SYLLABUS

OF

M.E. CIVIL (STRUCTURES)
w.e.f. July,2013

University of Pune
M.E. (Civil) (Structures)
COURSE STRUCTURE (2013Course)
(w.e.f. June – 2013)
University of Pune , Document on Rules and Regulation for P.G.Courses be referred for the detailed information
SEMESTER I

Code	Subject	Teaching Scheme	Examination Scheme					Credits
		Lect./ Pract.	Paper		T. W.	Oral / Presentation	Total	
			In Semester Assessment	End Semester Assessment				
501 001	Advanced Mechanics of Solids	4	50	50	--	--	100	4
501 002	Structural Dynamics	4	50	50	--	--	100	4
501 003	Advanced Design of Steel Structures	4	50	50	--	--	100	4
501 004	Research Methodology	4	50	50	--	--	100	4
501 005	Elective –I	5	50	50	--	--	100	5
501 006	Lab Practice- I	4			50	50	100	4
	Total	**25**	**250**	**250**	**50**	**50**	**600**	**25**

501 005-Elective I

Code	2 Credits Course	Code	1 Credit Course	Code	Audit Course (No Credit Course)
501 005A	Cyber Security/Information security	**501 005 F**	Economics & Finance For Engineers	**501 005 K**	Mass communication, Photography and Videography
501 005 B	Soil Structure Interaction	**501 005 G**	Foreign Language – I	**501 005 L**	Yoga and Meditation
501 005 C	Plastic Analysis and Design of Steel Structure	**501 005 H**	Engineering Ethics		
501 005	Optimization	**501**	Intellectual		

D	techniques	**005 I**	Property Rights		
501 005E	Mechanics of modern materials				

SEMESTER –II

Code	**Subject**	**Teaching Scheme**	**Examination Scheme**					**Credits**
		Lect. / Pract.	**Paper**		**TW**	**Oral / Presentation**	**Total**	
			In Semester Assessment	**End Semester Assessment**				
501 007	Finite Element Analysis	4	50	50	--	--	100	4
501 008	Theory of Plates & Shells	4	50	50	--	--	100	4
501 009	Advanced Design of Concrete Structures	4	50	50	--	--	100	4
501 010	Elective- II	5	50	50	--	--	100	5
501 011	Lab Practice- II	4	--	--	50	50	100	4
501 012	Seminar –I	4	--	--	50	50	100	4
	Total	**25**	**200**	**200**	**100**	**100**	**600**	**25**

501 010-Elective II

Code	**2 Credits Course** *L*	**Code**	**1 Credit Course**	**Code**	**Audit Course (No Credit Course)**
501010 A	Human Rights	**501010 E**	Foreign Language II	**501010 I**	Performing Arts – Music and Dance
501010 B	Design of precast components and Ferrocement	**501010 F**	Building Services and Maintenance	**501010 J**	Principle Centred Leadership
501010 C	Design of	**501010 G**	Green		

	Foundations		Building Design and Construction		
501010 D	Non linear Analysis of structure	**501010 H**	Forensic Civil Engineering		

SEMESTER –III

Code	**Subject**	**Teaching Scheme**	**Examination Scheme**					**Credits**
		Lect./ Pract.	**Paper**		**T. W.**	**Oral / Presentation**	**Total**	
			In Semester Assessment	**End Semester Assessment**				
601 013	Earthquake Engineering and Disaster management	4	50	50	--	--	100	4
601 014	Design of RCC&Prestressed CementConcrete Bridges	4	50	50	--	--	100	4
601 015	Elective- III	5	50	50			100	5
601 016	Seminar-II	4			50	50	100	4
601 017	Project stage I	8	--	--	50	50	100	8
	Total	25	150	150	100	100	500	25

601 015--Elective III

Code	**2 Credits Course** *L*	**Code**	**1 Credit Course**	**Code**	**Audit Course (No Credit Course)**
601 015A	Bio Mechanics and Bio Materials	**601015E**	Design of Composite Construction	**601015H**	Chess
601015B	Adv analysis of steel Frames	**601015F**	Foreign Language	**601015 I**	Abacus

601015C	Theory of Plasticity	**601015G**	Safety Practices in construction.		
601015D	Design of Concrete Shell Structures				

SEMESTER –IV

Code	**Subject**	**Teaching Scheme**	**Examination Scheme**					**Credits**
		Lect./ Pract.	**Paper**		**TW**	**Oral/Presentation**	**Total**	
			In Semester Assessment	**End Semester Assessment**				
601 018	Seminar III	5	--	--	50	50	100	5
601 019	Project Work Stage II	20	--	--	150	50	200	20
	Total	**25**	**--**	**--**	**200**	**100**	**300**	**25**

University of Pune
M.E. (Civil) (Structures)--2013Course
Semester I
1Credit =2 Modules=15 Hrs.
501 001 - Advanced Mechanics of Solids

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam: 50 marks**
Credits 4	**End Sem. Exam. : 50 marks**
	Duration of End Sem.Exam:3Hrs

Module1:
Analysis of Stresses and Strains
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, Relations between Elastic Constants, Problems on Navier Lame's Equilibrium Equations, Problems on Beltrami-Michell compatibility equations, Boundary value problems in Elasticity.
Module 2:
Stress-Strain Relationship
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.
Module 3:
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,
Module 4:
Stress concentration problems
Stress concentration problems such as stress concentration due to circular hole in stressed plate(Kirsch's Problem), stresses under concentrated load such as concentrated load acting on the vertex of a wedge (Michell's Problem) and Concentrated load acting on the free surface of a plate (Flamant's Problem), Axisymmetric Problems such as stresses in thick cylinders subjected to internal and external uniformly distributed pressures (Lame's Problem).
Module5:
Beams Curved in Plan
Analysis of Beams Curved in Plan such as cantilever circular arc, Semicircular beams fixed at two ends and subjected to central concentrated load, simply supported semicircular beam subjected to UDL supported on three equally spaced columns, Analysis of circular ring beam.
Module6:
Beams Curved in Elevation
Analysis of Beams Curved in Elevation, Application to curved circular and elliptical Rings and Crane hooks.
Module7:
Torsion
Assumptions and Torsion equation for general prismatic solid bars, Warping of Non-circular sections and St. Venant's theory, Prandtle's stress function approach, Torsion of Circular,

Elliptical and Triangular cross-section, Torsion of thin-walled structures by membrane analogy, Torsion of rolled sections and shear flow

Module 8:

Beams on Elastic Foundation

Differential equation, Infinite beams with concentrated load, concentrated moment, and finite uniformly distributed load. Semi-Infinite beams with free & hinged ends subjected to finite uniformly distributed load, hinged end. Finite beams with free end and hinged end.

