Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

Curriculum for
M. TECH Structures
(2017 Pattern)

Department of
Civil Engineering

Department of Civil Engineering

VISION:

- Excellence in Civil Engineering Education

MISSION:

- Make competent Civil Engineers with high level of professional, moral andethical values.
- Attain highest standards in theoretical as well as practical knowledge and skillset.
- Establish Centre of Excellence in major areas of Civil Engineering to respond to the current and future needs of the industry, higher studies as well as research.

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Department of Civil Engineering

Structure for First Year M. Tech. Structures with effect from Academic Year 2017-18

First Year - Semester I

Sr. No.	Course Code	Course	Teaching Scheme		Examination Scheme					Total	Credits
			L	P	ISE		CE	ESE	OR		
					T1	T2					
1	CVPB11171	Theory of Elasticity	4	-	15	15	20	50	-	100	4
2	CVPB11172	Critical Review of Concrete Structures	4	-	15	15	20	50	-	100	4
3	CVPB11173	Research Methodology	4	-	15	15	20	50	-	100	4
4	CVPB11174	Elective – I* (Program Specific)	4	-	15	15	20	50	-	100	4
5	CVPB11175	(Elective – II* Department Specific)	4	-	15	15	20	50	-	100	4
6	CVPB11176	Seminar - I	-	2	-	-	50	-	50	100	1
7	CVPB11177	Lab practice - I	-	8	-		50	-	50	100	4
8	CVPB11178	Audit Course	1	-	-	-	-	-	-	-	-
		Total	**21**	**10**	**75**	**75**	**200**	**250**	**100**	**700**	**25**

Theory: 1Hr. = 1 Credit, Practical: 2 Hrs. = 1 Credit #1 hr. = 1 Credit, Audit Course: No Credits

Subject Code	Elective - I	Subject Code	Elective - II
CVPB11174A	Plastic Analysis of Steel Structures	CVPB11175A	Optimization Techniques
CVPB11174B	Soil Structure Interaction	CVPB11175B	Finite Element Analysis
CVPB11174C	Structural Dynamics	CVPB11175C	Standard Working Practices
CVPB11174D	Analysis of High-rise Structures	CVPB11175D	Concrete technology for hydraulic structures

Audit Course

CVPB11178A	Review of consultancy projects
CVPB11178B	Review of codes
CVPB11178C	Review of exam answer books for effective teaching- learning
CVPB11178D	Presentation skill development

BOS Chairman Dean Academics Director

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Department of Civil Engineering

First Year - Semester II

Sr. No.	Course Code	Course	Teaching Scheme		Examination Scheme					Total	Credits
			L	P	ISE		CE	ESE	PR/ OR		
					T1	T2					
1	CVPB12171	Dynamics and Earthquake Engineering	4	-	15	15	20	50	-	100	4
2	CVPB12172	Design of Pre-stressed Structures	4	-	15	15	20	50	-	100	4
3	CVPB12173	Advanced Design of Steel Structures	4	-	15	15	20	50	-	100	4
4	CVPB12174	Elective – III* (Program Specific)	4	-	15	15	20	50	-	100	4
5	CVPB12175	Elective - IV (Program Specific)	4	-	15	15	20	50	-	100	4
6	CVPB12176	Seminar – II	-	2	-	-	50	-	50	100	1
7	CVPB12177	Intellectual Property Rights	1	-			50	-	-	50	1
8	CVPB12178	Lab practice – II	-	6	-	-	50	-	50	100	3
9	CVPB12179	Audit Course	1	-	-	-	-	-	-	-	-
		Total	**22**	**8**	**75**	**75**	**250**	**250**	**100**	**750**	**25**

Theory: 1Hr. = 1 Credit, Practical: 2 Hrs. = 1 Credit #1 hr. = 1 Credit, Audit Course: No Credits

Subject Code	Elective - III	Subject Code	Elective - IV
CVPB12174A	Advanced Analysis of Steel Frames	CVPB12175A	Advanced Earthquake Engineering
CVPB12174B	Design of RCC Bridges	CVPB12175B	Design of Foundation
CVPB12174C	Design of High-rise Structures	CVPB12175C	Design of Composite Construction
CVPB12174D	Theory of Plates and Shells	CVPB12175D	Nonlinear Analysis of Structures

Audit Course

CVPB12179A	Identification of modes of failure in various structural elements
CVPB12179B	Review of published technical note
CVPB12179C	Review of codes
CVPB12179D	Instrumentation in engineering

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Department of Civil Engineering

Second Year - Semester I

S.Y. M. Tech- Semester - I											
Sr. No	Course Code	Course	Teaching Scheme		Examination Scheme					Total	Credits
			L	P	ISE		CE	ESE	PR/OR		
					T1	T2					
1	CVPA21171A	Open Elective (Institute)	3	-	15	15	20	-	-	50	3
2	CVPA21171B	Foreign Language	2	-	15	15	20	-	-	50	2
3	CVPA21172	Internship/Value added course/In-house Project	-	8	-	-	100	-	100	200	8
3	CVPA21173	Project Stage I	-	12	-	-	100	-	100	200	12
		Total	5	20	30	30	240	-	200	500	25
Open Elective: Project Management/ Non Destructive Techniques and Engineering Diagnosis											

S.Y. M. Tech- Semester - II										
Sr.No	Course Code	Course	Teaching Scheme		Examination Scheme				Total	Credits
			L	P	ISE	CE	ESE	OR		
1	CVPA22171	Project Stage II	-	25	-	100	-	100	200	25
		Total	-	25	-	100	-	100	200	25

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Department of Civil Engineering

Semester – I

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Department of Civil Engineering

First Year M.Tech-Civil-Structures Semester I

Theory of Elasticity (CVPB11171)

Teaching Scheme

Credits : 4
Lectures : 4 Hrs./week
Laboratory Work : NA

Examination Scheme

F. A. : 50 Marks
S. A. : 50 Marks

Prerequisite: Strength of Materials, Engineering Mathematics, Structural Analysis

Course Objectives:

1. Be able to analyze representative problems and to formulate the conditions of theory of elasticity application
2. Be able to execute a reasonable choice of parameters of the model (geometry, material properties, boundary conditions)
3. Be able to interpret the result of solution by standard computational programs

Course Outcomes:

By the end of the course,

1. To be able to identify the state of stress and strains in different conditions
2. To be able to solve and appraise the state of stress and strains in different conditions
3. To be able to apply the concept to evaluate the practice problem related linear elastic behaviour

Unit I : Analysis of Stresses and Strain

Concept of stress at a point, stress tensor, stress on inclined plane, stress components on a Rectangular parallelepiped in Cartesian coordinate system, derivation of stress equilibrium equations, transformation of stresses, stress invariants. The state of strain at a point, strain displacement relations, strain compatibility condition and stress compatibility conditions.

Hands on

Self-pressure test, Drawing Sketches, Demonstrations.

Unit II : Stress-Strain Relationship

Relations between Elastic Constants, Problems on Navier Lame's Equilibrium Equations, Problems on Beltrami-Michell compatibility equations, Boundary value problems in Elasticity.

Generalized Hook's law for Isotropic, Orthotropic, plane stress, plane strain and axisymmetric problems, Problems in 2D and 3D Cartesian coordinate system, Airy's stress function, bending of beams.

Hands on

Drawing Sketches, Discussion based on technical video / documentaries, Failure case studies, Mini experiments

Unit III : Polar Coordinate System

Relationship between Cartesian and Polar coordinate system, Equilibrium equations, Strain displacement relations, Stress-strain relationship, Strain-displacement relationship for plane stress and plane strain conditions.

Hands on

Drawing Sketches, Demonstrations, Model making

Unit IV: Stress concentration problems
Stress concentration problems such as stress concentration due to circular hole in stressed plate (Kirsch's Problem), failure criterion- von miseset **Hands on** Discussion based on technical video / documentaries, Drawing Sketches, Failure case studies, Mini experiments
Unit V: Plates
Introduction: Thin and thick plates, small and large deflections. Small deflection theory of thin plates: Assumptions, Moment Curvature relations. Stress resultants. Governing differential equation in Cartesian co-ordinates, various boundary conditions. Pure bending of Plates. **Hands on** Discussion based on technical video / documentaries, Drawing Sketches, Application Case studies
Unit VI : Analysis of Rectangular Plates
Analysis of Rectangular Plates : Naiver solution for plates with all edges simply supported. **Hands on** Discussion based on technical video / documentaries, Application Case studies, Mini experiments.
Text books: 1. Irving Shames, Mechanics of deformable solids, Prentice Hall 2. Sadhu Singh – Theory of Elasticity, Khanna Publishers 3. L.S. Sreenath – Advanced Mechanics of Solids, Tata McGraw-Hill Publications 4. N. K. Bairagi- Advanced Solid Mechanics- Khanna Publishers, New Delhi 5. S. Crandall, N. Dahl and T. Lardner - Mechanics of Solids, McGraw Hill Publications
Reference books: 1. Timoshenko and Goodier - Theory of Elasticity, McGraw-Hill Publications 2. Wang - Applied Elasticity, Dover Publications 3. Enrico Volterra and J. H. Gaines – Advanced Strength of Materials, Prentice Hall 4. S M A Kazimi – Solid Mechanics, Tata McGraw-Hill Publications

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Department of Civil Engineering

Critical Review of Concrete Structure (CVPB11172)

Teaching Scheme

Credits : 3
Lectures : 3 hrs / week
Laboratory Work : NA

Examination Scheme

F.A. : 50 Marks
S.A. : 50 Marks

Pre-requisite:

Course Objectives :

The course will help

1) Enable student to appraise the basics of reinforced concrete design
2) Enable student to comprehend and apply the knowledge of composite behaviour
3) Apply knowledge to solve design problem

Course Outcomes : Students will be able to

1) Demonstrate the use of IS Codes
2) Apply knowledge to design concrete structures under different conditions
3) Prepare detailed structural drawings as per the design
4) Demonstrate appropriate use of design concepts for structure as a whol

Unit I : Preliminary considerations

Stress strain curve (characteristics and design) for concrete, steel and composite (RCC elements). Performance requirements – compressive strength, tensile strength, flexural strength, modulus of rupture, modulus of elasticity (initial, secant and tangent), Ductility and durability aspects. Various failure modes (axial, flexure, shear, torsion and combinations), Loads, load combinations for various limit states.

