Ou, H. Li and Z.D. Duan, "Structural Health Monitoring and Intelligent Infrastructure Vol-1", Taylor and Francis Group, London, U.K, 2006

4. Victor Giurglutiu, "Structural Health Monitoring with Wafer Active Sensors", Academic Press Inc., 2007

PE2: 1SMTCS05-iii Earthquake Resistant Design of Masonry Structures

Lectures/week: 03 **Credits: 03**
Tutorials: Nil
Course Prerequisites: Nil

Course Objectives:

Students will be taught -

To provide insight into relevant theories, simulation techniques and principles of earthquake resistant design and construction for various types of masonry structures and to introduce various code provisions.

Course Outcomes: At the completion of this course, the student shall acquire knowledge and ability,

1) To identify different failure modes of tomasonry
2) to critically assess various engineering properties of masonry components,
3) to analyzed and design masonry structures
4) to apply Earthquake Resistant Measures for masonry structures
5) to use various retrofitting methods for masonry structures.
6) Apply advance concept for analysis of masonry structures

SECTION A

Unit I: Behaviour of Masonry Structures

Behaviour of Masonry Structures During Past Earthquakes: Common modes of failure, effect of unit shapes and mortar type, effect of roof and floor systems; Common deficiencies. Material Properties: Masonry units- stones, brick and concrete blocks, hollow and solid units; Manufacturing process; Mortar, grout and reinforcement; Various tests and standards. Masonry Under Compression: Prism strength, Failure mechanism, types of construction and bonds; Eccentric loading; Slenderness – effective length and effective height, effect of openings;

Unit II: Code provisions

Code provisions. Masonry Under Lateral Loads: In-plane and out-of-plane loads, bending parallel and perpendicular to bed joints; Shear and flexure behaviour of piers; Test and standards; Analysis of perforated shear walls, lateral force distribution for flexible and rigid diaphragms; Arching action; Combined axial and bending actions.

Unit III: Earthquake Resistant Measures:

Earthquake Resistant Measures: Analysis for earthquake forces, role of floor and roof diaphragm; Concept and design of bands, bandages, splints and ties; Reinforced masonry; Vertical reinforcement at corners and jambs; Measures in random-rubble masonry; Confined masonry; Code provisions.

SECTION B

Unit IV: Masonry Infills:

Masonry Infills: Effect of masonry infills on seismic behaviour of framed buildings; Failure modes; Simulation of infills – FEM and equivalent strut; Safety of infills in in-plane action – shear, compression and buckling; Out-of plane action, arching; Code provisions.

Unit V: Retrofitting of Masonry Building:

Retrofitting of Masonry Building: Techniques of repair and retrofitting of masonry buildings; IS: 13935-1993 provision for retrofitting.

Unit VI: Advance Concepts:

Advance Concepts: Strength and ductility; Nonlinear pushover analysis; Performance based design; Vulnerability and fragility analysis.

Reference Books/Material

1. Drysdale, R. G., Hamid, A. A., & Baker, L. R. (1994). Masonry structures: behavior and design. Prentice Hall.
2. Schneider, R. R., & Dickey, W. L. (1994). Reinforced masonry design. Pearson College Division.
3. Thomas, P., & Priestley, M. J. (1992). Seismic design of reinforced concrete and masonry buildings.
4. Hochwalt, J. M., &Amrhein, J. E. (2012). Reinforced Masonry Engineering Handbook.
5. Hendry, A. W. (1990). Structural masonry. Scholium International.
6. Tomazevic, M. (1999). Earthquake-resistant design of masonry buildings. World Scientific.
7. Anderson, D., &Brzev, S. (2009). Seismic design guide for masonry buildings. Canadian Concrete Masonry Producers Association.

PE II -1SMTCS05-iv Earthquake Resistant Design of Bridges and Dams

Lectures/week: 03 **Credits: 03**

Tutorials/week: Nil **Course Prerequisites: Nil**

Course Objectives:

Students will be able to

1) Understand Performance of bridges in past earthquakes.
2) Know the codal provision for bridges.
3) Understand design philosophy for Bridges.
4) Understand Seismic design of well and pile foundations.
5) Understand Performance of different types of dam.
6) Understand Seismic design of dam as per code.

Course Outcomes:

Students who successfully complete this course will be able to:

1) Explain Performance of bridges in past earthquakes.
2) Explain codal provision of Bridges.
3) Explain design philosophy for Bridges
4) Design of well and pile foundations considering earthquakes forces.
5) Explain Performance of different types of dam.
6) Design of dam as per code considering earthquakes forces.

Section A

Unit I: Performance of Bridges

Bridges: Performance in past earthquakes, Types of bridge superstructure and introduction to their design, sub-structure, bearings, IRC / IRS Bridge loadings and other codal recommendations, Performance of Bridges in past earthquakes.

Unit II: Bridge Design

Seismic design philosophy for Bridges, State of art modeling of bridges, Seismic Design of Substructures, Capacity design of substructures and ductile detailing.