Reference Books

1. Swaroop Adarsh---Mechanics of Materials------- New Age International Publishers
2_S. Crandall, N. Dahl and T. Lardner - Mechanics of Solids, McGraw Hill Publications
3. S.S.Bhavikatti – Structural Analysis-II Vikas Publishing House, Pvt Ltd.
4.Enrico Volterra and J. H. Gaines – Advanced Strength of Materials, Prentice Hall
5. Nautiyal, B.D.--Introduction to Structural Analysis--- New Age International Publishers
6. S M A Kazimi – Solid Mechanics, Tata McGraw-Hill Publications
7. Irving Shames, Mechanics of deformable solids, Prentice Hall
8. Scholer, Elasticity in Engineering, McGraw-Hill Publications
9. Sadhu Singh – Theory of Elasticity, Khanna Publishers
10. L.S.Sreenath – Advanced Mechanics of Solids, Tata McGraw-Hill Publications
11. N. K. Bairagi- Advanced Solid Mechanics- Khanna Publishers, New Delhi.
12.Timoshenko and Goodier - Theory of Elasticity, McGraw-Hill Publications
13.Wang - Applied Elasticity, Dover Publications

University of Pune
M.E. (Civil) (Structures)--2013Course
Semester I
1Credit =2 Modules=15 Hrs.

501 002 : Structures Dynamics

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam: 50 marks**
Credits 4	**End Sem. Exam. : 50 marks**
	Duration of End Sem.Exam:3Hrs

Module1:
Nature of exciting forces, degrees of freedom and mathematical modelling of dynamic systems. Single degree freedom system (SDOF): An undamped and damped free vibrations, Viscous and Coulomb's damping.

Module 2:
SDOF system: Undamped and damped Forced Vibrations to harmonic excitations, Fourier analysis of periodic forces. Response to unit impulse and arbitrary loading by Duhamel's integral.

Module 3:
SDOF system: Step and Ramp forces, Pulse loadings, Response to ground motion and transmissibility..

Module4:
Non-linear analysis by step-by-step method with linear acceleration

Module 5:
Multiple degrees of freedom (MDOF) system: Free vibrations of a shear building, fundamental frequencies and mode shapes,

Module6:
Orthogonality of mode shapes, Power and Stodola methods. Concept of Tuned Mass Dampers..

Module7:
MDOF System: Forced Vibrations of shear building, transformation of coordinates and mode superposition method, Response to ground motion. Non-linear analysis by Wilson-Theta method

Module8:
Continuous system: Free transverse vibrations of beams for various boundary conditions. Free vibration analysis of a cantilever beam by Rayleigh Ritz and Finite Element Method.

Lab Practice assignment for the term work:
Report on the experimental work based on Horizontal and Vertical Shake Table

Reference Books

1. Dynamics of structures--Poultre, Wiley India
2. Mario Paz – Structural Dynamics Theory and Computation, CBS Publications
3.Anil K Chopra – Dynamics of Structures Theory and Applications to Earthquake Engineering,
Prentice-Hall Publications
4.R.W Clough and J Penzin – Dynamics of Structures, McGraw Hill Publications
5.R.C. Roy - Structural Dynamics an Introduction to Computer Methods, John Wiley & Sons Publications.

6.Madhujit Mukhopadhyay – Structural Dynamics Vibrations and Systems, Ane Books India Publishers

University of Pune
M.E. (Civil) (Structures)--2013Course
Semester I
1Credit =2 Modules=15 Hrs.

501 003 : Advanced Design of Steel Structures

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam: 50 marks**
Credits 4	**End Sem. Exam. : 50 marks**
	Duration of End Sem.Exam:3Hrs

Module1: 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.

Module 2: Castellated beams - Concept, 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.

Module 3: Microwave Towers - Introduction, structural configuration, function, analysis and design.

Module 4Transmission Towers - Introduction, structural configuration, bracing systems, analysis and design as per codal provisions. Use working stress method.

Module 5: Tubular Structures - Design of tubular Trusses and scaffoldings using circular hollow, rectangular hollow sections as per codal provisions, detailing of joints.

Module 6: 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.

Module 7: Design of chimneys – Introduction, type, joints, lining, ladder, forces acting on chimneys, design of thickness of steel plates for self supporting chimney,

Module8 -Design of base plate, anchor bolt and foundation, stability of steel chimneys. Use working stress method.

References Books and I. S. Codes

1. Ram Chandra, Design of steel Structures, Volume II, Standard Book House, Delhi.

2. Punmia and Jain, Comprehensive Design of steel structure, Laxmi Publication, Delhi.

3. M Raghupathi, Design of steel structures, Tata McGraw Hill, New Delhi.

4. S K Duggal, Limit state design of steel structures, Tata McGraw Hill Education.
5. N Subramanian, Design of steel structures, Oxford University Press.
6. Sarwar Alam Raz—Structural Design in Steel---New Age International Publishers
7. IS: 800 - 2007, Code of Practice for General Construction in Steel, BIS, New Delhi.
8. IS: 800 - 1984, Code of Practice for General Construction in Steel, BIS, New Delhi.
9. IS: 801 - 1975, Code of Practice for use of cold formed light gauge steel structural members in general building construction, BIS, New Delhi.

University of Pune
M.E. (Civil) (Structures)--2013Course
Semester I
1Credit =2 Modules=15 Hrs.