Hands On

Demonstrations, Drawing Sketches, Interactions with Experts on specific course content

Unit II : WSM

a) Introduction and assumptions
b) Transformed section philosophy
c) Plot the working stresses in steel and concrete and marked WSM limits specified by IS 456
d) Design procedure for flexure (singly and doubly)

Hands On

Discussion based on technical video / documentaries for understanding the concept of modular ratio, illustrative examples

Unit III : LSM

a) Introduction –assumptions and Philosophy
b) Performance limit states
c) Flexure section analysis, M-phi curve
d) Demark the various performance states on M-phi curve (serviceability, cracking, yielding, ultimate)

Unit IV : LSM - Flexure

a) Crack width and depth analysis for flexure (singly reinforced section)
b) Short term and long term deflection calculations

Hands On (2 hrs)

Illustrative examples using IS 456.

Unit V : LSM - Shear

a) Shear stresses in beams, modes of cracking in shear
b) Shear transfer mechanisms in RC beams
c) Shear failure modes: effect a/d ratio
d) Critical sections for shear
e) Review of examples

Hands On (2 hrs)
Illustrative examples using IS 456

Unit VI : LSM – Column

a) Introduction and assumptions
b) Section analysis- under compression and uni-axial bending
c) Distribution of strains at ultimate limit states
d) Design strength – axial load and moment interaction (P-M curve)

Hands On
Illustrative examples using IS 456.

Reference Books:

1. Pillai and Menon, Reinforced Concrete Design, McGraw Hill Publication, New Delhi
2. Advance R.C.C. Design By S.S. Bhavikatti, New Age International Publishers
3. B.C. Punmia, Ashok K. Jain, Arun K. Jain – Reinforced Concrete Structures Vol. II, Laxmi Publications, New Delhi
4. N.C. Sinha, S.K. Roy – Fundamentals of Reinforced Concrete, S. Chand & Co. Ltd, New Delhi
5. P.C. Varghese – Advanced Reinforced Concrete Design, Prentice Hall of India Pvt. Ltd., New Delhi
6. Reinforced Concrete design ---Dr.H. J. Shah—Charotar publishing house
7. Design of R.C.C—S. Ramaamruthum -- DhanpatRai publications
8. IS: 456-2000 Indian Standard code of practice for plain and reinforced concrete, Bureau of Indian Standards, New Delhi.
9. Park and Paulay, Reinforced Concrete Structures, John Wiley and Sons Inc., New York

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Department of Civil Engineering

Research Methodology (CVPB11173)

Teaching Scheme

Credits : 4
Lectures : 4Hrs/week
Laboratory Work: NA

Examination Scheme

F.A. : 50 Marks
S.A. : 50 Marks

Prerequisite : Basis statistical tools

Course Objectives : Upon completion of the course students must be able to:

1. Get introduced to the concept of research and research design
2. Formulate the problem statement and prepare research plan for the problem under investigation.
3. Apply various numerical/quantitative techniques for data analysis.
4. Communicate the research problem effectively.
5. Get introduced to applications of soft computing techniques in research

Course Outcomes : The students will be able to:

1. Define research and formulate a research problem
2. Understand applications of Soft computing in Research
3. Explain the importance of literature review, Data collection, Measuring, Sampling and Scaling techniques
4. Discuss preliminary data analysis and Advanced data analysis techniques
5. Identify and evaluate various research designs
6. Write a research proposal to a suitable funding agency

Unit 1 : Introduction to Research and Research problem

Meaning of research, types of research, process of research, Objectives of research, Research and Scientific Method, Sources of research problem, Criteria / Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem, defining a research problem (Real life example or case study), formulation of research hypotheses, Qualities of a good Hypothesis, Null Hypothesis & Alternative Hypothesis. Hypothesis Testing -Logic & Importance

Unit II : Research Design

Research Design- Concept and Importance in Research, Features of a good research design, different research designs in research studies, Experimental research designs (informal and formal), Replication, Randomization, Blocking.

Unit III : Data collection, Measuring, Sampling and Scaling

Classification of data, benefits and drawbacks of data, evaluation of data, qualitative methods of data collection, types of data analysis, statistics in research- measure of central tendency, measure of dispersion, measure of asymmetry, measure of relationship, Sampling, sample size, sample design- concept of probability sampling and non-probability sampling, attitude measurement and scaling, types of measurements, criteria of good measurements, classification of scales.

Unit IV: Data analysis

Testing of hypothesis- concepts and testing, analysis of variance techniques, introduction to non-parametric tests. Validity and reliability, Approaches to qualitative and quantitative data analysis. Correlation and regression analysis, Introduction to factor analysis, discriminant analysis, cluster analysis, multidimensional scaling, Descriptive statistics, inferential statistics, Multidimensional measurement and factor analysis.

Unit V: Report, Research proposal and funding agencies

Need of effective documentation, types of reports, report structure, Format of research proposal, Individual research proposal, Institutional research proposal, Funding for the proposal, Different funding agencies. Plagiarism. Research briefing, presentation styles, elements of effective presentation, writing of research paper, presenting and publishing paper, patent procedure.

Unit VI : Soft computing in Research

Demonstration of statistical software like SPSS, GRETL, minitab etc. in research. Introduction to evolutionary algorithms- Fundamentals of Genetic algorithms, Neural Network based optimization, Optimization of fuzzy systems with applications.

Continuous Assessment (CE):

1. Assignment on Defining a research problem with literature review (A case study or current societal problem). **(5 marks)**
2. Assignment on Data Analysis. (A data set will be given and analyzed) **(5 marks)**
3. A research proposal should be made which should consist of writing a research proposal to a suitable funding agency with a suitable research problem, identification of gap in research, hypothesis, Methodology, data collection, sampling, probable method of data analysis, cost analysis and time frame (with reference to the type of project and/or requirement of funding agencies, other relevant topics can be added). The proposal should be made using Latex or MS office- with techniques and a plagrism check with free software to be done.

The Research proposal made using Latex / MS office with plagrism checked report is a compulsory assignment to be performed. (10 marks)

Internal Assessment (ISE)

Test 1: Will consist of written examination on I, II and III units OR defining a problem which currently is faced by society.

Test 2: Will contain: presenting summary of 2 International Journal papers or data analysis using appropriate software (data set will be provided).

Text books:

1. Research Methodology: Methods and Trends', by Dr. C. R. Kothari--- New Age International Publishers.
2. Research Methods in Education---Louis Cohen, Manion, Morrison---Routledge (Taylor & Francis Group) / -- Cambridge University Press India Pvt. Ltd.-ISBN-978-0-415-58336-7
3. Research Methodology: An Introduction' by Wayne Goddard and Stuart Melville
4. Research Methodology: A Step by Step Guide for Beginners', by Ranjit Kumar
5. Research in Education---John Best and James Kahn, Prentice Hall of India Pvt. Ltd.
6. Fuzzy Logic with Engg Applications, Timothy J.Ross, Wiley Publications, 2nd Ed[d]
7. Genetic Algorithms in Search, Optimization, and Machine Learning by David E. Goldberg

8. Neural Networks - A Systematic Introduction- Raul Rojas, Springer; 1 edition (July 12, 1996)
9. e-Resource---For class room ppts---www.wileyeurope.com/college/sekaran

Reference books:

1. Research Methodology: concepts and cases—Deepak Chawla and NeenaSondhi,Vikas Publishing House Pvt. Ltd. (ISBN 978-81-259-5205-3)
2. Research Methods for Business—Sekaran Uma and Roger Bougie—Wiley, India

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Department of Civil Engineering

Elective I
Plastic Analysis of Steel Structures (CVPB11174A)

Teaching Scheme
Credits : 4
Lectures : 4 Hrs/week
Laboratory Work: 2 Hrs/week

Examination Scheme
F.A. : 50 Marks
S.A. : 50 Marks

Prerequisite : Structural Analysis-I, Structural Analysis-II

Course Objectives : The course will help students

1) To recognize the concept of plastic analysis of steel frames.
2) To identify the effect of additional stresses interacting with bending stresses in steel members.
3) To employ the design concepts of steel frames with and without haunches along with connections.

Course Outcomes:

By the end of the course, Students will be able to

1) Demonstrate the behavior of steel structures in plastic state of deformation.
2) Analyze various steel frames using plastic analysis method.
3) Asses the importance of plastic analysis and employ the concept for design of steel structures.
4) Design the various components of steel structures and their connections.

Unit I : Rectangular portal frames

Introduction, Shape factor, performance states and modes of failure, various mechanisms (formation of plastic hinge with regards to material behaviour),
Analysis of single bay – single story rectangular frames.
Hands on
Illustrative examples, Drawing Sketches

Unit II : Plastic Analysis of multi bay rectangular frame

Analysis of Multi Bay- Multi Storey rectangular portal frame, Joint & Various mechanisms
(Two bays - Three stories)
Hands on
Discussion based on technical video, Consultancy projects

Unit III : Connection to foundation

Types of connections viz. Pinned, fixed and partial fixed,
Effects of base connections on portal frame
Detailing of various base conditions (arrangements of anchor bolts)
Hands on
Model making, Drawing Sketches, Discussion based on technical video

Unit IV: Braced portal frames

Types of bracings,
Function, Importance of bracing
Effect of various joints and end conditions
Analysis of frame with and without bracing
Hands on –
Model making, Gamefication (Mechano), Visit

Unit V : Secondary considerations

Effect of support Sinking on portal frames considering various load combinations,
Consideration of fatigue

Hands on

Illustrative examples, Animated video for support sinking, Discussion with expert based on technical video / documentaries/ case study for fatigue consideration

Unit VI : Secondary considerations

Effect of lateral torsional buckling,
Stability analysis for various load combinations

Hands on (2Hrs)

Illustrative examples, Failure case studies

Text books:

1. "Limit state Design of Steel Structures", S K Duggal , McGraw Hill education, 2010
2. "Limit State Design of Steel Structures", Dr. M R Shiyekar, PHI Publication, 3rd Print
3. e-Recourses:)Teaching Resource for Structural Steel Design – INSDAG Kolkatta

Reference books:

1. B.G. Neal – Plastic Method of Structural Analysis, Chapman & Hall
2. L.S. Beedle – Plastic Design of Steel Frames, John Willey & Sons
3. A.S. Arya and J.L. Ajmani – Design of Steel Structures, Nemchand& Bros., Roorkee
4. Ramchandra – Design of Steel Structures Vol – II, Standard Book House, Delhi
5. Structural design in steel by SalwarAlamRaz New Age International Publishers
6. Steel Designers Manual – ELBS

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Department of Civil Engineering

Elective I
Soil Structure Interaction (CVPB11174B)

Teaching Scheme
Credits : 4
Lectures : 4 Hrs/week
Laboratory Work: 2 Hrs/week

Examination Scheme
F. A. : 50 Marks
S. A. : 50 Marks

Prerequisite : Theory of Structures, Engineering Mathematics III

Course Objectives:

1. To introduce and analyze SSI problem
2. To introduce knowledge in principles for design of soil structure interaction.