SECTION B

Unit III: Foundation design

Seismic design of well and pile foundations.

Unit IV: Dam Design

Dams: Performance of concrete and masonry gravity dams, seismic design considerations, dynamic analysis of dams. Dam-foundation-reservoir interaction, bending, shear and finite element method of analysis.

Reference Books:

1 Chen W.F. and Duan L., Bridge engineering Handbook; CRC Press; 1999

2 Fintel, M.; Handbook of Concrete Engineering; 2 nd Edition; CBS Publishers Delhi; 1986

1SMTCS06 Research Methodology

Lectures/week: 02 **Credits: 02**

Tutorials: NA

Course Prerequisites: NA

Course Objectives:

4) To provide knowledge regarding effective literature studies, approaches, analysis, plagiarism and research ethics.
5) To provide information regarding patent rights and new development in IPR.
6) To enrich research quality.

Course Outcomes:

1) Apply effective technical writing skill for research work.
2) Understand research problem formulation.
3) Analyze research related information.
4) Follow research ethics.
5) Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
6) Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

SECTION A

UNIT I: Understanding research

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

UNIT II: Literature survey

Effective literature studies approaches, analysis Plagiarism, and Research ethics.

UNIT III: Research Proposal writing

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

SECTION B

UNIT IV: Intellectual property right

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

UNIT V: Procedure for Patenting

Patent Rights, Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT VI: New Developments in IPR

Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Text Books:

1) C.R. Kothari and Gaurav garg, "Research methodology : methods and techniques".
2) Dr. N.W. Ingole & Dr. M.V.Mohod "Research methodology".

Reference Books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

1SMTCS07 Structural Dynamics Lab-1

Practical: 02 Hours/week **Credits: 01**

Course Prerequisites: Nil

Course Objectives:

Students will be taught -

1) To learn and understand the basic concepts of Structural Dynamics.
2) To learn and understand the response of SDOF system.
3) To learn and understand the response of MDOF/Continuous system.

Course Outcomes:

Students will be able to -

1) Prove the concepts related to Structural Dynamics.
2) Calculate response of SDOF system
3) Calculate response of MDOF/Continuous system

List of Experiments/ Practicals:

1. Simple Harmonic Oscillator
2. Free Vibration of S.D.O.F System
3. Forced Vibration of S.D.O.F System
4. Impulse Response of S.D.O.F System
5. Concept of Response Spectrum
6. Vibration of M.D.O.F System
7. Continuous Systems
8. Vibration Control

Minimum Four (04) experiments/ Practical's are to be performed

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1SMTCS08 Earthquake Resistant Design of Reinforced Concrete Structures-Lab-2

Practical/week: 2 **Credits: 01**

Tutorials/week: Nil **Course Prerequisites: Nil**

Course Objectives:

Students will be able to

1) Understand Earthquake resistant design Concept.
2) Understand IS code provision to find seismic and wind forces.
3) Know RCC beam, column and shear wall design procedure.

Course Outcomes:

Students who successfully complete this course will be able to:

1) Explain Earthquake resistant design Concept.
2) Analyze seismic and wind forces as per IS Code
3) Design of RCC beam, column and shear wall

List of Experiments/ Practicals:

- Candidates are required to prepare at least two Complete Design calculations and Drawings to be developed based on theoretical course (1XXX1) detailed workings are necessary.

- A compulsory site visit for studying the various aspect and prepare a report.

1SMSE09: Computer Aided Analysis & Design of Structures – Lab

Course Objectives: Students will be able to analyze and design Building design of RCC structure using software like SAP, ETAB, STAAD-PRO, etc.

Course Outcomes:

1) To know the analysis & Design of simple beam & Continues beam
2) To understand the analysis and design of single bay frame
3) To Known the multi-storey RCC design and analysis
4) To able design of structure

Syllabus

1.Introduction to Computer systems and facilities. Operating systems, Software, Software development processes. Introduction to software packages like STAADPRO, STRUDS, SAP-2000, Etab and ANSYS

2) Analysis and design of Simple type of continue beam and Portal Frame by Using Software

3) Complete Design calculations and Drawings to be developed for structures multi-storey RCC building, as per IS 456-2000 by Using Software

Syllabus of Semester-II

2SMTCS01: ADVANCED COMPUTATIONAL ANALYSIS OF STRUCTURE

Lectures/week: 03 **Credits: 03**

Course Prerequisites:

Course Objectives:

1) To analytically formulate the problem for understanding the behaviour of structure under gravity as well as lateral loads.
2) To prepare 2D/3D wireframe model of structure with reference to actual site condition.
3) To understand fundamentals of seismic analysis with reference to latest codal provisions
4) To aware students regarding various methods and related software for computational analysis.