501 004 : Research Methodology

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam: 50 marks**
Credits 4	**End Sem. Exam. : 50 marks**
	Duration of End Sem.Exam:3Hrs

Module1:
Introduction to Research ,Meaning of research ,types of research, process of research, Sources of research problem, Criteria / Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem, formulation of research hypotheses**.** Search for causation
Module 2:
Developing a Research Proposal Format of research proposal, Individual research proposal, Institutional research proposal,Significance,objectives,methodology,Funding for the proposal,Different funding agaencies.Framework for the planning
Module 3:
Literature survey- Definition of literature and literature survey, need of literature survey, sources of literature, elements and objectives of literature survey, styles of literature survey, and strategies of literature survey.
Module 4:
Data collection ,Measuring,Sampling and Scaling—Classification of data, benefits and drawbacks of data, evaluation of data,qualititative methods of data collection, methods of qualitative research, Sampling,sample size,sampling strategy,attitude measurement and scaling, types of measurements, criteria of good measurements, classification of scales.
Module 5:
Preliminary data analysis- Testing of hypothesis- concepts and testing , analysis of variance techniques, introduction to non parametric tests.Valedity and reliability,Approaches to qualitative and quantitative data analysis,
Module 6:

Advanced data analysis techniques-Correlation and regression analysis, Introduction to factor analysis, discriminant analysis, cluster analysis, multidimensional scaling,Descriptive statistics,Inferential statistics,Mutidimentional measurementnand factor analysis

Module 7:

Report writing—Need of effective documentation, importance of report writing, types of reports, report structure, report formulation,Plagirism.

Module 8:

Presentation of research---Research briefing, presentation styles, impact of presentation, elements of effective presentation, Writing of research paper, presenting and publishing paper, patent procedure,

Reference Books:

1. Research Methodology: concepts and cases—Deepak Chawla and Neena Sondhi,Vikas Publishing House Pvt.Ltd. (ISBN 978-81-259-5205-3)
2. Research Methods for Business—Sekaran Uma and Rogure Boudie—Wiley,India
3. Research Methodology: Methods and Trends', by Dr. C. R. Kothari--- New Age International Publishers.
4. Research Methods in Education---Louis Cohen,Manion,Morrison---Routledge(Taylor &Francis Group) / -- Cambridge University Press India Pvt. Ltd.-ISBN-978-0-415-58336-7
5. Research Methodology: An Introduction' by Wayne Goddard and Stuart Melville
6. Research Methodology: A Step by Step Guide for Beginners', by Ranjit Kumar
7. Research in Education---John Best and James Kahn,Prentice Hall of India Pvt.Ltd.

e-Resource---For class room ppts---www.wileyeurope.com/college/sekaran

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University of Pune
M.E. (Civil) (Structures)--2013Course
Semester I
1Credit =2 Modules=15 Hrs.

501 005 : ELECTIVE –I

Teaching Scheme
Lectures: 5 hours/week
Credits 5

Examination Scheme
In semester Exam: 50 marks
End Sem. Exam. : 50 marks
Duration of End Sem.Exam:3Hrs

Select any combination having total of 5 credits from following technical / interdisciplinary courses

----------Elective I

Code	2 Credits Courses	Code	1 Credit Courses	Code	Audit Courses (No Credit Course)
501 005 A	Cyber Security/Information security	**501 005 F**	Economics and Finance for Engineers	**501 005 K**	Mass communication, Photography and Videography
501 005 B	Soil Structure Interaction	**501 005 G**	Foreign Language - I	**501 005 L**	Yoga and Meditation

501 005 C	Plastic Analysis and Design of Steel Structure	**501 005 H**	Engineering Ethics		
501 005 D	Optimization technique	**501 005 I**	Intellectual Property Rights		
501 005 E	Mechanics of modern materials				

501 005 –A-Elective I - Cyber Security / Information security (2Credits course)

Module1:

Basic Concepts of Technology and Law*:* Basics of Information Technology, Basics of Indian Legal System, Information Technology Act 2000 (Amended), Relevant Amendments in all other laws.E-Contract**:** The essence of digital contracts, Law of Contract, Construction of E-contracts, Issues of security, Employment contracts, Consultant Agreements and Digital signature

Module2:

Intelligent Property Issues in Cyber space: Doman names and related issues, Copyright in digital media, Patents in cyber world.

Rights of Neitzens and E- Governance: Privacy and freedom issues in cyber world, E-Governance, Cyber crimes and Cyber laws.

Module 3:

Information Security Fundamentals: Background, Importance, Statistics, National and International Scenario, Goals of security, Confidentiality, Privacy, Integrity, Non-repudiation, Availability.

Essentials of computer security - Sources of security threats – Intruders, Viruses, Worms and related threats - Threat identification - Threat analysis - Vulnerability identification and Assessment.

Module 4:

Security Investigation: Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues

Access Control, Intrusion Detection and Server Management, Firewalls:

Overview of Identification and Authorization, Overview of IDS, Intrusion, Detection Systems and Intrusion Prevention Systems, User Management, Overview of Firewalls, Types of Firewalls, DMZ and firewall features

Security Policies and Management: Security Policy Design, Designing Security Procedures, Risk Management and Assessment Techniques, Security standards, Security Models. Security Management Practices, Security Laws, Information Classification Process, Risk Management, Security Procedures and Guidelines, Business Continuity and Disaster Recovery, Ethics and Best Practices, Security Assurance,

Reference Books:

1) Bakshi P M and Sri R K, Cyber and E-commerce Laws, Bharat Publishing House, 1st Edn, 2002
2) Syed Shakil Ahmed, Rajiv Raheja, A handbook on Information technology: Cyber law and E-Commerce, Capital Law House, 2004

3) Rodney D Ryder, Business Process Outsourcing, Date Protection and Information Security, Wadhwa & Co., 1st Edn, 2001
4) Vakul Sharma, Information Technology Law and Practice, Delhi Law House, 3rd Edn, 2011
5) Lipton, K., Cyberspace Law Cases and Materials, 2nd edition. Aspen Publishers. NY: New York, 2006
6) Michael E Whitman and Herbert J Mattord, Principles of Information Security, Vikas Publishing House, New Delhi, 2003
7) Micki Krause, Harold F. Tipton, Handbook of Information Security Management, Vol 1-3 CRC Press LLC, 2004.
8) Michael E Whitman and Herbert J Mattord, Principles of Information Security, Vikas Publishing House, New Delhi, 2003

501 005 –B-Elective–I Soil Structure Interaction (2Credits course)

Module 1

Introduction, Importance and Applications of Soil Structure Interaction **(**SSI)

a) Introduction to SSI, Importance of SSI, Applications and examples of SSI for structural engineer, Effects of structure roughness/smoothness on soil behaviour.

b)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.