Course Outcomes:

By the end of the course, the students will be able to:

1. Calculate Contact pressure and settlement under foundations
2. To understand the various theories applicable for SSI
3. To understand the soil behavior
4. Understand the soil structure interaction problem in axially an laterally loaded pile
5. Calculate earth pressure on different retaining structures

Unit I : Soil – Foundation Interaction

Introduction, Importance and Applications of Soil Structure Interaction **(**SSI), Effects of structure roughness/smoothness on soil behavior, General soil-structure interaction problems – Shallow Foundations, Sheet piles, Mat/Raft foundations etc., Contact pressures and soil-structure interaction for shallow Foundations, Fixed/Flexible Base.

Unit II : Soil Structure Interaction - Parameters

Concept of sub grade modulus, effects/parameters influencing sub grade modulus, Flexible and Rigid Foundations – Rigidity calculations, Static and Dynamic Spring Constants – Winkler Model, Estimation of soil spring constants/stiffness for foundations design.
Elastic Continuum, Winkler Model, Multi-Parameter Models, Hybrid Model. Structure Contact Interface.

Unit III : Soil Behavior

Elastic and plastic analysis of stress distribution on yielding bases. Analysis of conduits/pipes in soils. Beams on elastic foundation concept, introduction to the solution of beam problems. Arching in soils.

Unit IV: Soil-Pile Behavior

Introduction, axial and laterally loaded piles, load-displacement behavior, Modified Ramberg Osgood Model, pile group, interaction effect in pile group, soil-pile modeling in FEM.

Unit V: SSI in Retaining Structures

SSI in Retaining Structures: Mohr-Coulomb envelope and circle of stresses. Earth pressure computations by friction circle method. Earth pressure distribution on walls with limited/restrained deformations, Earth pressures on sheet piles, braced excavations. Design of supporting system for excavations.

Unit VI : Seismic Soil-Structure Interaction

Fundamentals of Seismic Soil-Structure Interaction,- Dynamic response of soil, strain-compatibility, and damping characteristics of soil-structure. Shake-table tests

Text books:

1. Selvadurai, A. P. S. - Elastic Analysis of Soil-Foundation Interaction, 1979
2. Rolando P. Orense, NawawiChouw& Michael J. Pender - Soil-Foundation-Structure Interaction, CRC Press, 2010 Taylor & Francis Group, London, UK

Reference books:

1. Bowels J.E., "Analytical and Computer Methods in Foundation", McGraw Hill Book Co.
2. Desai C.S. and Christian J.T., "Numerical Methods in Geotechnical Engineering" McGraw Hill Book Co. New York.
3. Soil Structure Interaction, the real behavior of structures, Institution of Structural Engineers
4. Das, B. M. - Principles of Foundation Engineering 5th Edition Nelson Engineering
5. Scott, R.F. Foundation Analysis, Prentice Hall, 1981
6. Structure Soil Interaction - State of Art Report, Institution of structural Engineers, 1978

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Department of Civil Engineering

Elective I

STRUCTURAL DYNAMICS (CVPB11174C)

Teaching Scheme
Credits : 4
Lectures : 4 Hrs/week
Laboratory Work: 2 Hrs/week.

Examination Scheme
F. A. : 50 Marks
S. A. : 50 Marks

Prerequisite : Theory of Structures, Engineering Mathematics III

Course Objectives:

1. To introduce and analyze SDOF and MDOF systems
2. To introduce Lumped mass and Distributed Mass systems

Course Outcomes:

By the end of the course, the students will be able to:

1. Analyse damped and undamped SDOF systems subjected to free and forced harmonic vibrations
2. Analyse damped and undamped MDOF systems subjected to free and forced harmonic vibrations
3. Perform modal analysis of Multistoried buildings subjected to lateral loads
4. Analyse SDOF system subjected to general loading

Unit I : Single Degree of Freedom Systems - I

Introduction to structural dynamics, definition of basic problem in dynamics, static versus dynamic loads, different types of dynamic loads.
Introduction to single degree of Freedom (SDOF) systems- Un-damped vibration of SDOF system, natural frequency and period of vibration, damping in structures, viscous damping and coulomb damping, effect of damping on frequency of vibration and amplitude of vibration, logarithmic decrement, forced vibration. Resonance. **(6 Hrs)**

Hands on
Discussion based on technical video, Model making

Unit II : Single Degree of Freedom Systems - II

Duhamel's integral, response of structure subjected to general dynamic load, numerical evaluation of dynamics response of SDOF systems, response of structure in frequency domain subjected to general periodic and non-periodic/impulsive forces of short duration, use of Fourier Series for periodic forces, response of SDOF system subjected to ground motion.

Hands on
Discussion based on technical video / documentaries, Drawing Sketches

Unit III : Generalized Single Degree of Freedom System

Generalized Single Degree of Freedom System-Generalized properties: Assemblages of Rigid Bodies, Systems with distributed mass and elasticity, expressions for generalized system properties.

Hands on
Drawing Sketches, Software

Unit IV: Multi - Degree of Freedom Systems – I

Lumped mass multi degree of freedom (MDOF) system- Coupled and uncoupled systems, direct determination of frequencies of vibration and mode shapes, orthogonality principle, vibration of MDOF systems with initial conditions, approximate methods of determination of natural frequencies of vibration and mode shapes-vector iteration methods.

Hands on

Software, Discussion based on technical video, Lab demos

Unit V: Multi - Degree of Freedom Systems – II

Concept of modal mass and modal stiffness, forced vibration of MDOF system, modal analysis, application to multi-storey rigid frames subjected to lateral dynamic loads.

Hands on

Illustrative examples, Software, Discussion based on technical video, Lab demos

Unit VI : Distributed Mass System

Structure with distributed mass system- Use of partial differential equation, free vibration analysis of single span beams with various boundary conditions, determination of frequencies of vibration and mode shapes, forced vibration of single span beams subjected to the action of specified dynamic loads

Hands on

Illustrative examples

Text books:

1. Structural Dynamics- Theory and Computations, Mario Paz, CBS Publications
2. Dynamics of Structures, Anil K. Chopra, Prentice Hall, India.

Reference books:

1. Structural Dynamics-An Introduction to Computer Methods, R.C.Roy, John Wiley & Sons.
2. Dynamics of Structures, Cloguh & Penzein, Tata McGraw Hill. New Delhi

Elective I

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Department of Civil Engineering

Analysis of high-rise structures (CVPB11174D)

Teaching Scheme	**Examination Scheme**
Credits : 4	F.A. : 50 Marks
Lectures : 4 Hrs/week	S.A. : 50 Marks
Laboratory Work: 2 Hrs/week	Oral : 50 Marks

Prerequisite: Structural Analysis, Matrices, Design of Structures (basic courses)

Course Objectives:

1. Be able to analyze some real problem and to formulate the conditions of High-rise structures application
2. Be able to execute a reasonable choice of parameters of the building skeleton model (geometry, material properties, boundary conditions)
3. Be able to analyze the result of high-rise structures model solution by standard computational programs

Course Outcomes:

By the end of the course,

1. To be able to execute the analysis of high-rise structure using approximate and Computational methods
2. To be able to use model problem of high-rise building analysis using Computational Tool
3. To be able to use theory for solution of practice problem of high-rise building analysis Final examination

Unit I : (analysis of indeterminate structures)

a) Review of basic concepts in structural analysis.
b) Force methods: Statically indeterminate structures (method of consistent deformations; theorem of least work),
c) Displacement Methods: Kinematically indeterminate structures (slope-deflection method; moment distribution method).

Hands on Assignments:

1. Identification of inderminancy based problems
2. 3 Assignments on each topic
3. Comparison statements for various methods

Unit II: (Matrix analysis of structures)

a) Introduction: Axial stiffness and flexibility; stiffness matrices for an axial element (two dof), plane truss element (four dof) and space truss element (six dof);
b) One-dimensional axial structures: Analysis by conventional stiffness method (two dof per element) and reduced element stiffness method (single dof);
c) Plane Trusses: Analysis by conventional stiffness method (four dof per element) and reduced element stiffness method (single dof);

Hands on

Assignments: 1. 3 Assignments on each topic

Unit III : (Matrix analysis of plane frame)

Conventional stiffness method for plane frames: Element stiffness (six dof); generation of structure stiffness matrix and solution procedure; dealing with internal hinges and various end conditions;

Hands on assignments:

1. Examples on formation of element stiffness matrix
2. 3 Assignments on each topic

Unit IV: (Loadings and various structural configuration of Tall Buildings)

a) Gravity, Wind, Blast & Earthquake Loads. Load combinations for stability, service and ultimate states.
b) Various structural configurations of Tall Buildings: Gravity and lateral load resisting Structural Systems: High rise behavior, Rigid frames, braced frames, in-filled frames, shear walls, coupled shear walls, frames, tubular, cores, Concrete Composite Floor Systems Aluminum Façades.

Hands on (2 Hrs) Assignments:

1. Literature review of papers on various type of loading and application on high-rise structures
2. Literature review of papers on various configuration of high-rise structures

Unit V: (Analysis Methods for Tall Buildings)

a) Analysis of Tall Buildings for gravity and lateral loads – Approximate and Exact methods.
b) Stability of tall Buildings: Overall buckling analysis of frames, wall frames, approximate methods, second order effects of gravity loading, simultaneous first order and P-Delta analysis, translational, Torsional instability

Hands on Assignments:

1. Literature review on high-rise structures (minimum 2 papers)

Unit VI : (Modeling of High-Rise Building)

Modeling of High-Rise building using Software. Understanding the various aspects of modeling, analysis tools available in the software and interpreting the analysis results.

Hands on

Assignments : Analysis examples of building structures using software (minimum 4 assignments)

Text books:

1. DevdasMenon, "Advanced Structural Analysis", Narosa Publishing House, 2009.
2. AsslamKassimali, "Matrix Analysis of Structures", Brooks/Cole Publishing Co., USA, 1999.
3. Amin Ghali, Adam M Neville and Tom G Brown, "Structural Analysis: A Unified Classical and Matrix Approach", Sixth Edition, 2007, Chapman & Hall.
4. DevdasMenon, "Structural Analysis", Narosa Publishing House, 2008.