Course outcomes: At the end of the subject the students will be able to -

1) Formulate the structural problem with reference to various analysis methods.
2) Behaviour of tall buildings due to various types of loads.
3) Analyse and design such buildings by approximate, accurate and simplified methods
4) Find the response of structure by approximate methods subjected to lateral loads
5) Students will be able to differentiate, analyse structures with reference to different soil conditions
6) By virtue of advance concepts of analysis allied with critical structures such as high rise can be understood.

SECTION – A

Unit I: Loading and Design principles:

Loading- sequential loading, Gravity loading, Wind loading, Earthquake loading, - Equivalent lateral force, combination of loading, – Static and Dynamic approach –Design philosophy - working stress method, limit state method and plastic design.

Unit II: Structural systems of high rise buildings:

Moment resistant frames, braced frames, approximate methods of design of high rise buildings; concept of foundation for high rise buildings

Unit III: Shear walls:

Necessity - structural behaviour of large frames with and without shear walls, coupled shear walls.

SECTION - B

Unit IV: Analysis and Design:

Modelling for approximate analysis, Analysis of buildings as total structural system considering overall integrity, Analysis for member forces, drift and twist - Computerized three dimensional analysis –Assumptions in 3D analysis – Simplified 2D analysis.

Unit V: Exposure to advance computational methods:

Introduction to IS 1893, Analysis of framed structures subjected to earthquake forces by virtue of linear, nonlinear, static /dynamic methods of analysis such as static- equivalent static method, linear dynamic-Response Spectrum Method, Non-linear static- Pushover method and Non-Linear dynamic- time history method

Unit VI: Recent traits in structural analysis and computation:

Introduction to artificial intelligence, representation, inference, applications.

Reference Books:

1. Chopra A. K. , Dynamic of Structures, Theory and Applications to Earthquake Engineering , 3rd edition (2007), Prentice Hill (on reserve)

2. Duggal S.K. Earthquake Resistant Design of Structures , Oxford University Press 2007

3. Beedle.L.S., "Advances in Tall Buildings", CBS Publishers and Distributors, Delhi, 1986

4. Bryan Stafford Smith and Alexcoull, "Tall Building Structures - Analysis and Design", John Wiley and Sons, Inc., 2005.

5. Taranath B.S., "Structural Analysis and Design of Tall Buildings", McGraw Hill, 1988.

2SMTCS02: Advanced Design of Steel Structures

Lectures/week: 03 **Credits: 03**

Course Prerequisites: Knowledge of UG's subjects of design of steel structures.

Course Objectives:

1) To learn advanced design concepts for structural steel applicable to various types of steel structures.
2) To understand primary code source applies to building design, which is supplemented by a strong theoretical background in steel behavior applicable to non-typical structures.

Course Outcomes:

At the completion of this course, the student shall acquire knowledge and ability,

1) To understand the methods of design of steel structure.
2) To design various types of steel structure.
3) To understand techniques and method of communicating engineering design to industry.
4) Apply unified code philosophy to steel building design
5) Apply plastic method for design of beams and frames.
6) Design & detail Industrial building structures as per the IS code

SECTION-A

UNIT I: Introduction to Design philosophy

Introduction to Allowable Stress Design, Plastic design, Limit state Design, Loadings as per IRC, IS (IS: 800-2007, IS: 875 part1-V, IS: 1893) applicable to various steel structures. Design of Welded and Bolted connections.

UNIT-II Design of Flexure Members

Design of Beams, Beam-column, Plate Girders.

SECTION-B

UNIT-III Design of Industrial Buildings
Design of Industrial Buildings including crane girders, Design of Foot Bridge.

UNIT-IV Introduction to Composite structures
Introduction to Composite structures, Analysis and Design of Multistory building subjected to Seismic and Wind forces. (IS 875 (Part 3): 2015, IS 1893(Part 1):2016)

Reference Books:
1. Owens, G.W. & Knowles, P.R.; Steel Designers Manual; Blackwell;1994
2. Gaylords E.H. &Gaylords, C. N.; Design of Steel Structures; McGraw Hill Publ.1998
3. Steel Design Manual; ELBS and Granada Publishers; London
4. Johnson, R.P.; Composite Structures of Steel and Concrete; Volume-I; Granado Publishing Ltd.; London; 1975
5. Salmon and Johnson; Steel Structures – Design and Behaviour,Harper and Collins Publishers.
6. Subramanian N., Design of Steel Structures, Oxford University Press2008
7. IS 800-2007, BIS
8. Duggal S.K., Limit State Design of Steel Structures, Tata McGraw Hill Education Private Limited.
9. Bavikatti S.S., Design of Steel Structures By Limit State Method AsPer IS:800-2007, I.K. International Publishing House Pvt. Ltd.
10. Subramanian N., Steel Structures Design and Practice, Oxford University Press 2008

2SMTCS03: Design of Prestressed Concrete Structures

Lectures/week: 03 **Credits: 03**

Tutorials/week: Nil **Course Prerequisites: Nil**

Course Objectives: Students will be able to

1) To understand the Prestressing concept
2) To understand design philosophy of prestress.
3) To understand flexural design.
4) To understand shear design.
5) Understand special structure design.
6) Understand water tank design.