Module 2:

Soil Structure Interaction - Parameters

a) Concept of sub grade modulus, effects/parameters influencing sub grademodulus, Flexiable and Rigid Foundations – Rigidity calculations, Static and Dynamic Spring Constants – Winkler Model, Estimation of soil spring constants/stiffness for foundations design.

b)SSI Models - Elastic Continuum, Winkler Model, Multi-Parameter Models, Hybrid Model. Structure Contact Interface

Module 3:

Soil Behaviour

a)Arching in soils. 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.

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

Module 4:

A) SSI in Retaining Structures: Curved failure surfaces, their utility and analytical/graphical predictions from Mohr-Coulomb envelope and circle of stresses. Earth pressure computations by friction circle method. Earth pressure distribution on walls with limited/restrained deformations, Dubravo's analysis. Earth pressures on sheet piles, braced excavations. Design of supporting system for excavations.

B)Soil-Pile Behaviour: Introduction, axial and laterally loaded piles, load-displacement behaviour, Modified Ramberg Osgood Model, pile group, interaction effect in pile group, soil-pile modelling in FEM, Elastic continuum and elasto-plasticanalysis of piles and pile groups. Non-linear load-deflection response.

Reference Books:

1. Bowels J.E., "Analytical and Computer Methods in Foundation", McGraw Hill Book Co. New York.
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 behaviour of structures, Institution of Structural Engineers, 1989.
4. Elastic Analysis of Soil Foundation Interaction, Developments in Geotechnical Engg.vol-17, Elsevier Scientific Publishing Co.
5. Prakash, S., and Sharma, H. D., "Pile Foundations in Engineering Practice."John Wiley & Sons, New York, 1990.

General Reading Suggested:

Codes/Hand books:

1)"Foundation Engineering Handbook," H.-Y. Fang, Editor, Van Nostrand Reinhold, 2nd Ed., New York, USA.

e-Resources:

1)http://trb.metapress.com/home/main.mpx ... … (Free Online Research Reports)

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501 005 –C-Elective-I Plastic Analysis& Design of Steel Structure (2Credits course)

Module 1:

Plastic collapse loads of gable portal frames, various mechanisms.
Analysis of Multi Bay- Multi Storey rectangular portal frame, Joint & Various mechanisms (Two bays - Three storeys)

Module 2:

Secondary design considerations: Effect of axial force, shear, residual stresses and brittle fracture on moment capacity. Design of beams with high shear, interaction of bending & axial force: section and member strength.

Module 3:

Design of rectangular and gable portal frames Design of corner connection with and without haunches. Review of semi-rigid connections .

Module 4:

Design of beam to column Moment resisting connections. End plate: Flush & extended, T-Stub connections. Combined tension & shear considerations in welded & bolted connection.

Reference 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) 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) B.G. Neal – Plastic Method of Structural Analysis, Chapman & Hall
6) L.S. Beedle – Plastic Design of Steel Frames, John Willey & Sons
7) Structural design in steel by Salwar Alam Raz New Age International Publishers

8) Steel Designers Manual – ELBS

General Reading Suggested:

1)Codes: IS: 800 - 2007 Code of Practice for General Construction in SteelHand books
2) SP: 6 (6) – 1972 Handbook for Structural Engineers: Application of plastic Theory in Design of Steel Structures
3) Handbook for Structural Engineers SP 6 (8) 1972 (Reaffirmed 1993) – Bureau of Indian Standards.
4) NPTEL
5)e-Recourses:)Teaching Resource for Structural Steel Design – INSDAG Kolkatta

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501 005 –D-Elective –I Optimization Techniques (2Credit Course)

Module 1:

Linear Programming I: Introduction to Optimization techniques, Linear programming basic concepts, graphical method, Simplex method

Module 2:

Linear Programming II: Big M Method, Two phase method, Duality, sensitivity analysis. Application of Linear Programming to Hydraulics & Water Resource

Module 3:

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

Module 4:

Dynamic Programming:Principle of optimality, recursive equations.

Reference Books

1. Engineering Optimazation Theory & Practice – S.S. Rao., Wiely. Wiely.
2.Engineering Optimization—Methods and Applications—Ravindran,Wiely
2. Operation Research – Taha Hamdey A.
3. Principles of Operation Research – Wagner, Prentice Hall.
4. Operation Research – Hira and Gupta, S.Chand
5. Operation Research—Ravindran-- Wiely.

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501 005 –E-Elective –I Structural Mechanics of Modern Materials (2 Credits course)

Module 1

Introduction to Modern Materials: Fiber-Reinforced Polymer Composite (FRPC) Materials: Definition, Historical development, applications. Fibers and Matrix, types and their properties.

Manufacturing process and methods for composites. Types and classification of composite materials, properties, advantages over conventional materials. Piezoelectric Materials: History,crystal structure, applications. Shape Memory Alloys (SMA), Functionally Graded Materials (FGM): definition and applications.

Module 2

Engineering Properties of Modern Materials: FRPC Composite Lamina: Micromechanics approach, methods. Longitudinal and transverse elastic properties of composite lamina, in-plane shear modulus for continuous fibers. Stress-strain relationship, compliance and stiffness

matrices for generally anisotropic, specially orthotropic material, transversely isotropic material, orthotropic, isotropic materials, Plane stress condition for thin lamina, transformation of stress

a) Three dimensional transformations. Stress-Strain: Force Equilibrium, Strain Compatibility, Constitutive Laws of materials. Introduction to Fracture Mechanics.

b)Design of Steel Fiber Concrete elements – flexure, shear, ductility etc., smeared concept, constitutive models for FRC, codal provisions for FRC (ACI, RILEM etc.), Hybrid Fiber composites, behaviour of macro-micro-nano fiber matrix.

Stiffness matrix for Functionally Graded Materials.Pultruded Rod,GFRComposite,flexural members,Self healing Materials,Nano Composites.