Reference books:

1. Gere, W. and Weaver; J. M., Matrix Method of Structural Analysis 3rd Edition, Van Nostrand Reinhold; New York; 1990
2. Tall Building – A.Coull and B.S.Smith, Programme Press,1966.
3. Response of Multistory Concrete Structures to Lateral Forces, SP–36,ACI Publication.
4. Schuellar, W, High Rise Building Structures
5. M. Fintal, Handbook of Concrete Structures
6. B.S. Taranath, Structural Analysis & Design of tall Buildings
7. B. Stafford Smith & A. Coule, Tall Building Structures: Analysis & Design
8. Advances in Tall Buildings, CBS Publishers and Distributors Delhi, 1986.

Elective II
Optimization Techniques (CVPB11175A)

Department of Civil Engineering

Teaching Scheme
Credits : 4
Lectures : 4Hrs/week
Laboratory Work: NA

Examination Scheme
F.A. : 50 Marks
S.A. : 50 Marks

Prerequisite : M-I , M-II, M-III

Course Objectives:

1. To introduce students to optimization techniques and basic concepts of Linear programming
2. To equip the students to advanced Linear Programming techniques.
3. To impart the knowledge of Non Linear Programming through unconstrained optimization techniques.
4. To make students aware of dynamic programming.
5. To impart the knowledge of different Stochastic Methods of optimization
6. To expose students to benefits of game theory and to furnish them to solve the water resources Problems.

Course Outcomes:

By the end of the course, students would be able to

1. Well conversant with optimization techniques and its components
2. Implement LPP with all its variants
3. Use of NLP like constrained and unconstrained optimization
4. use of Dynamic Programming for problems related to project investment
5. Implement sequencing, queuing theory and simulation to stochastic problems
6. Use the fundamental of game theory to optimize the practical problem

Unit 1 : Linear Programming I:

Introduction to Optimization techniques, Linear programming basic concepts, graphical method, Simplex method, Big M Method, Two phase method, Duality, sensitivity analysis.

Unit II : Linear Programming II:

Application of Linear Programming in civil engineering, Transportation Model and its variants, Assignment Model, and its variants

Unit III : Non Linear Programming:

Unconstrained one Dimensional search methods: Dichotomous search method, Fibonacci, Golden section, Multivariable unconstrained techniques: Steepest ascent and Descent methods, Newton's methods, Constrained technique: Lagrangian Multiplier.

Unit IV: Dynamic Programming:

Multi stage decision processes, Principle of optimality, recursive equation, Applications of D.P.

Unit V: Stochastic Methods:
Sequencing– n jobs through 2, 3 and M machines Queuing Theory : elements of Queuing system and it's operating characteristics, waiting time and ideal time costs, Kendall's notation, classification of Queuing models, single channel Queuing theory : Model I (Single channel Poisson Arrival with exponential services times, Infinite population (M/M/1) : (FCFS/∞ / ∞) Simulation : Monte Carlo Simulation
Unit VI : Games Theory:
Theory of games, 2 person zero sum game with and without saddle point, mixed strategies (2 x n games or m x 2 games), 2 x 3 game with no dominance, graphical method
Text books 1. Operations Research – Premkumar Gupta &D.S.Hira ., S.Chand 2. Problems in Operations Research - Premkumar Gupta &D.S.Hira ., S.Chand
Reference books 1. Engineering Optimization Theory & Practice – S.S. Rao., Wiely. 2. Operation Research – TahaHamdeyA. 3. Principles of Operation Research – Wagner, PrenticeHall.

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Department of Civil Engineering

Elective II
Finite Element Analysis (CVPB11175B)

Teaching Scheme

Credits : 4
Lectures : 4 Hrs/week
Laboratory Work: NA

Examination Scheme

F.A. : 50 Marks
S.A. : 50 Marks

Prerequisite : Structural Analysis I & II, Maths I, II & III

Course Objectives :

1. Be able to analyze some real problem and to formulate the conditions of FEA application
2. Be able to execute a reasonable choice of parameters and variables of the FEA model (geometry, material properties, boundary conditions)
3. Be able to analyze the result FEA model solution by standard computational programs

Course Outcomes :

By the end of the course,

1. To be able to execute the analysis concepts using Computational methods
2. To be able to use formulation techniques
3. To be able to use theory for finite element analysis Final examination

Unit I : Introduction

a. **Introduction to Finite Element Analysis:** Background of Finite Element Analysis, Numerical Methods, Concepts of Elements and Nodes, Degrees of Freedom, Steps in Finite Element Analysis
b. **Basic Concepts of Finite Element Analysis:** Discretization of Technique Basic, Concepts of Finite Element Analysis, Advantages of FEA, Disadvantages of FEA, Limitations of the FEM, Errors and Accuracy in FEA through examples and importance.
c. **Introduction to Elasticity:** Strain-Displacement Relations, Linear Constitutive Relations

Unit II : Finite Element Formulation Techniques

Choice of Displacement Function: Convergence criteria, Compatibility, Geometric invariance, Shape Function, Degree of Continuity, Isoparametric Elements, Various Elements.

Unit III : Stiffness Matrix and Boundary Conditions

a. Element Stiffness Matrix, Global Stiffness Matrix, Boundary Conditions, Stiffness of Truss Members: Introduction, Element Stiffness of a Truss Member, Member Stiffness with Varying Cross Section,
b. Generalized Stiffness Matrix of a Plane Truss Member: Analysis of Truss, Element Stiffness of a 3 Node Truss Member
c. Stiffness of Beam Members: Introduction, Derivation of Shape Function, Derivation of Element Stiffness Matrix, Generalized Stiffness Matrix of a Beam Member

Unit IV : FEM for Two and Three Dimensional Solids

a. Constant Strain Triangle: Element Stiffness Matrix for CST, Nodal Load Vector for CST
b. Linear Strain Triangle: Element Stiffness Matrix for LST, Nodal Load Vector for LST, Numerical Example using CST
c. Shape functions in Cartesian & natural coordinate systems

Unit V: FEM for Two Dimensional Solids

How FEM works? Steps, algorithm flow charts etc demo through examples, common mistakes, validation study with available experts and case study

Unit VI : FEM for Three Dimensional Solids

How FEM works? Steps, algorithm flow charts etc demo through examples, common mistakes, validation study with available experts and case study

Lab Practice assignment for the term work:

1. Any three assignments based on FEM by using coding tools such as EXCEL, MATLAB etc. for
   a) Formulation of stiffness matrix for any 1-D element
   b) Formulation of stiffness matrix for any 2-D element
   c) Formulation of stiffness matrix for any 3-D element
   d) Assembly procedure using Jacobian matrix
2. Finite Element Method – Software applications using either SATDD-Pro / Anysis / Etabs / SAP./Midas FEA

Text books:

1. S.S. Bhavikatti - Finite Element Analysis – New Age International Publishers, Delhi
2. Thompson---Introduction to the Finite Element, Method: Theory, Programming and Applications, Wiley, India
3. S.S. Rao - The Finite Element Method in Engineering 4th Edition – Elsevier Publication
4. G.R. Buchanan – Finite Element Analysis Schaum's outlines - Tata McGraw Hill Publishing Co. Ltd
5. Energy & Finite Element Methods in Structural Mechanics by Iriving Shames & Clive Dym, New Age International Publishers, Delhi
6. NPTEL Notes

Reference books:

1. Zienkiewicz& Taylor - The Finite Element Method 4th Edition – Vol – I & II – McGraw Hill International Edition
2. Robert D. Cook, D.S. Malkus, M.E. Plesha – Concepts & Applications of Finite Element Analysis –Wiley, India.
3. J.N. Reddy – An Introduction to the finite element method – Tata McGraw Hill Publishing Co. Ltd
4. Segerlind L.J. – Applied Finite Element Analysis - John Wiley & Sons.
5. C.S. Krishnamoorthy – Finite Element Analysis – Theory & Programming – Tata McGraw Hill Publishing Co. Ltd

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Department of Civil Engineering

Elective II
Standard Working Practices (CVPB11175C)

Teaching Scheme

Credits : 4
Lectures : 4 Hrs/week
Laboratory Work: NA

Examination Scheme

F.A. : 50 Marks
S.A. : 50 Marks

Prerequisite : Concrete Technology, Strength of Materials, Dams and Hydraulics Structures

Course Objectives:

To prepare students to be aware of standard working practices in construction industry

Course Outcomes:

By the end of the course,

1. To be able to appraise standard practices in construction.
2. To prepare the student to tackle challenges in construction industry at start of career.

Unit I : (Stake Holders)

a. Roles and responsibilities of stake holders in construction industry.
b. Understanding the laws and ethics related to the construction activity

Unit II : (Drawing)

a. Introduction and importance of field sketching
b. Review of standard drawing
c. Scaling, detailing, representation and imagination
d. Review of symbols, standard practices
e. Understanding shop drawings (practicing inspection, revisions, verification and construction)

Unit III : (Safety) :

a. Introduction and importance
b. Standard practices
c. Quality control and monitoring safety practices

Unit IV: (Supporting structural systems)

a. Introduction and importance of shuttering, form work, false work and scaffolding
b. Standard practices
c. Do's and don'ts (Checklists)

Unit V: (Concrete Production)

a. Introduction and importance
b. Standard practices
c. Quality control and monitoring practices

Unit VI : (Steel Construction)

a. Introduction and importance
b. Standard practices
c. Quality control and monitoring practices

Text books:

1. NBC guidelines
2. FEEMA guidelines
3. Relevant IS codes
4. Civil Engineers Handbook

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Department of Civil Engineering

Elective II
Concrete Technology for Hydraulic Structures (CVPB11175D)

Teaching Scheme

Credits : 4
Lectures : 4 Hrs/week
Laboratory Work: NA

Examination Scheme

F.A. : 50 Marks
S.A. : 50 Marks

Prerequisite : Concrete Technology, Strength of Materials, Dams and Hydraulics Structures

Course Objectives:

1. To prepare students to evaluate the appropriate concrete for hydraulic structures
2. To prepare the students to assess and practice the QAQC norms for concrete

Course Outcomes:

By the end of the course,

1. Student should be able to compare and select different concrete for different hydraulic structures
2. Student should be able to design and test various concrete for hydraulic structures
3. Student will be able to produce and test quality concrete

Unit I : Cement and Ingredients of Concrete

a. Introduction and constituents of cement, hydration, water cement ratio
b. Advantages and disadvantages of cement concrete
c. Types of cements
d. Problems in concrete (ASR, carbonation and incompatibility)
e. Aggregates, types, gradation and suitability.