Course Outcomes: Students who successfully complete this course will be able to:

1) Explain the general behavior of PC sections under external load.
2) Explain design philosophy and codal provision.

3) Design of flexural member.
4) Design for shear
5) Design of special structure.
6) Design of water tank/composite beam.

SECTION A

UNIT I: Introduction

Basic concepts – Advantages – Materials required – Systems and methods of Prestressing, Losses of prestress, Analysis of pre-stress Section, Load balancing, Effect of tendon profile, Factors influencing deflections, Partial Prestressing – Definition, methods of achieving partial Prestressing, merits and demerits of partial Prestressing, Grouting of beams, fire resistance of beams.

UNIT II: LSM

Introduction to Limit state method (Collapse and Serviceability), bending, shear, Deflection(Short-term and Long-term), Cracking (Type I, II, III Members), Permissible stresses in steel and concrete as per I.S.1343-2012 Code, Anchorage zone stresses in post-tensioned beams by I.S.1343-2012 code.

UNIT III: Beam Design

1. Comprehensive design of a rectangular and/or a T-section by limit state method.
2. Comprehensive design of post-tensioned girders.

SECTION B

UNIT IV: Shear Design

1. Analysis and design of end block, anchorage zone reinforcement, Check for transfer bond length in pre-tensioned beams.
2. Analysis and design of Poles.

UNIT V: Special Member Design

1. Analysis and design of Piles.
2. Analysis and design of Sleepers.
3. Analysis and design of pipes

UNIT VI: Water Tank

1. Design and analysis of pre-stressed concrete circular tank.
2. Analysis and design of composite beams.

Reference Books:

1. Krishna Raju, N.; Prestressed Concrete Structures; TMH; Delhi; 1981
2. Lin, T.Y. and Burns, N.H.; Design of Prestressed Concrete Structures; 3rd Edition; John Wiley & Sons; NY; 1981
3. Ashok Jain, R. C. C. Design
4. P. Dayaratnam, Prestressed Concrete Structures, Oxford & IBH
5. Latest relevant BIS codes

Professional Elective 3

PE3: 2SMTCS04-i Finite Element Method

Lectures/week: 03 **Credits: 03**
Tutorials: Nil
Course Prerequisites: MMSA

Course Objectives:
The objectives of this course are to -

1) Understand the purposes and uses of the finite element analysis process in industry and the possible roles of the structural engineering technologist in that process
2) Learn basic aspects of finite element technology, including domain discretization, polynomial interpolation, application of boundary conditions, assembly of global arrays, and solution of the resulting algebraic systems.
3) Enable the students to perform engineering simulations using commercially available Finite element analysis programs and software's.

Course Outcomes:
At the end of the course, students will be able to

1) Derive shape function for 1D, 2D,3D elements
2) Derive element matrix equation by different methods by applying basic laws
3) Solve different one Dimensional structural engineering problems using FEM.
4) Solve different Two Dimensional structural engineering problems using FEM.
5) Use professional-level finite element software to solve engineering problems in Solid mechanics
6) Develop and exercise critical thinking in interpreting results from FEM analysis.

SECTION A

UNIT I: Introduction and 1D FEM

Introduction, Basic Concepts of Finite Element Analysis, advantages, disadvantages, Introduction to Elasticity, Steps in Finite Element Analysis, Minimum potential energy theorem, Relation to Rayleigh- Ritz method Interpolation, shape functions, one dimensional Lagrangian and first order Hermitian functions, Natural or local coordinate, Stiffness Matrix and Boundary Conditions

UNIT II: 2D FEM

Two dimensional shape functions, Lagrangian and Serendipity shapes, Area and volume coordinates. Two dimensional plane stress and plane strain analysis, Constant strain triangle, Linear strain triangle, rectangle, Isoparametric elements, Nodal load matrix due to body forces, Stiffness Matrix and Boundary Conditions, Gauss integration, locations and weightages of Gauss points.

UNIT III: Analysis of Frame Structures

Stiffness of Truss Members, Analysis of Truss, Stiffness of Beam Members, Finite Element Analysis of Continuous Beam, Plane Frame Analysis

SECTION B

UNIT IV: 3D FEM

Axisymmetric Element, Finite Element Formulation of Axisymmetric Element for analysis of axisymmetric solids subjected to axisymmetric loads only, Finite Element Formulation for 3 Dimensional Elements using eight and twenty noded isoparametric hexahedron, four noded tetrahedron.

UNIT VI: Plates and Shells

Introduction to Plate Bending Problems, Finite Element Analysis of Thin Plate (12DOF ACM element, 16DOF Bogner Fox element), Finite Element Analysis of Thick Plate, Finite Element Analysis of Shell

UNIT VI: Computer Implementation

Computer Implementation of FEM procedure, Pre-Processing, Solution, Post Processing, Use of Commercial FEA Software.