Module 3

Strength of Composite Lamina: Introduction. Failure theories, Maximum stress theory, Maximum strain theory, Energy based interaction theory (Tsai-Hill), Interactive tensor polynomial theory (Tsai-Wu), Failure mode based theory (Hasin-Rotem). Computation of lamina strength by Tsai-Wu theory for plane stress condition. Comparison of various failure theories.

Module 4

Elastic behaviour of Composite Laminates: Basic assumptions, Laminate configurations, Straindisplacement relationship, Stress-strain relationship, Force and moment resultants, Laminate compliances and stiffness matrices, Transformation of matrices. Load deformation relationship for symmetric laminates, symmetric cross-ply, symmetric angle-ply, balanced, antisymmetric cross-ply and angle ply, orthotropic, quasi-isotropic laminates.

Experimental Methods of Testing of Composite Materials: Fiber volume ratio, void volume ratio. Determination of, tensile, compressive and shear properties of unidirectional laminates. Testing of interlaminar fracture toughness, Biaxial testing. Introduction to stress concentration in laminates.

Reference Books

1. Isaac M. Daniel and Ori Ishai - Engineering Mechanics of Composite Materials, Oxford University Press, Second Edition, New Delhi.
2. Michael W. Hyer - Stress Analysis of Fiber-Reinforced Composite Materials, WCB/McGraw-Hill,Singapore.
3. Jones R. M. – Mechanics of Composite Materials, McGraw-Hill, New York
4. Roman Solecki and R Jay Conant – Advanced Mechanics of Materials, Oxford University Press,New York, Special Edition for sale in India.

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501 005 –F- Elective –I Economics and Finance for Engineers (1Credit Course)

Module1:

Introduction & Basics of Economics & Finance: Meaning & necessity of: Economics, Costing & Finance, History & fundamentals of Economics, Basics of Finance & Accounting, rates of interest, Basics of Financial Statement, Financial Analysis, Inflation, etc.

Module2:

Principles of Costing, Estimation & Valuation: Basics of Costing, activity based costing & case studies, Basics of Estimation & Valuation, present & future values of properties, Profitability & Financial Decisions, Inventory Management

Reference

1. As specified by the instructor

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501 005 –G- Elective –I Foreign Language -I (French-I) (1Credit Course)

Module1:

Introduction: Glimpse of France, life of French people (Culture, food, etc.), French alphabets, accent, etc., Unit zero of the Text Book (Grammar, Vocabulary, and Lesson), Exercise of Unit zero of Text Book & workbook

Module2:

French Lessons: Brief revision, Unit-1 of the Text Book (Grammar, vocabulary), Unit-1, Lesson 1 of the Text Book, Exercise of Unit-1, Lesson 1 of the Text book & workbook

Reference

1. Jumelage-I Text Book by Manjiri Khandekar & Roopa Luktuke (Latest edition)
2. Jumelage-I workbook by Roopa Luktuke

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501 005 –H- Elective –I Engineering Ethics (1Credit Course)

Module1:

Introduction : Meaning & scope of Ethics in general & for engineers in particular, Moral obligations and rules in engineering,Categories of moral,Work Culture, Corporate, local & global issues, Rights & responsibilities of Engineers, Conflicts in the profession, Mental Stresses & Emotional Intelligence

Module2:

Code of Ethics for Engineers: First principles of Engineering Ethics & Ethical terminology, Social Values, Character, considerations for general Individuals, Engineers & the Society, Recommendations of the Professional bodies (Code of Conduct), Introduction to Copyright, IPR (Intellectual Property Right), Plagiarism & Legal issues

Reference

1.Ethics in Enginerring Practice and Research---Carolin Whitbeck—Cambridge University Press—ISBN—978-1-107-66847-8

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501 005 –I- Elective –I Intellectual Property Rights (1Credit Course)

Module1

Introduction to Intellectual Property Rights

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.

Module2

Patent Rights

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

Recent Developments in IPR

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

Reference Books

1 Prabuddha Ganguly, " Intellectual Property Rights",Tata Mc-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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501 005 –K-Elective –I Mass communication, Photography and Videography

(Audit Course—No Credits)

Module 1:

Mass Communication - Theories & methods

Concepts and Theories, Communication concepts, Process and Function, Interpersonal & Intra personal, Group behaviour, need for Mass Communication. Relevance of Communication Theories to Practice, Models of Communication, Impact and Effect of Communication Old and new media, Communication Techniques, - Feedback and Evaluation of Communication Effect, Interview and Questionnaires- Method of Data Analysis, use of Information Technology, various methods of mass communication like seminars, conferences, print and digital media, internet, CDs, DVD, movies, U-tube, video conferencing.

Module 2 :

Photography and Videography

Camera Basics, Still Photography, Lenses, Exposure, Composition, Colour. Shot Angle, Camera Movement, Light techniques and final printing.
Videography Basics – Video camera –types, mounting. Sound Basics, Film Sound appreciation, Sound Track analysis, Editing Basics, Fragmentation
Juxtaposition: Frame, Shot, Sequence, Scene Time, Pace, Rhythm. Learning basic editing software and primary editing on available/given materials.

Reference Books

1. Richard Dimbleby and Graeme Burton, 1995, More than words: An introduction to communication, London: Routledge.
2. Melvin L. DeFleur and Everette E. Dennis, 1991, Understanding mass communication, New Delhi: Goyal Saab.
3. Marshall McLuhan, 1964, Understanding Media, New York: McGraw –Hill
4. Wilbur Schramm, 1964, Mass media and national development, the role of information in developing countries, Stanford: Stanford University Press.
5. Holman, Tomlinson, Sound for film and television, Focal Press
6. McCormick, Tim and Rumsey, Francis, Sound and recording: An introduction, Focal Press
7. Talbot-Smith, Michael, Sound engineering explained, Focal Press
8. Talbot-Smith, Michael, Sound assistance, Focal Press
9. Altman, Rick, ed., Sound theory sound practice, Routledge Talbot-Smith, Michael, Sound engineer's pocket book, Focal Press
10. Truebitt, Rudy and David, Trubitt, Live sound for musicians,
11. Hal Leonard Nathan, Julian, Back to basic audio,
12. Newnes Yewdall, Lewis, David, Practical art of motion picture sound, Focal Press
13. Leider, N., Colby, Digital audio workstation, McGraw-Hill

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501 005 –L-Elective I Yoga and Meditation (Audit course--Non Credit course)

Module 1

Yoga: Sukshma (subtle) yoga techniques, Difference between physical exercises and yogasans, Impact of yogasans on human body, benefits of yogasans, Patanjali yoga sutras, Technique of different yogasans like, Trikonasan, Ardhachandrasan, Padmasan, Akarnadhanurasan, Ardhamatsendrasan, Vajrasan, Pachhimottanasan, Bhujangasan, Shalbhasan, Dhanurasan, Naukasan, Makrasan, Pawanmuktasan, Halasan, Sarvangasan, Shavasan, Suryanamaskar(Sun Salutation), Yoga and Food.