Unit II : Types of concrete

a. Aggregate to matrix bond
b. Interfacial transition zone, Nano to micro to macro to messo behavior.
c. Normal concrete, High strength concrete, HPC, Fiber reinforced concrete, SCC and mass concrete

Unit III : Performance of Cement Concrete

a. Fresh state (Workability and stability)
b. Hardened state (strength, serviceability and durability)
c. Concrete properties significate to hydraulics structures (fresh and hardened state)

Unit IV: Suitable concrete for hydraulics structures

a. Types of hydraulics structures
b. Loads on hydraulics structures (static, hydrodynamic and fatigue load)
c. Durability consideration (permeability, crack, chemical attack and corrosion)
d. Suitable concrete for various applications (Normal Concrete, Mass concrete, HPC, Green concrete)

Unit V: Mix design (8 Hrs.)

a. Mix design of Mass concrete
b. Mix design of Sustainable concrete

Unit VI : QAQC in concreting for hydraulic structure
a. Lab and field tests b. NDT
Text books: 1. General Reading suggested: 1) Codes : i)IS 456 ii)IS 383 iii)IS 10262-2009 iv)IS 9103 2. Ambuja cement booklets on concrete Vol .1 to 158 3. ACC booklets on concrete
Reference books: 1. Handbook on Advanced concrete Technology Edited by N V Nayak,A .K.Jain, Narosa Publishing House 2. Properties of concrete by A. M. Neville, Longman Publishers. 3. Concrete Technology by R.S. Varshney, Oxford and IBH. 4. Concrete technology by A M. Neville, J.J. Brooks, Pearson 5. Concrete Mix Design-A.P.Remideos--Himalaya Publishing House (ISBN-978-81-8318-996-5 6. Concrete, by P. Kumar Metha, GujratAmbuja. 7. Learning from failures ---- R.N.Raikar 8. Structural Diagnosis ---- R.N.Raikar 9. Concrete Mix Design---Prof. GajananSabnis

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Department of Civil Engineering

SEMINAR I (CVPB11176)

Teaching Scheme

Credits : 1
Lectures : NA
Laboratory Work: 2Hrs/week

Examination Scheme

In Sem Assessment : NA
CE : 50 marks
Oral Marks : 50 Marks

Objectives:

To train the students to study a fundamental and advanced topic relevant to theircurriculum and make a report both in writing as well as in the form of presentation showing its highlights.

Outcomes:

By the end of the course,

1. Students would be able to write a report about the topic chosen by them in the prescribed format and give oral presentation of the same.
2. Students will be made aware of ethical and professional practice.

The Seminar I shall be on fundamental topic of own choice approved by the authority.The concept must be compared with code guidelines on that topic qualitatively and quantitatively. The oral exam on Seminar I will be based on spiral bound report preferably printed on both the sides of pages on any technical topic of interest associated with the post graduate course and should be submitted in a standard format having the following contents.

i. Introduction
ii. Literature Survey
iii. Theoretical contents/fundamental topics
iv. Relevance to the present national and global scenario of construction industry
v. Strengths and weaknesses of the particular area of seminar
vi. R & D in the particular area
vii. Field Applications / case studies / Experimental work / software application / Benefit cost studies – feasibility studies
viii. Vendors associated
ix. Conclusions
x. References

Students should prepare a power point presentation to be delivered in 15 minutes and should be able to answer questions asked in remaining five minutes.

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Department of Civil Engineering

LAB PRACTICE I (CVPB11177)

Teaching Scheme

Credits : 3
Lectures : NA
Laboratory Work : 6Hrs/week

Examination Scheme

In Sem Assessment : NA
CE : 50 Marks
Oral Exam : 50 Marks

Objectives :

1. To prepare students for practice and hands on assignments on various course works.
2. Introduce the students to independent thinking.
3. Exposure to practical considerations.

Outcomes :

By the end of the course,

1. Student will be able to identify and assess practical parameters in the study domain.
2. Criticize and evaluate the research work.
3. Report writing

Lab Practice I :

The oral exam for Labpractice-I should be based on completion of assignments / reports of site visitsconfined to the Theory of Elasticity, Advanced Design of Concrete Structures and Elective I courses.

The file will consist of -

i) Visit reports of minimum three site visits, exploring the field aspects for various subjects

ii) Report on minimum 3 assignments / designs / laboratory work on each subject.

iii) Report on minimum 2 software applications on any subject of the semester.

iv) Report on atleast one patent with its details studied in any subject of the semester.

v) Technical review and critique of a research article/paper on any topic from the refereed journal paper related to any subject learnt in the semester.

Semester - II

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Department of Civil Engineering

Dynamics and Earthquake Engineering (CVPB12171)

Teaching Scheme

Credits : 4
Lectures : 4 Hrs/week
Laboratory Work: Nil

Examination Scheme

F.A. : 50 Marks
S.A : 50 Marks

Prerequisite : Engineering Mechanics, Theory of Structures, Engineering Mathematics III, Structural Design II

Course Objectives:

1. Introduce students to the fundamentals of dynamics and it application
2. Introduce students to analyze building structure under earthquake loads

Course Outcomes:

By the end of the course, the students will be able to:

1. Will be able to apply the theory of dynamics in structural engineering
2. Analyse multistoried buildings for earthquake induced loads

Unit I : Vibration analysis- SDOF systems

Vibrations and the nature of time dependent phenomena, inertia, dynamic equilibrium and mathematical models of physical systems.
Introduction to structural dynamics, definition of basic problem in dynamics, static versus dynamic loads, different types of dynamic loads.
Introduction to single degree of Freedom (SDOF) systems- Un-damped vibration of SDOF system, natural frequency and period of vibration, damping in structures, viscous damping and coulomb damping, effect of damping on frequency of vibration and amplitude of vibration, logarithmic decrement, forced vibration. Resonance.

Hands on

Discussion based on technical video, Model making

Unit II : Single Degree of Freedom Systems

Duhamel's integral, response of structure subjected to general dynamic load, numerical evaluation of dynamics response of SDOF systems, response of structure in frequency domain subjected to general periodic and non-periodic/impulsive forces of short duration, use of Fourier Series for periodic forces, response of SDOF system subjected to ground motion. **Hands on**

Discussion based on technical video / documentaries, Drawing Sketches

Unit III : Multi - Degree of Freedom Systems

Lumped mass multi degree of freedom (MDOF) system- Coupled and uncoupled systems, direct determination of frequencies of vibration and mode shapes, orthogonality principle, vibration of MDOF systems with initial conditions, approximate methods of determination of natural frequencies of vibration and mode shapes-vector iteration methods.

Hands on

Software, Discussion based on technical video, Lab demos

Unit IV : Earthquake Inputs
Time History Records and Frequency Contents of Ground Motion; Power Spectral Density Function of Ground Motion; Concept of Response Spectrums of Earthquake; Combined D - V- A Spectrum and Construction of Design Spectrum; Site Specific, Probabilistic and Uniform Hazard spectrums; Predictive Relationships for earthquake parameters. **Hands on** Discussion on Tutorial Problems, Discussion based on technical video
Unit V : Modeling of Multistoried Buildings
Deterministic earthquake response: types of earthquake excitation, lumped SDOF elastic systems, translational excitation, lumped MDOF elastic systems, distributed-parameter elastic systems, translational excitation, combining maximum modal responses using mean square response of a single mode, SRSS and CQCC combination of modal responses. **Hands on** Model making, Discussion on Tutorial Problems, Discussion based on technical video/ animations
Unit VI : Analysis of Multistoried Buildings
Equivalent lateral load method of analysis Response spectra method of analysis **Hands on** Discussion on Tutorial Problems.
Text books: 1. A.K. Chopra, 'Dynamics of Structures - Theory and Application to Earthquake Engineering' Prentice Hall 2. PankajAgarwal and Manish Shrikhande, 'Earthquake Resistant Design of Structures', PHI, 2008
Reference books: 1. Clough R.W. and Penzien J., 'Dynamics of Structures', McGraw-Hill, 2nd edition, 1992 2. Seismic Design of Reinforced Concrete and Masonry Buildings---Paulay, Wiley India

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Department of Civil Engineering

Design of Prestressed Concrete Structures (CVPB12172)

Teaching Scheme
Credits : 4
Lectures : 4 Hrs/week
Laboratory Work: Nil

Examination Scheme
F.A. : 50 Marks
S.A : 50 Marks

Prerequisite: Strength of Materials, Analysis of structures, Design of structures

Course Objectives:

1. To prepare civil engineering graduates who can analyze and design prestressed concrete structures.
2. To use IS: 1343 in the design of prestressed concrete structures.
3. To understand various aspects of maintenance and rehabilitation of prestressed concrete structures

Course Outcomes:

By the end of the course, the students will be able to:

1. To appraise prestressed systems
2. To evaluate the structural capacity of prestresed concrete systems structures

Unit I : Introduction to prestressed concrete

Introduction to basic concept and general principle of prestressed concrete. Materials used in prestressed concrete. Prestressing systems. Concepts of prestressing. Losses in prestress. Cable profile and cable zone.

Hands on

Discussion based on technical video, Model making

Unit II : Analysis of prestressed concrete

Analysis of prestressed concrete section for flexure. Philosophy of limit state design for prestressed concrete members. Efficiency of a section. Permissible stresses in concrete and steel.

Deflections of prestressed concrete members. Anchorage zone stresses in prestressed concrete members.

Hands on

Illustrative examples.

Unit III : Losses in Prestressed systems

Introduction to prestressed losses and its Significance,

Estimation of prestressed losses in pretensioned and post tensioned systems as IS code.

Hands on

Illustrative examples, Discussion based on technical video, Model making

Unit IV : Design of prestressed concrete beams

Design of post tensioned prestressed concrete simply supported rectangular and flanged sections for flexure, shear, bond and bearing including end block.

Hands on

Discussion on Tutorial Problems, Discussion based on technical video

Unit V: Design of prestressed concrete slabs

Design of one way and two way pre-tensioned and post tensioned slabs.

Hands on - Illustrative examples.

Unit VI : Maintenance and rehabilitation of prestressed concrete structures

General aspects of maintenance and rehabilitation. Inspection of structures. Use of NDT equipments in the inspection. Cracks in prestressed concrete structures- remedy and repair. Repair and rehabilitation of prestressed concrete structures. Strengthening of prestressed concrete structures.

Hands on

Discussion based on technical video, Case study.

Text books:

1. Design of Prestressed concrete structures - T. Y. Lin, John Wiley Publishers.
2. Prestressed Concrete- N. Krishna Raju – Tata McGraw Hill Publication Co.
3. Prestressed Concrete, S. Ramamrutham, DhanpatRai& Sons.
4. IS: 1343-2012: Indian Standard code of practice for Prestressed concrete, BIS, New Delhi.