Text Books:

1. O. C. Zienkiewing and R. L. Taylor, The finite element method, Vol.1 and 2, Mc Graw Hills.1995
2. Desai Y.M, Eldo T.L. and Shah A.H ; Finite Element Method with Applications in Engineering; Kindle Edition; 2011

Reference Books:

1. C.S.Krishnamoorthy, Finite Element Analysis, Theory and Programming., Tata Mc Graw Hills 1994
2. R. D. Cook, Concept and application of finite element analysis, John Willey and Sons.
3. Bathe and Wilson, Numerical Methods of Structural analysis
4. E.Hinton and D.R.J. Owen, Finite Element programming, Academic press
5. A.D. Belegunda and T.R.Chandrupatla, Finite element method in engineering, pretile Hall

PE3: 2SMTCS04-ii ADVANCED STRUCTURAL ANALYSIS (2)

Lectures/week: 03 **Credits: 03**

Tutorials: Nil

Course Prerequisites:

Course Objectives:

1) To introduce students with advanced approach for analysis of skeletal structure by using varied amount of method suiting requirement of problem statement.
2) To form the bridge form basic subject like structural analysis to more advanced analysis subjects such as matrix methods / finite element method
3) To enable the student to have a good grasp of all the fundamental issues in structural analysis, besides enjoying the learning process, and developing analytical and intuitive skills.

Course outcomes: At the end of the subject the students will be able to -

1) Formulate and understand the dynamic concepts for analysis of structures
2) Demonstrate an understanding the assumptions and limitations of the structural theories.
3) Solve engineering problems in the context of structural dynamics.
4) Students will be able to differentiate, analyze structures on firm base and elastic base foundations.
5) By virtue of stress-strain relationship, advance aspects of stress-strain resultants allied with plates and shell can be understood.
6) Produce design output with reference to earthquake concepts

SECTION – A

Unit I: **Approximate methods**

1. Approximate methods of analysis of multi-bay multi-storeyFrames by – (a) Cantilever method, (b) Portal method & (c)Factor method. 2. Shear centre for thin walled beam section.

Unit II: Behaviour of Structure under Earthquake

Importance of flexible and ductile structures, Effect of earthquake on RCC Building, How Beam, Column & Beam Column joint resist earthquake, Effect of open ground story, Effect of short column, Use of shear wall, latest technique used to reduce earthquake effect on building (Base Isolation). Behaviour of R.C. building in past earthquakes.

Unit III: Cantilever moment distribution method and Vierndeel girders

1. Cantilever moment distribution method, application to rigid jointed plane frames.
2. Vierndeel girders - analysis for vertical sway cases only.

SECTION – B

Unit IV: Finite difference method and Minimum potential principle

1. Finite difference method, application to beam deflection problems 2. Minimum potential principle, Rayleigh & Rayligh-Ritz approach to continuous problems, application to simply supported and cantilever beams using power series and trigonometric series.

Unit V: Guidelines for achieving efficient seismic resistant planning

Guidelines for achieving efficient seismic resistant planning, selection of sites, importance of architectural features in earthquake resistant buildings, continuity of construction, projection & suspended parts, special construction features like separation of adjoining structure, stair case etc, twisting of building, seismic design philosophy for building.

Unit VI: Wind and Earthquake, Analysis

1. Wind load Calculation for Multy-story Building as per IS 875-Part-3
2. Structural response to earthquake, analysis of multi-storied frames by I.S. code provisions.

Reference Books:

1. Norris, Wilbur, Elementary Structural Analysis
2. Timoshenko & Goodier, Theory of Elasticity
3. Jaikrishna, Chandrashekharan, Element of Earthquake Engineering,
Sarita Publication, Meerut (U.P.)
4. Vazirani & Ratwani : Advanced Theory of Structures.
5. Ross C.T.F.: Advanced Stress Analysis.

PE3: 2SMTCS04-iii Computer Programming and Numerical Methods

Lectures/week: 03 **Credits: 03**

Tutorials: Nil

Course Prerequisites: Nil

Course Objectives:

Students will be taught -

To empower students with programming skill and application of various numerical methods to solve large scale computation heavy problems

Course Outcomes: At the completion of this course, the student shall acquire knowledge and ability,

1) to do programming using Fortran /C/MATLAB
2) To find numerical solution using different method
3) To do software programming of Numerical Integration
4) To do software programming Interpolation
5) To do software programming Regression
6) To find solution of nonlinear Equations

SECTION A

Unit I: Computer programming

Computer programming Fortran /C/MATLAB–Programming fundamentals, Introduction to algorithm development, Computer Implementation of Matrices, Guidelines for development of a large sized problem.

Unit II: Numerical methods-Solution

Numerical methods-Solution of Linear Simultaneous equations – Method of Gauss Elimination, Cholesky''s, Jacobi iteration, Gauss – Seidel method of Iteration,

Unit III: Numerical Integration

Numerical Integration – Trapezoidal, Simpson's and other Newton – Cotes formulae, Method of Gauss Quadrature.