Module 2

Meditation: Breathing Technique, Pranayam, Benefits of Pranayam, Precautions for Pranayam, Kumbhak, Bandh(Locks), Chakras, Mudra, Technique of Pranayam,Anulom-VilomPranayam, UjjayiPranayam, BhramariPranayam, BhastrikaPranayam, AgnisarPranayam, KapalbhatiPranayam, Meditation(Dhyan).

References Books:

Light on Yoga: by B.K.S. Iyengar, Harper Collins Publishers India

1. Light on Pranayama: by B.K.S. Iyengar, Harper Collins Publishers India
2. Yoga for Dummies by Georg Feuerstein and larry Payne, Wiley India publishing
3. Yoga, Pilates, Meditation & Stress Relief By Parragon Books Ltd
4. The Yoga Sutrasby Patanjali, Swami Satchidananda, Integral Yoga Publications
5. Meditation - Science and Practice by N. C. Panda, D. K. PrintworldPublisher
6. YogPravesh by Vishwas VMandlik,YogchaitanyaPrakashan
7. Asanand YogVigyan, BhartiyaYogSansthan, Delhi
8. PranayamVigyan, BhartiyaYogSansthan, Delhi

Reference Web Sites:

1. http://www.artofliving.org/in-en/yoga
2. http://www.artofliving.org/in-en/yoga/sri-sri-yoga/sukshma-yoga-relaxation
3. http://www.yogsansthan.org/
4. http://www.yogapoint.com/
5. http://www.divyayoga.com/
6. http://www.yogaville.org/about-us/swami-satchidananda/
7. http://www.yogaVision.net
8. http://www.swamij.com

University of Pune
M.E. (Civil) (Structures)--2013Course
Semester I
1Credit =15 Hrs.

501 006 : Lab.Practice–I

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**Term work : 50marks**
Credits : 4	**Oral : 50 marks**

Lab Practice I

The lab. practice-I will be based on completion of assignments / practicals / reports of site visits, confined to the course in that semester.

The term work 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. Report on the experimental work based on Horizontal and Vertical Shake Table is mandatory.

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–

University of Pune
M.E. (Civil) (Structures)--2013Course
Semester II
1Credit =2 Modules=15 Hrs.

501 007-Finite Element Method

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam: 50 marks**
Credits 4	**End Sem. Exam. : 50 marks**
	Duration of End Sem.Exam:3Hrs

Module 1:

a)Background on variational calculus. Galerkin methods, Collocation methods, Leastsquares methods. Variational methods of approximation- Rayleigh-Ritz method.

b)Variational theorem; Principle of minimum potential energy, Use of polynomial displacement function. Variational approach for formulation of element stiffness matrix for truss and beam elements.

Module 2:

a)Two dimensional elements in plane stress /plane strain problems. CST, LST & Rectangular elements, modelling considerations; aspect ratio, Use of polynomial displacement functions, Pascal triangle. Requirements for convergence, Geometric Invariance, Grid refinement

Module:3 Standard stiffness and load vector formulation procedure using variational principle.

Module 4:

a)Shape functions in cartesian & natural coordinate systems, shape functions for one dimensional element such as truss & beam. Shape function for two dimensional elements.

b)Three dimensional elements such as Tetrahydron, Hexahydron, shape functions, stress strain relations

Module 5:

a)Axisymmetric elements in axisymmetric problems, stress strain relations, triangular and Quadrilateral elements.

Module 6:

Concept of isoparametric elements and isoparametric mapping, Jacobian Matrix, Formulation procedure for 2 D quadrilateral isoparametric element in plane elasticity problem, 3-D isoparametric elements.

Module 7:

a)Thin Plate bending elements, various Triangular and Rectangular elements, ACM (Adini, Clough, Melosh) and BFS (Bogner, Fox, Schimdt) elements

Conforming & nonconforming elements, Concept of four noded & eight nodded isoparametric elements, Mindlin's hypothesis for plate bending element.

Module 8:

a)Flat & curved shell element, elements for cylindered shells, curved solid element

b)Ahmad's degenerated solid element, Pawsey's eight noded shell element.

Reference 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. C.S. Krishnamoorthy – Finite Element Analysis – Theory & Programming – Tata McGraw Hill Publishing Co. Ltd
4. Zienkiewicz & Taylor - The Finite Element Method 4th Edition – Vol – I & II – McGraw Hill International Edition
5. Robert D. Cook, D.S. Malkus, M.E. Plesha – Concepts & Applications of Finite Element Analysis – Wiley ,India.
6. J.N. Reddy – An Introduction to the finite element method – Tata McGraw Hill Publishing Co. Ltd
7. S.S. Rao - The Finite Element Method in Engineering 4th Edition – Elsevier Publication
8. G.R. Buchanan – Finite Element Analysis Schaum's outlines - Tata McGraw Hill Publishing Co. Ltd
9. Segerlind L.J. – Applied Finite Element Analysis - John Wiley & Sons.
10 Energy & Finite Element Methods in Structural Mechanics by Iriving Shames & Clive Dym, New Age International Publishers,Delhi.

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 of any one of following cases using either SATDD-Pro / Anysis / Etabs / SAP .

a) Plane stress / plane strain problem

b) Axisymmetric problem

c) Three dimensional problem

d) Plate or shell structures

University of Pune
M.E. (Civil) (Structures)--2013Course
Semester II
1Credit =2 Modules=15 Hrs.