Reference books:

1. Prestressed Concrete, Y.Guyon, Contractors Record Ltd.
2. Prestressed Concrete, R.H.Evans&E.W.Bennette, McGraw Hill Book Co.

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Vishwakarma Institute of Information Technology, Pune-48

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Department of Civil Engineering

COURSE NAME: ADVANCED DESIGN OF STEEL STRUCTURES (CVPB12173)

Teaching Scheme

Credits : 4
Lectures : 4 Hrs/week
Laboratory Work: NA

Examination Scheme

F.A. : 50 Marks
S.A. : 50 Marks

Prerequisite : Strength of Materials, Structural Analysis, Structural Design

Course Objectives: The course will help students

1) To identify the application of basic concepts of design of steel structures.
2) To recognize the purpose of specific steel structure and interpret its behavior under various loads.
3) To recognize the behavior of thin components of steel structures subjected to various loads.
4) To analyze various steel structures subjected to various loads based on its application.
5) To design various steel structures having specific application.

Course Outcomes:

By the end of the course, Students will be able to

1) Demonstrate the use of IS Codes and standards related to design of steel structures.
2) Design of various types of steel structures used for specific application as per Indian Standard provisions.
3) Demonstrate appropriate use of design concepts for structure as a whole.
4) Recognize the behavior of steel structures as a whole through software applications

Unit I : Hoarding Structures

Analysis and design of hoarding structures under dead, live and wind load conditions as per codal provisions by limit state method, introduction to fatigue failure.

Hands on

Illustrative examples, site visits, failure case studies.

Unit II : Castellated beams

Concepts, fabrication of the castellated beam from rolled steel section, design of castellated beam for bending and shear as per codal provisions by limit state method

Hands on

Illustrative examples.

Unit III : Microwave and Transmission Towers

Introduction, structural configuration, function, analysis and design

Hands on

Illustrative examples, failure case studies.

Unit IV: Tubular Structures

Design of tubular Trusses and scaffoldings using circular hollow, rectangular hollow sections as per codal provisions, detailing of joints

Hands on

Illustrative examples.

Unit V : Cold form light gauge section

Type of cross section, stiffened, multiple stiffened and un-stiffened element, flat-width ratio, effective design width, design of light gauge compression, tension and flexural members as per codal provisions.

Hands on

Illustrative examples, Interactions with Experts on specific course content

Unit VI : Design of gantry girder

Selection of gantry girder, design of cross section, check for moment capacity, buckling resistance, bi-axial bending, deflection at working load and fatigue strength.

Hands on

Illustrative examples.

Text books:

1. S K Duggal, Limit state design of steel structures, Tata McGraw Hill Education.
2. Punmia and Jain, Comprehensive Design of steel structure, Laxmi Publication, Delhi.

Reference books:

1. N Subramanian, Design of steel structures, Oxford University Press.
2. SarwarAlamRaz—Structural Design in Steel---New Age International Publishers
3. IS: 800 - 2007, Code of Practice for General Construction in Steel, BIS, New Delhi.
4. IS: 800 - 1984, Code of Practice for General Construction in Steel, BIS, New Delhi.
5. IS: 801 - 1975, Code of Practice for use of cold formed light gauge steel structuralmembers in general building construction, BIS, New Delhi.

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Department of Civil Engineering

Elective III
Advanced Analysis of Steel Frames (CVPB12174A)

Teaching Scheme

Credits : 4
Lectures : 4 Hrs/week
Laboratory Work: NA

Examination Scheme

F.A. : 50 Marks
S.A. : 50 Marks

Prerequisite : Strength of Materials, Structural Analysis-I, Structural Analysis-II

Course Objectives: The course will help students

1) To identify the application of basic concepts of stability of structures.
2) To recognize the purpose of specific steel structure and interpret its behavior under various loads.
3) To recognize the behavior of steel frames structures subjected to various loads.
4) To analyze various steel frame components subjected to various loads based on its application.

Course Outcomes:

By the end of the course, Students will be able to

1) Analyse the various components of steel frames.
2) Demonstrate use of appropriate method of analysis of steel structures.
3) Recognize the behavior of steel structures as a whole through software applications.

Unit I : Stability of structures

Elastic stability & structural Instability, Review of critical loads of long columns for various boundary conditions; beam-columns, critical load of simple rectangular frames. Columns with initial imperfection.

Hands on

Illustrative examples.

Unit II : First order elastic and inelastic analysis **(8 Hrs.)**

First order elastic (FOE) & first order inelastic (FOIE) (Plastic) analysis of rectangular portalframes. Elastic & limit state of strength of frame. **(6 Hrs.)**

Hands on **(2Hrs.)**

Illustrative examples.

Unit III : Second order elastic analysis

Second order considerations in elastic analysis of frames P-δ & P-_ effect. Critical load ofsingle bay, single story portal frame using P-δ & P-effect; classical & semi geometricalapproach.Direct second order elastic analysis (SOE), international codal provisions,application for simple frame.

Hands on

Illustrative examples.

Unit IV : Second order inelastic analysis

Second order inelastic (SOIE) analysis of frames, elastic plastic hinge analysis, plastic zone method, use of finite element method Refined plastic hinge analysis, reduction in stiffness ofmember due to plasticity at hinge. Advantages of advanced analysis.

Hands on - Illustrative examples.

Unit V : Pre-Engineered Buildings

Introduction, basic concept of pre-engineered building, advantages and disadvantages, analysis and design of purlins and structural frame.

Hands on

Illustrative examples.

Unit VI : Software application

Design of frame using advanced analysis. Use of suitable software illustrating difference in analytical results among all methods such as FOE, FOIE, SOE, SOIE. Software application for pre-engineered building.

Hands on

Illustrative examples.

Text books:

1. "Stability Analysis & design of Structures" M.L. Gambhir, Springer, SIE.
2. "Limit State Design in Structural Steel" M. R. Shiyekar, PHI publication.

Reference books:

1. "Advanced Analysis of steel frames, Theory Software and application", W F Chen, S.Toma, CRC press, Tokyo.
2. "LRFD steel design using Advanced Analysis", W F Chen, S. Kim, CRC press.

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Department of Civil Engineering

Elective III
Design of RCC and Pre-Stressed Concrete Bridges (CVPB12174B)

Teaching Scheme

Credits : 4
Lectures : 4 Hrs/week
Laboratory Work: NA

Examination Scheme

F.A.: 50 Marks
S.A.: 50 Marks

Prerequisite : Strength of Materials, Structural Analysis, Structural Design

Course Objectives: The course will help students

1) To identify the application of basic concepts of design of steel structures.
2) To recognize the purpose of specific steel structure and interpret its behavior under various loads.
3) To recognize the behavior of thin components of steel structures subjected to various loads.
4) To analyze various steel structures subjected to various loads based on its application.
5) To design various steel structures having specific application.

Course Outcomes:

By the end of the course, Students will be able to

1) Demonstrate the use of IS Codes and standards related to design of steel structures.
2) Design of various types of steel structures used for specific application as per Indian Standard provisions.
3) Demonstrate appropriate use of design concepts for structure as a whole.
4) Recognize the behavior of steel structures as a whole through software applications

Unit I : Introduction to Bridge Engineering

a) Classification and components of bridges, layout, planning. Structural forms of bridge decks, beam and slab decks, cellular decks.
b) Design of slab culvert, box culvert and skew bridge.

Hands on

Model making, site visits

Unit II : Design of T-Beam Bridge

a) Introduction to Courbon's method, Henry-Jaegar method and Guyon-Massonet method.
b) Design of T-beam PC bridges using Courbon's method

Hands on

Illustrative examples.

Unit III : Design of Rigid Frame Bridge

Structural classification of Rigid Frame bridge, analysis and design of Rigid Frame bridge.

Hands on

Illustrative examples, failure case studies.

Unit IV: Bearings

Classification and design of bearings. Expansion joints. Forces acting on abutments and piers.

Hands on

Discussion based on technical video / documentaries.

Unit V : Wing walls

Analysis and design, types and design of wing walls.

Hands on

Illustrative examples

Unit VI : Design of Bridge Foundations

Bridge foundations introduction, design of open well, pile and caisson foundation.

Hands on

Illustrative examples, Discussion based on technical video / documentaries.

Text books:

1. T.R. Jagadeesh, M.A. Jayaram - Design of Bridge Structures, Prentice-Hall of India
2. N. Krishna Raju - Design of Bridges, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
3. David Lee – Bridge Bearings and Expansion Joints,E & FN Spon
4. IRC Codes – IRC: 5, IRC: 6, IRC -21, IRC: 18, IRC: 27, IRC: 45, IRC: 78, IRC: 83
5. Nainan P. Kurian – Design of Foundation Systems, Narosa Publishing House

Reference books:

1. D. Johnson Victor - Essentials of Bridge Engineering Fifth Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
2. V.K. Raina – Concrete Bridge Practice Analysis, design and Economics, Tata McGraw Hill
3. Joseph E. Bowles – Foundation Analysis and Design, McGraw-Hill International Edition

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Vishwakarma Institute of Information Technology, Pune-48

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Department of Civil Engineering

Elective III
Design of High-rise Structures (CVPB12174C)

Teaching Scheme

Credits : 4
Lectures : 4 Hrs/week
Laboratory Work: NA

Examination Scheme

F.A.: 50 Marks
S.A.: 50 Marks

Prerequisite : Structural Analysis, Matrices, Design of Structures (basic courses), Analysis of High-Rise Structures , Earthquake Engineering

Course Objectives:

1. Be able to design some real problem of High-rise building structures application
2. Be able to design and analyze the result of high-rise structures model solution by standard computational programs

Course Outcomes:

By the end of the course,

1. To be able to execute the design of high-rise structure using Computational methods
2. To be able to use model problem of high-rise building analysis using Computational Tool
3. To be able to use theory for solution of practice problem of high-rise building analysis Final examination

Unit I :

Review of Codal provisions with reference to stability, serviceability and strength states (latest IS codes, IBC codes)

Hands on

Illustrative examples.

Unit II :

Performance of buildings, behaviors of various type of buildings in past earthquakes, modes of failures, influence of unsymmetry, infill walls, foundations, soft story & detailing of reinforcements in buildings.

Hands on

Drawing Sketches, Discussion based on technical video

Unit III :

Frames shear walled buildings, mathematical modeling of building with different structural systems.

Hands on

Software, Illustrative examples, Discussion based on technical video

Unit IV :

Special aspects in Multi-story buildings, Effect of torsion, flexible first story, P-delta effect, drift limitation.

Hands on

Software, Failure case studies.

Unit V:

Strength, ductility and energy absorption, ductility of reinforced members subjected to flexure, axial loads & shear. Detailing of RCC members, beam, column, Beam-column joints for ductile behaviors, IS code provisions.