SECTION B

Unit IV: Interpolation

Interpolation (Lagrange Interpolation, Taylor series expansion, Extrapolation), curve fitting.

Unit V: Regression

Regression Initial and boundary value problem, Euler's, Runge-kutta, Milne's etc, Computer oriented Algorithms.

Unit V: Solution of nonlinear Equations.

Solution of nonlinear Equations. Eigen value and Eigen vectors. Problems associated with choice and implementation of solution techniques in the eigen solution of large problems arising in dynamic systems.

Reference Books/Material

1. Scarborough J. B., "Numerical Mathematical Analysis", Oxford and IBH publishers, 1966.
2. Gerald C. F., "Applied Numerical Analysis", Addison – Wesley Publishing Company, 1970.
3. Jain M. K., Iyengar S. R. K. and Jain R. K, "Numerical Methods for Scientific and Engineering Computations", John Wiley – New Age International Limited, 1993.
4. Balgurusamy E., "Numerical Methods", Tata McGraw Hill, New Delhi, Fifth Edition, 2001.
5. Rajaraman, V., "Fortran-95", Prentice Hall of India, 1988.
6. McCormic J. M. and Salvadori M. G., "Numerical Methods in FORTRAN", Prentice Hall of India, New Delhi, 1966.
7. Press, W.H; Tenkolsky, S.A.; Vetterling, W.T.; & Flannery, B.P., "Numerical Recipes-the art of scientific Computing; 2nd Edition", Cambridge University Press, 1993.
8. Kanetkar Y. P., "Let us C", BPB Publication, New Delhi.
9. Bathe, K. J., "Finite Element Procedures", Springer, 2nd Edition, 2002
10. Jaan Kiusalaas, "Numerical method in engineering with Matlab" Cambridge University Press, 2010.

Professional Elective 4

PE04: 2SMTCS05-i Advance Design of RCC Structure

Lectures/week: 03 **Credits: 03**
Tutorials: Nil
Course Prerequisites: Nil

Course Objectives:

1) To enhance the understanding of various methods for analysis and design of different types of foundations
2) To impart knowledge on the shallow foundation & Deep foundation
3) To enhance the understanding the students to analyze and design RC structures

Course Outcomes: At the completion of this course, the student shall acquire knowledge and ability,

1) To select and design appropriate foundations based on various criteria,
2) To check the stability of various components of foundations and retaining walls.
3) To analyse and design of raft foundation
4) Analyse and design Pile & Machine Foundation
5) To analyze and design RC structures such as RC continuous beams, ribbed slabs,..
6) To understand the multi story RC frames, RC deep beams and corbels and understand various aspects of tall buildings, and yield line analysis etc.

SECTION A

Unit I: Design of Portal Frame

Design of Portal Frame up to Two Bay Two Storied Symmetrical Frame for symmetrical loading.

Unit II: - Design of circular slab & T-Beam

Design of circular slab for uniformly Distributed load only And Design of RCC Girder (T-Beam) Bridge for IRC Class A Loading

SECTION B

Unit I: Design of shallow foundations

Analysis and Design of shallow foundations: Individual and combined footings for axial and bending loads (Uniaxial and biaxial), Loss of contacts and calculation of liftoff.

Unit II: Analysis and Design of raft foundations & Deep Foundations

Analysis and Design of raft foundations, deep Foundations: Piles, Analysis and Design of Piers, Abutments

Reference Books

1. Hetényi, M. (1971). Beams on elastic foundation: theory with applications in the fields of civil and mechanical engineering. University of Michigan.
2. Bowles, J. E. (1988). Foundation analysis and design.
3. Saran, S. (2006). Soil dynamics and machine foundation.
4. Srinivasulu, P., &Vaidyanathan, C. V. (1976). Handbook of machine foundations. Tata McGraw- Hill Education.
5. Kurian, N. P. (1982). Modern foundations: introduction to advanced techniques. Tata McGraw-Hill.
6. Reese, L. C., Isenhower, W. M., & Wang, S. T. (2006). Analysis and design of shallow and deep foundations (Vol. 10). Hoboken, NJ: Wiley.
7. Portney, L. G., & Watkins, M. P. (2000). Foundations of clinical research: applications to practice (Vol. 2). Upper Saddle River, NJ: Prentice Hall.
8. McCarthy, D. F., & McCarthy, D. F. (1977). Essentials of soil mechanics and foundations (p. 505). Reston Publishing Company.

PE04: 2SMTCS05-ii DESIGN OF ENVIRONMENTAL STRUCTURES

Lectures/week: 03 **Credits: 03**
Tutorials: Nil
Course Prerequisites: Nil

Course Objective:

1) To design Environmental RCC structure.
2) To educate the students on aspects of water retaining structures design.

Course Outcomes: At the completion of this course, the student shall acquire knowledge and ability,

1) to apply the principle of limit state design.
2) to design E.S.R.
3) to design underground water storage structures.
4) to design aeration tank.
5) to design Clari- flocculator.
6) to design digestion tank.