501 008-Theory of Plates and Shells

Teaching Scheme
Lectures: 4 hours/week
Credits 4

Examination Scheme
In semester Exam. : 50 marks
End Semester Exam. : 50 marks
Duration of End Sem.Exam:3Hrs

Module 1:
a)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

Module 2:
Analysis of Rectangular Plates: Navier solution for plates with all edges simply supported. Distributed loads, point loads and rectangular patch load.

Module 3:
a) Levy's Method: Distributed load and line load. Plates under distributed edge moments. Raleigh- Ritz approach for simple cases in rectangular plates.
b) Introduction to shear deformation theories. Reissener - Mindlin Theory, Moment curvature relationship for First order shear deformation theory.

Module 4:
a)Circular Plates: Analysis of circular plates under axi-symmetric loading. Moment Curvature relations.Governing differential equation in polar co-ordinates.
b)Simply supported and fixed edges. Distributed load, ring load, a plate with a central hole.

Module 5:
a) Introduction: Classification of shells on geometry, thin shell theory, equations to shell surfaces, stress resultants, stress- displacement relations, compatibility and equilibrium equations.
b)Shells of Revolution: Membrane theory, equilibrium equations, strain displacement relations, boundary conditions, cylindrical, conical and spherical shells.

Module 6:
a)Circular cylindrical shells: Membrane theory: Equilibrium equations, strain displacement relations, boundary conditions.

Module 7:
b)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.

Module 8:
Beam theory of cylindrical shells: Principles of Lundgren's beam theory, beam analysis, arch analysis, application to cylindrical roof shells.

Reference Books

1. S. Timoshenko and W. Krieger, Theory of Plates and Shells, Mc Graw Hill.
2. Ansel C. Ugural Stresses in Plates and Shells, Mc Graw Hill
3. G. S Ramaswamy, Design and Construction of Concrete Shell Roofs, CBS Publications
4. Chandrashekhara K., Analysis of Concrete Shells, New Age International Edition
5. Chandrashekhara K., Analysis of Plates, New Age International Edition

University of Pune
M.E. (Civil) (Structures)--2013Course
Semester II
1Credit =2 Modules=15 Hrs.

501 009-Advance Design of Concrete Structures

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam. : 50 marks**
Credits 4	**End Semester Exam. : 50 marks**
	Duration of End Sem.Exam:3Hrs

Module 1:
Yield line theory for analysis of slabs, Various patterns of yield lines , Assumptions in yield line theory, Equilibrium and virtual work method of analysis ,

Module 2:
Design of various slabs such as rectangular, triangular, circular with various edge conditions Using yield line theory, Design for limit state of strength and serviceability orthotropically reinforced slabs,

Module3 :
- Grid and coffered floors, general features , rigorous and approximate method of analysis design of grid floor by approximate method, Design of flat slab, column and middle strip, proportioning of flat slab element,

Module 4:
Design methods for flat slabs , Design by direct method only of intermediate and end panel , total design moment , distribution of moments , effect of pattern loading, Design for shear.

Module 5 :
Elevated service reservoir – Rectangular and Circular type only flat bottom, Design of staging for wind and earthquake forces, Effect of joint reactions and continuity

Module6:
Design of Bunkers, Silos, and chimney—Square and circular bunkers, silos shallow and deep

Module 7:
Design of raft foundations, Pile foundations, single pile, group of piles, Pile cap

Module 8:
Design of Shear wall, design of form work for slabs, girders, columns etc.

Reference Books-

1. Advance R.C.C.DesignBy S.S.Bhavikatti, New Age International Publishers
2. B.C. Punmia, Ashok K. Jain, Arun K. Jain – Reinforced Concrete Structures Vol. II, Laxmi Publications, New Delhi
3. N.C. Sinha, S.K. Roy – Fundamentals of Reinforced Concrete, S. Chand & Co. Ltd, New Delhi
4. P.C. Varghese – Advanced Reinforced Concrete Design, Prentice Hall of India Pvt. Ltd., New Delhi
5- Reinforced Concrete design ---Dr.H.J.Shah—Charotar publishing house
6- Design of R.C.C—S.Ramaamruthum -- Dhanpat Rai publications
7. IS: 456-2000 Indian Standard code of practice for plain and reinforced concrete, Bureau of

Indian Standards, New Delhi.
8. IS: 1893:-2002 Indian Standard Code of practice for criteria for Earthquake resistant design of Structures, Bureau of Indian Standards, New Delhi.
9. IS: 3370-Indian Standard code of practice for concrete structures for storage of liquids, Bureau of Indian Standards, New Delhi

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University of Pune
M.E. (Civil) (Structures)--2013Course
Semester II
1Credit =2 Modules=15 Hrs.

501 010 - Elective –II

Teaching Scheme | **Examination Scheme**
Lectures: 5 hours/week | **In semester Exam: 50 marks**
Credits 5 | **End Sem. Exam. : 50 marks**
Duration of End Sem.Exam:3Hrs

Select any combination having total of 5 credits from following technical / interdisciplinary courses

Code	2 Credits Course *L*	Code	1 Credit Course	Code	Audit Course (No Credit Course)
501 010 A	Human Rights	**501 010 E**	Foreign Language II	**501 010 I**	Performing Arts – Music and Dance
501 010 B	Design of precast components and Ferrocement	**501 010 F**	Building Services and Maintenance	**501 010 J**	Principle Centred Leadership
501 010 C	Design of Foundations	**501 010 G**	Green Building Design and Construction		
501 010 D	Non linear Analysis of structure	**501 010 H**	Forensic Civil Engineering		

501 010 –A-Elective II Human Rights (2 Credits course)

Module 1

Human Rights – Concept, Development, Evolution

- Philosophical, Sociological and Political debates
- Benchmarks of Human Rights Movement.

Human Rights and the Indian Constitution

- Constitutional framework

- Fundamental Rights & Duties
- Directive Principles of State Policy
- Welfare State & Welfare Schemes

Module 2:

Human Rights & State Mechanisms

- Police & Human Rights
- Judiciary & Human Rights
- Prisons & Human Rights
- National and State Human Rights Commissions

-**Module 3:**

Human Rights of the Different Sections and contemporary issues

- Unorganized Sector ,
- Right to Environment, particularly Industrial sectors of Civil Engineering and Mechanical Engineering .