Hands on

Illustrative examples, Failure case studies.

Unit VI :

Design of multi-story buildings with bracings &infills.

Hands on

Illustrative examples.

Text books:

1. Paulay, T. &Prestiley, M.J.N., Seismic design of R C & Masonry Buildings, John Willey & Sons; 2nd Edition, 1999
2. FarzadNaeim, Handbook on Seismic Analysis and Design of Structures, Kluwer Academic Publisher, 2001
3. Booth, E., Concrete Structures in Earthquake Regions, Longman Higher Education, 1994

Reference books:

1. Response of Multistory Concrete Structures to Lateral Forces, SP–36, ACI Publication.
2. Response of Buildings to Lateral Forces, ACI Task Committee Report 442.
3. Schuellar, W, High Rise Building Structures
4. M. Fintal, Handbook of Concrete Structures
5. B.S. Taranath, Structural Analysis & Design of tall Buildings
6. B. Stafford Smith & A. Coule, Tall Building Structures: Analysis & Design
7. Advances in Tall Buildings, CBS Publishers and Distributors Delhi, 1986.

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Vishwakarma Institute of Information Technology, Pune-48

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Department of Civil Engineering

Elective III
Theory of Plates and Shells (CVPB12174D)

Teaching Scheme
Credits : 4
Lectures : 4 Hrs/week
Laboratory Work: NA

Examination Scheme
F.A. : 50 Marks
S.A. : 50 Marks

Prerequisite : Theory of Elasticity, Advanced Solid Mechanics

Course Objectives: The course will help students

1) To identify the application of basic concepts of analysis of 2-D plates and shells.
2) To interpret the behavior of plate and shell structure under various loads.
3) To understand and compare various analysis methods for plates and shells.
4) To analyze plates and shells subjected to various loads based on its application.

Course Outcomes:

By the end of the course, Students will be able to

1) Demonstrate the concept of analysis of 2-D plates and shells.
2) Analysis of various types of plates and shells subjected to various loads based on its application.
3) Recognize the behavior of plate and shell structures through software applications.

Unit I : Thin plates

Introduction: Theory of thin plates: Assumptions, Moment Curvature relations. Navier and Levy's solution for plates with distributed loads.Raleigh- Ritz approach for simple cases in rectangular plates.

Hands on

Illustrative examples.

Unit II : Shear deformation theories

Introduction to shear deformation theories. Reissener - Mindlin Theory, Moment curvature relationship for First order shear deformation theory.

Hands on

Illustrative examples.

Unit III : Circular Plates

Circular Plates: Analysis of circular plates under axi-symmetric loading. Moment Curvature relations. Governing differential equation in polar co-ordinates. Simply supported and fixed edges. Distributed load, ring load, a plate with a central hole.

Hands on

Illustrative examples.

Unit IV : Thin Shells

Shells of Revolution: Membrane theory, equilibrium equations, strain displacement relations, boundary conditions, cylindrical, conical and spherical shells.

Hands on

Illustrative examples.

Unit V : Shell bending and beam theory

Bending Theory: Equilibrium equation, strain displacement relations, governing differential equation, solution for a simply supported cylindrical shell, various boundary conditions. Application to pipes and pressure vessels. Beam theory of cylindrical shells: Principles of Lundgren's beam theory, beam analysis, arch analysis, application to cylindrical roof shells.

Hands on Illustrative examples.
Unit VI : Circular cylindrical Shells
Circular cylindrical shells: Membrane theory: Equilibrium equations, strain displacement relations, boundary conditions. **Hands on** Illustrative examples.
Text books: 1. Chandrashekhara K., Analysis of Concrete Shells, New Age International Edition 2. Chandrashekhara K., Analysis of Plates, New Age International Edition
Reference books: 1. S. Timoshenko and W. Krieger, Theory of Plates and Shells, McGraw Hill. 2. Ansel C. Ugural Stresses in Plates and Shells, McGraw Hill

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Vishwakarma Institute of Information Technology, Pune-48

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Department of Civil Engineering

Elective IV
Advanced Earthquake Engineering (CVPB12175A)

Teaching Scheme
Credits : 4
Lectures : 4 Hrs/week
Laboratory Work: Nil

Examination Scheme
F.A. : 50 Marks
S.A. : 50 Marks

Prerequisite : Theory of Structures, Engineering Mathematics III

Course Objectives:

1. To introduce Response Spectrum and Time History Analysis for earthquake induced loads
2. To introduce seismic soil structure interaction
3. To introduce base isolation techniques

Course Outcomes:

By the end of the course, the students will be able to:

1. Analyze the buildings using response spectrum method of analysis
2. Analyze the response of the buildings for specific ground motion
3. Analyse the response of the buildings incorporating soil structure interaction

Unit I : Earthquake Inputs

Time History Records and Frequency Contents of Ground Motion; Power Spectral Density Function of Ground Motion; Concept of Response Spectrums of Earthquake;
Combined D-V-A Spectrum and Construction of Design Spectrum; Site Specific, Probabilistic and Uniform Hazard spectrums; Predictive Relationships for earthquake parameters.

Hands on

Discussion on Tutorial Problems, Discussion based on technical video

Unit II : Response Spectrum Analysis Method

Characterization of ground motion: earthquake response spectra, factors influencing response spectra, design response spectra for elastic systems, peak ground acceleration, response spectrum shapes, deformation, pseudo-velocity, pseudo-acceleration response spectra, peak structural response from the response spectrum, response spectrum characteristics.

Hands on

Discussion on Tutorial Problems

Unit III : Analysis of Multistoried Buildings

Deterministic earthquake response: types of earthquake excitation, lumped SDOF elastic systems, translational excitation, lumped MDOF elastic systems, multistoried buildings with symmetric plans, multistoried buildings with unsymmetric plans, torsional response of symmetric plan building, distributed-parameter elastic systems.

Hands on

Discussion on Tutorial Problems

Unit IV :

Design of RC building with Shear Walls. Ductile detailing as per latest IS:13920.

Hands on

Illustrative examples.

Unit V : Retrofitting of structures
Retrofitting of Structures, Sources of weakness in framed buildings, Classification of retrofitting techniques, Conventional and non-conventional methods, Comparative study of various methods and case studies. **Hands on** Discussion based on technical video, failure case study.
Unit VI : Base Isolation Techniques
Base isolation concept, isolation systems and their modeling; linear theory of base isolation; stability of elastomeric bearings; codal provisions for seismic isolation, practical applications. **Hands on** **(2Hrs)** Discussion based on technical video.
Text books: A.K. Chopra, 'Dynamics of Structures - Theory and Application to Earthquake Engineering' Prentice Hall PankajAgarwal and Manish Shrikhande, 'Earthquake Resistant Design of Structures', PHI, 2008
Reference books: Clough R.W. and Penzien J., 'Dynamics of Structures', McGraw-Hill, 2nd edition, 1992 Ellis L. Krinitzsky, J.M. Gould and Peter H. Edinger, 'Fundamentals of Earthquake Resistant Construction', John Wiley, 1993

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Vishwakarma Institute of Information Technology, Pune-48

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Department of Civil Engineering

Elective IV
Design of Foundation (CVPB12175B)

Teaching Scheme

Credits : 4
Lectures : 4 Hrs/week
Laboratory Work: 2 Hrs/Week

Examination Scheme

F.A. : 50 Marks
S.A. : 50 Marks

Prerequisite : Strength of Materials, Geotechnical and Foundation Engineering

Course Objectives:

1. To analyze and design various foundations
2. To introduce knowledge in principles for design of retaining wall.

Course Outcomes:

By the end of the course, the students will be able to:

1. Identify a suitable foundation system for a structure
2. Evaluate the importance of raft foundation and principles of design
3. Analyze and design pile foundations
4. Analyze and design Retaining Wall
5. Analyze and design sheet pile system

Unit I : Soil – Foundation Interaction

Foundation objectives and their importance, Classification of foundations, Soil classification. Geotechnical design parameters, bearing capacity, settlements and factors affecting settlement. Loads for design, depth of foundation and depth of soil exploration. Parameters for design of foundation on various types of soil, soil structure interaction.

Hands on

Discussion based on technical video, Engineering sketches, case study

Unit II : Design of Raft Foundations

Types of rafts, Design of Flat slab raft foundation .Design of beam and slab raft foundation.

Hands on

Illustrative examples and case studies.

Unit III : Pile Foundation –I

Function and Classification of piles, Concrete piles, Precast and cast-in-situ piles. Static point and skin resistance capacity of a Pile, Pile settlements.
Laterally loaded Piles. Various pile group patterns, Efficiency of Pile in group, Negative skin friction.

Hands on

Illustrative examples.

Unit IV: Pile Foundation –II

IS code recommendations for structural design for various piles. Design of RC cast-in-situ and precast pile by IS code method. Pile group analysis by rigid and flexible methods, Design of pile cap.

Hands on

Illustrative examples

Unit V: Design of Sheet Pile

Earth pressure diagram, determination of depth of embedment in sands and clays, timbering of trenches, Earth pressure diagrams, forces in struts

Hands on

Illustrative examples, Model making

Unit VI : Software application

Software application on laterally loaded pile, raft foundation and sheet pile.

Hands on

Software.

Text books:

1. IS 1904: 1986 Code of practice for design and construction of foundations in soils: general requirements (Third Revision)
2. IS 2911: Part 1 : Sec 1 to3 : 1979 Code of practice for design and construction of pile foundations: Part 1 Concrete piles
3. IS 2911: Part 1: Sec 4 : 1984 Code of practice for design and construction of pile foundations: Part 1 Concrete piles
4. IS 2911: Part 3: 1980 Code of practice for design and construction of pile foundations: Part 3 Under-reamed piles
5. IS 2950: Part 1: 1981 Code of Practice for design and construction of raft foundations: Part 1: Design
6. IS 2974: Part 1to 5: 1982 Code of practice for design and construction of machine foundations

Reference books:

1. Kurain N.P, Modern Foundations: Introduction to Advance Techniques: TataMcGraw
2. Kurain N. P, Design of foundation systems Principles and Practice, Narosa Publishing house, New Delhi, 2005
3. Dr. H.J.Shah, Reinforced Concrete, Vol II, Charotar Publishing House
4. Winterkorn H.F. and Fang H.Y. Ed., Foundation Engineering Hand Book, Van-NostrandReynold, 1975
5. Bowles J.E., Foundation Analysis and Design (4th Ed.), Mc.Graw –Hill, NY, 1996
6. Poulose H.G. and Davis E.H., Pile foundation Analysis and Design, John-Wiley Sons, NY
7. Leonards G. Ed., Foundation Engineering, Mc.Graw-Hill, NY, 1962
8. ShamsherPrakash, Soil Dynamics, McGraw Hill
9. Sreenivasalu&Varadarajan, Handbook of Machine Foundations, Tata McGraw Hill

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Vishwakarma Institute of Information Technology, Pune-48

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Department of Civil Engineering

Elective IV:
Design of Composite Construction (CVPB12175C)

Teaching Scheme

Credits : 4
Lectures : 4 Hrs/week
Laboratory Work: NA

Examination Scheme

F.A. : 50 Marks
S.A. : 50 Marks

Prerequisite : Strength of Materials, Theory of Elasticity

Course Objectives : The course will help students

1) To understand the basic concepts of composite constructions.
2) To interpret behavior composite structures under various loads.
3) To analyze various composite structural components subjected to various loads using different codal provisions.
4) To design various composite structural elements having specific application.