SECTION A

Unit I: Design of ESR

Analysis and design of cylindrical shaped E.S.R, supported peripherally & internally making the tank floor a solid continuous slab system, Analysis and design of staging.

Unit II: Design of underground water tanks

Design of underground water tanks

Unit III: Design of swimming pools & Jacks well.

Design of swimming pools, Jacks well

SECTION B

Unit IV: Design of Water Treatment Plant units & aeration tank.
Design of Water Treatment Plant units & aeration tank.

Unit V: Design of Clari- flocculator
Design of Clari- flocculator, flash mixers, Design of water sumps, filters.

Unit VI: Design of digestion tank.
Design of digestion tank

Text Books:

1. Krishna Raju, "Prestressed Concrete" Tata McGraw Hill Publishing Co. 2nd Edition, 1988.
2. Sinha N.C. &.Roy S.K "Reinforced Concrete" S. Chand and Co., 1985
3. Ramaswamy, G.S., Design and Construction of Concrete shell roofs", CBS Publishers, India 1986.
4. Punmia B. C., R. C. C. Design, Laxmi publications.

Reference Books:

1. Green, J.K. and Perkins, P.H., Concrete liquid retaining structures", Applied Science Publishers, 1981.
2. Rajagopalan K.,"Storage structures", Tata McGraw Hill, New Delhi, 1989.
3. Krishna Raju N., "Advanced Reinforced Concrete Design", CBS Publishers and Distributors, New Delhi, 1988.
4. Datta N. P., Waste Water Treatment, Oxford & IBH Publication.

PE04: 2SMTCS05-iii Analysis and Design of Multistoried Buildings

Lectures/week: 03 **Credits: 03**

Course Prerequisites: Knowledge of Structural Analysis, Concrete Technology & Reinforced Concrete Design required

Course Objectives: To impart knowledge of analysis and design of multistoried buildings for static and dynamic loading

Course Outcomes:
At the completion of this course, the student shall acquire knowledge and ability,

1) To understand methods of structural RCC design.
2) To design various types of multistoried structures.
3) To understand techniques and method of communicating engineering design to industry.
4) Students will be able to design buildings under earthquake loads.
5) Students will be able to estimate the wind load on building structures and design using software.
6) Understand the importance of detailing reinforced concrete structure.

SECTION A

Unit I: Building frames

Building frames, frame-shear wall buildings, Braced Buildings, Mathematical modeling of buildings with different structural systems with and without diaphragms.

Unit II: Loads and their combinations

Earthquake load calculations along with dead load and live loads and their combinations.

Unit III: Wind and other load calculations

Wind and other (i.e. blast, snow) load calculations along with dead load and live loads and their combinations.

SECTION B

Unit IV: Special aspects in Multi-storied buildings

Special aspects in Multi-storied buildings: Effect of torsion, flexible first story, P-delta effect, soil-structure interaction on building response, drift limitation.

Unit V: Analysis and Design of multi-storied buildings

Analysis and Design of multi-storied buildings with masonry infill, Sequential analysis for multistoried buildings.

Unit VI: Performance based design.

Introduction to Performance based design.

Reference Books / Material:

1. FarzadNaeim, “Handbook on Seismic Analysis and Design of Structures”, Kluwer Academic Publisher; 2001
2. Paulay, T. &Prestiley, M.J.N., “Seismic design of R C & Masonry Buildings”, John Willey & Sons, 2 nd Edition; 1999
3. Booth, E., “Concrete Structures in Earthquake Regions”, Longman Higher Education, 1994
4. Park, R. &Paulay, T., “Reinforced Concrete Structures”, John Willey & Sons, 2nd Edition, 1975
5. Fintel, M., “Handbook of Concrete Engineering”, 2nd Edition, CBS Publ.Delhi, 1986

2SMTCS06 ADVANCE COMPUTATIONAL ANALYSIS OF STRUCTURE-LAB 4

Practicals/week: 02 **Credits: 01**

Course Objectives:

1) To make students understand the concept of modelling, analysis and design of structures.
2) To make students aware about various methods of analysis adaptable to computation problem.
3) To make students understand the concept of load calculation during analysis and design of structures
4) To learn and apply various testing methods for destructive as well as non destructive strength prediction.

Course Outcomes:

At the end of this topic student will be able to,

1) Apply various methods of analysis to structure via different software as per problem definition.
2) Correlate output of analysis with reference to design application
3) Fabricate, cast and test for understand process of checking structure elements as per codal provisions
4) Study various failure stages of structural elements

(Minimum **five (5)** practical from the list below should be conducted with proper submission and viva voce exam)

1. Analysis of axially loaded member/ problem using suitable analysis method and Compare the output obtained through the structural analysis using software/ computer program/ excel program.

2. Analysis of Continuous beam problem using suitable analysis method and Compare the output obtained through the structural analysis using software/ computer program/ excel program.

3. Analysis of Truss problem using suitable analysis method and Compare the output obtained through the structural analysis using software/ computer program/ excel program

5. Analysis of Plane frame problem using suitable analysis method and Compare the output obtained through the structural analysis using software/ computer program/ excel

6. Design & Analysis of high rise structure with reference to any one advance computational methods like seismic coefficient method, response spectrum method, pushover method, time history method.

7. Fabrication, casting and testing of simply supported reinforced concrete beam for strength And deflection behaviour **or** reinforced concrete column subjected to concentric and eccentric loading

8. Extraction and Study of Concrete Core samples from existing structures with reference to strength detection via destructive and NDT

LIST OF EQUIPMENTS

1. Strong Floor
2. Loading Frame
3. Hydraulic Jack
4. Load Cell
5. Proving Ring
6. LVDT sensors
7. Electrical Strain Gauge with indicator/ data logger
8. Rebound Hammer
9. Ultrasonic Pulse Velocity Tester
10. Dial Gauges
11. Clinometer
12. Vibration Exciter
13. Vibration Meter

2SMTCS07 Advanced Design of Steel Structures – Lab 5

Lectures/week: 02 **Credits: 01**

Course Objectives:

To develop skill for design and detailing of various steel structures.

Course Outcomes:

The students will learn techniques and method of communicating engineering design to industry

1) Design & detail of various steel structures.
2) Use of cold form sections in the steel structure.
3) Develop design basis report.

Content:

Complete Design calculation and Drawing to be developed for the following structures based on syllabus.

- Design of Industrial Buildings including Crane girders & Gantry girder.
- Design of Foot Bridge.

2SMTCS08 Design Of Prestressed Concrete Structures –Lab 6

Practical/week: 2 **Credits: 01**

Tutorials/week: Nil **Course Prerequisites: Nil**

Course Objectives:

Students will be able to

1) Understand Earthquake resistant design Concept.
2) Understand IS code provision to find seismic and wind forces.
3) Know RCC beam, column and shear wall design procedure.

Course Outcomes:

Students who successfully complete this course will be able to:

1) Explain Earthquake resistant design Concept.
2) Analyze seismic and wind forces as per IS Code
3) Design of RCC beam, column and shear wall

Practicals

1) Candidates are required to prepare at least two Complete Design calculations and Drawings to be developed based on theoretical course (1XXX1) detailed workings are necessary.
2) A compulsory site visit for studying the various aspect and prepare a report.

2SMTCS09 Mini- Project & Seminar

Practicals /week: 04 **Credits: 02**

Course Objectives: Students will be taught -

1) Procedure to analyze and design of structure using software like SAP, ETAB, STAAD-PRO, etc.

2) Procedure to prepare Structural Drawing

Course Outcomes: Students who successfully complete this course will be able:

1) To analyze and design structure using software like SAP, ETAB, STAAD-PRO, etc.
2) To prepare Structural Drawing

Syllabus

Complete analysis and design of structure as per current IS performed and detailed working Drawings for structures should be submitted along with the report.

Syllabus of Semester-III

3SMTCS01 Internship

Practical: **Credits: 06**

Course Prerequisites: First Year Course Completion

Compulsory Internship Two Months (After Completion of 1st Year)

3SMTCS02 Seminar & Dissertation Phase- 1

Practical: 08 Hours/week
Lectures/week: Nil **Credits: 04**

Course Objectives:

1) To identify and define the problem with OBJECTIVES
2) To perform the literature review of past work related to the problem and identify the research gap.
3) To demonstrate the problem with respect to society.
4) To demonstrate understanding, application of relevant methodology techniques and analysis

Course Outcomes: On successful Completion of the course, students will be able to

1) Complete the definition of the problem with bridging the research gap.
2) To demonstrate the problem in-depth knowledge and thoughtful application in stating an in-depth analysis of key theories supporting the study.
3) Apply the relevant methodology and technique to solve the problem.
4) To complete 40% study on defined problem through mathematical application or experimentation.

The student has to select a topic for the dissertation, carry out literature review, find the literature gap, carry out 40% or more work on dissertation topic and submit the report and deliver the seminar based on it.

Syllabus of Semester-IV

4SMTCS01 Seminar & Dissertation Phase –II

Practical: 20hrs/week **Credits: 10**

Course Prerequisites: Nil

Course Objectives:

1) To record the findings of a study.
2) To co-relate the results with previous work results.
3) To prepare the report on a complete study with clear interpretation and discussion of the results

Course Outcomes:

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

1) Carry out detailed mathematical modelling or experimental validation.
2) Present the report on the complete study with clear interpretation and discussion of the results.
3) Demonstrate the utility of study to the society.
4) Define future scope of study.

Student has to carryout remaining dissertation work on the selected dissertation topic and submit the report. Seminar shall be delivered on the dissertation submitted. Marks shall be based on your work, Seminar and Viva-Voce on dissertation.