Course Outcomes:

By the end of the course, Students will be able to

1) Demonstrate the use of different Codes and standards related to design of composite structures.
2) Design of various composite structures used for specific application as per Indian Standard provisions.
3) Demonstrate appropriate use of design concepts for composite structure as a whole.
4) Recognize the behavior of composite structures as a whole through software applications.

Unit I : Concept of composite construction

Introduction of Composite Constructions. Benefits of Composite Construction, Introduction to IS, BS and Euro codal provisions.

Hands on

Illustrative examples

Unit II : Composite Beams

Composite beams, elastic behaviour of composite beams, No and Full Interaction cases, Shear Connectors, Ultimate load behaviour, Serviceability limits, Effective breadth of flange, Interaction between shear and moment.

Hands on

Illustrative examples

Unit III : Composite Floors

Basic design consideration and design of composite beams. Composite floors, Structural elements, Profiled sheet decking, Bending resistance, Serviceability criterion, Analysis for internal forces and moments.

Hands on

Illustrative examples

Unit IV : Composite Columns

Composite Columns, Materials, Concrete filled circular tubular sections, Non-dimensional slenderness, local buckling of steel sections, Effective elastic flexible stiffness, resistance of members to axial compressions, Composite Column design, Fire Resistance.

Hands on

Illustrative examples

Unit V: Multi-storeyed commercial and residential composite building

Design of Multi-storeyed commercial and residential composite building, Design basis, load calculations, Design of composite slabs with profile decks, composite beam design, design for compression members, vertical cross bracings, design of foundation.

Hands on

Illustrative examples

Unit VI : Software application

Use of suitable software illustrating design of various composite structural components using different codes.

Hands on

Software, Illustrative examples

Text books :

1. Composite Structures of Steel and Concrete: Beams, Slabs Columns and Frames for Buildings, 3ed Johnson, -Wiley India.
2. INSDAG teaching resources for structural steel design Vol – 2, Institute for Steel Development and Growth Publishers, Calcutta

Reference books:

1. Johnson R. P. – Composite Structures of Steel and Concrete, Vol I, Beams, Columns and Frames in Buildings, Oxford Blackwell Scientific Publications.
2. INSDAG Handbook on Composite Construction – Multi-Storey Buildings, Institute for Steel Development and Growth Publishers, Calcutta.

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Vishwakarma Institute of Information Technology, Pune-48

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Department of Civil Engineering

Elective IV:
Nonlinear Analysis of Structures (CVPB12175D)

Teaching Scheme
Credits : 4
Lectures : 4 Hrs/week
Laboratory Work: NA

Examination Scheme
F.A. : 50 Marks
S.A. : 50 Marks

Prerequisite : Strength of Materials, Structural Analysis

Course Objectives: The course will help students

1) To recognize the concept of non-linear analysis of steel frames.
2) To identify the effect of various non-linearity in analysis.
3) To employ the non-linear analysis concepts for various structures like columns, trusses, plates.

Course Outcomes:

By the end of the course, Students will be able to

1) Demonstrate the behavior of structures in considering material and geometric non-linearity.
2) Analyze various structures using non-linear analysis concept.
3) Asses the importance of non-linear analysis and employ the concept for design of various structures.

Unit I : Concept of nonlinear analysis

Types of Nonlinearities - Geometric Nonlinearity, Material Nonlinearity, Nonlinear Governing Equation for Beams: Moment-curvature Nonlinearity, Geometric Nonlinearity Due to Strectching, Material Nonlinearity, Geometrically Nonlinear Beam Problems - Moment-Curvature Nonlinearity-Cantilever Beam, Centrally Loaded beam with two supports, Cantilever Beam subjected to Tip Load.

Hands on

Illustrative examples

Unit II : Nonlinear Analysis of Columns

Nonlinear Analysis of Columns- Post buckling of cantilever column, Large deflection of column with both ends hinged.

Hands on

Illustrative examples

Unit III : Nonlinear Analysis of Trusses

Nonlinear Analysis of Trusses - Derivation of nonlinear stiffness matrix, Matrix displacement method for nonlinear analysis of structures.

Hands on

Illustrative examples

Unit IV : Nonlinear Elastic Analysis of Frames

Nonlinear Elastic Analysis of Frames - Derivation of nonlinear stiffness matrix, Matrix displacement method for nonlinear analysis of structures.

Hands on

Illustrative examples

Unit V : Concept of Nonlinear Analysis of Plates
Nonlinear Static Analysis of Plates - Geometric and Material Nonlinearities, Governing Nonlinear Equations of Plates: Stress Function Approach, Displacement Equations Approach. **Hands on -** Illustrative examples
Unit VI : Nonlinear Static Analysis of Plates
Nonlinear Static Analysis of Plates - Boundary Conditions and method of solution, Large Deflection of Rectangular Plates. **Hands on** Illustrative examples
Text books: 1. M.Sathyamoorthy, 'Nonlinear Analysis of Structures', CRC Press, New York 2. K.I. Majid, 'Non Linear Structures', Butter worth Publishers, London.
Reference books: 1. N G R Iyengar, 'Elastic Stability of Structural elements', Macmillan India Ltd.

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Vishwakarma Institute of Information Technology, Pune-48

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Department of Civil Engineering

SEMINAR II (CVPB12176)

Teaching Scheme

Credits : 1
Lectures : NA
Laboratory Work: 2Hrs/week

Examination Scheme

In Sem Assessment : NA
CE : 50 marks
Oral Marks : 50 Marks

Objectives:

To train the students to study a fundamental and advanced topic relevant to their curriculum and make a report both in writing as well as in the form of presentation showing its highlights.

Outcomes:

By the end of the course,

1. Students would be able to write a report about the topic chosen by them in the prescribed format and give oral presentation of the same.
2. Students will be made aware of ethical and professional practice.

The Seminar II shall be on fundamental topic of own choice approved by the authority. The concept must be compared with code guidelines on that topic qualitatively and quantitatively. The oral exam on Seminar II will be based on spiral bound report preferably printed on both the sides of pages on any technical topic of interest associated with the post graduate course and should be submitted in a standard format having the following contents.

i. Introduction
ii. Literature Survey
iii. Theoretical contents/fundamental topics
iv. Relevance to the present national and global scenario of construction industry
v. Strengths and weaknesses of the particular area of seminar
vi. R & D in the particular area
vii. Field Applications / case studies / Experimental work / software application / Benefit cost studies – feasibility studies
viii. Vendors associated
ix. Conclusions
x. References

Students should prepare a power point presentation to be delivered in 15 minutes and should be able to answer questions asked in remaining five minutes.

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Department of Civil Engineering

Intellectual Property Rights (CVPB12177)

Teaching Scheme

Credits : 1
Lectures : 1 Hrs/week
Laboratory Work: NA

Examination Scheme

CE : 50 Marks

Prerequisite:

Course Objectives : Upon completion of the course students must be able to:

1. Get introduced to the concept of Intellectual property rights
2. Classify patentable and non-patentable inventions.
3. Demonstrate the understanding of IPR issues in cyber world.
4. Demonstrate the understanding of IPR with the help of case studies.

Course Outcomes : The students will be able to:

1. Define concept of Intellectual property rights.
2. Classify patentable and non-patentable inventions
3. Understand the issues of IPR in cyber world
4. Select Patents/ Designs/ Trademarks/ Copyright and analyze them through case studies.

Unit I : Introduction to IPR (6 Hrs)

Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR in abroad, Some important examples of IPR. Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright.

Process of Patenting

Process of Patenting and Development: technological research, innovation, patenting, development, patenting under PCT, patent license, patentable and non-patentable inventions. Drafting of a patent Filing of a patent.

Unit II : Patent Rights (6 Hrs)

Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.Rights and obligations among co-inventors, co-authors, employers, and licensees.International cooperation on Intellectual Property.

Developments in IPR

Administration of Patent System. New developments in IPR; IPR of Biological Systems, Traditional knowledge Case Studies, understanding of IPR issues in cyber world

Assignments

1. Presentations on any one type of patent.
2. Assignments on Process of patent and development
3. Assignment on detail study on inventions which were patentable and non-patentable (case study)

Reference books

1. PrabuddhaGanguly, " Intellectual Property Rights",TataMc-Graw Hill.
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007
3. Robert P. Merges, Peter S. Menell, Mark A. Lemley "Intellectual Property in New"

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Vishwakarma Institute of Information Technology, Pune-48

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Department of Civil Engineering

Lab Practice II (CVPB12178)

Teaching Scheme

Credits : 3
Lectures : NA
Laboratory Work: 6 Hrs/week

Examination Scheme

In Sem Assessment : NA
CE : 50 Marks
Oral Exam : 50Marks

Objectives :

1. To prepare students for practice and hands on assignments on various course works.
2. Introduce the students to independent thinking.
3. Exposure to practical considerations.

Outcomes : By the end of the course,

1. Student will be able to identify and assess practical parameters in the study domain.
2. Criticize and evaluate the research work.
3. Proposal / Report writing.

Lab Practice II :

The oral exam for Lab practice-I should be based on completion of assignments / reports of site visits confined to the Core courses.

The file will consist of --

i) Visit reports of minimum three site visits, exploring the field aspects for various subjects

ii) Report on minimum 3 assignments / designs / laboratory work on each subject.

iii) Software applications of any two of following cases using either SATDD-Pro / Ansys / Etabs / SAP
   a) Equivalent lateral load method and Response spectra problem
   b) Hoarding structures
   c) Microwave / Transmission tower structures
   d) Tubular Structures

iv) Prepare Professional Bidding proposal with detail drawings and specifications of any one topic from (iii)- (b), (c) & (d).