-Globalization and Human Rights

- Right to Development,

Module 4. :

Citizens' Role and Civil Society

- Social Movements and Non-Governmental Organizations
- Public Interest Litigation

-Role of Non Government organizations in implementation of Human rights.

- Right to Information

Human Rights and the international scene –Primary Information with reference to Engineering Industry.(2 hrs)

- UN Documents
- International Mechanisms (UN & Regional)
- International Criminal Court

Reference Books:

1. Introduction to International Humanitarian Law by Curtis F. J. Doebbler - CD Publishing
2.Human Rights in India- A Mapping ,Usha Ramanathan: free download from http://www.ielrc.org/content/w0103.pdf
3. Study material on UNESCO,UNICEF web site
4.Information, by Toby Mendel - UNESCO **,** 2008

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501 010 –B-Elective II Design of Precast Components and Ferrocrete (2 Credits course)

Module 1

Introduction

History and Development of Precast concrete construction, Advantages and disadvantages of precast concrete construction; different types of units involved in general building construction, including residential, factory and industrial framed structure; their general principles of design; mechanical handling of large projects like stadium, bridges etc.

Materials viz. Concrete, Self Compacting Concrete, Grout, Reinforcement and structural welded wire cages.Requirements of industrialized buildings, standardization of precast elements and unification of building design. Influence of manufacture, transport and erection technologies on design solution (Modular and Tilt-Up); expansion and contraction joints.

Module 2

Prefabricated Components and Its Behaviour

Design of Precast Concrete Components and Behaviour of structural components, large panel constructions, Construction of roof and floor slabs, Wall panels, Beams, Columns, Shear walls.

Design for Flexure: Strength Design (Depth of Stress block, Flanged Elements, Strength reduction factor, Limitations on reinforcement, Critical sections), Service load design.

Design for Shear: Horizontal and vertical shear resistance.

Module 3

Joints and Connections

Joints and connections in precast construction; classification and their requirements.

Design of Concrete bracket and corbels; Cantilever beam-design method, Strut-and-tie method. Introduction to Hanger Connections. Design of bearing pads, column bases and moment connections. Typical connection designs for lateral load resisting systems.

Module 4

Design of Ferrocrete Structures

Design, analysis and optimization, Special design considerations, Typical features of ferrocrete affecting design, Design criteria, Rational method of design ferrocrete structure.

Strength through shape, Shape and form of a structure, various structural forms and their behaviour, Comparative study of various forms

Reference Books--

1--.Ferrocement Construction Mannual-Dr. D.B.Divekar-1030,Shivaji Nagar,Model Colony, Pune

2.--.CBRI, Building materials and components, India, 1990

3--Gerostiza C.Z., Hendrikson C. and Rehat D.R., Knowledge based process planning for construction and manufacturing, Academic Press Inc., 1994

4---.PCI Design Handbook – Precast and Prestressed Concrete (6th Edition), ISBN – 0-937040-71-1.

5---Koncz T., Manual of precast concrete construction, Vols. I, II and III, Bauverlag, GMBH, 1971.

6---.Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 1978.

7-- State-of-the-art report and guide for Design,Construction and Repairs of Ferrocement; ACI committee Report. No ACI549R- 88 and ACI 549.1R.88. Published by American Concrete Institute, Detroit, USA

8--- Ferrocement--- B R Paul and R P Pama. Published by International Ferrocement Information Centre. A.I.T.Bangkok, Thailand.

9---Ferrocement and laminated cementitious composites--- A E Naaman.: Techno-press, Ann Arbor, Michigan, U S A.

10 --Ferrocement- Materials and applications-- Publication SP 61, A C I Detroit. U S A

11---Concrete Technology by Kulkarni & Ghosh, New Age International Publishers

12----Ferrocement code -ACI 549.1R

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501 010 –C- Elective I - Design of Foundations (2 Credits course)

Module 1

Soil Structure 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.

Module 2

Design of Raft Foundations

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

Module 3

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. Shell Foundations: Types and applications, Soil structure interaction, Membrane analysis for Hyper and Conical RC shells with and without edge beams, detailing of critical sections.

Module4

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.

References Books

1.Kurain N.P, Modern Foundations: Introduction to Advance Techniques: TataMcGraw Hill,1982

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-Nostrand Reynold, 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, 1980.

7.Leonards G. Ed., Foundation Engineering, Mc.Graw-Hill, NY, 1962

8.Shamsher Prakash, Soil Dynamics, McGraw Hill

9.Sreenivasalu & Varadarajan, Handbook of Machine Foundations, Tata McGraw Hill

10.O'Neil, M.W. and Reese, L.C. "Drilled Shafts: Construction Procedures and Design Methods", FHWA Publication No. FHWA-IF-99-025, Federal HighwayAdministration, Washington, D.C., USA, 1999.

11.P. C. Varghese, "Design of Reinforced Concrete Foundations", PHI Learning Pvt. Ltd., New Delhi, 2009.

12.IS 1904: 1986 Code of practice for design and construction of foundations in soils: general requirements (Third Revision)

13.IS 2911: Part 1 : Sec 1 to3 : 1979 Code of practice for design and construction of pile foundations: Part 1 Concrete piles

14.IS 2911: Part 1: Sec 4 : 1984 Code of practice for design and construction of pile foundations: Part 1 Concrete piles

15.IS 2911: Part 3: 1980 Code of practice for design and construction of pile foundations: Part 3 Under-reamed piles

16.IS 2950: Part 1: 1981 Code of Practice for design and construction of raft foundations: Part 1: Design

17.IS 2974: Part 1to 5: 1982 Code of practice for design and construction of machine foundations

General Reading Suggested :Codes:

1)Reese, L.C. and O'Neill, M.W., 1988. "Drilled Shafts: Construction and Design." FHWA, Publication No.HI-88-042, USA.

2)FHWA-NHI-10-016, "Drilled Shaft: Construction Procedures and LRFD Design Methods,"2010, U.S. Department of Transportation Federal Highway Administration, Washington, D.C., USA.

(http://www.fhwa.dot.gov/engineering/geotech/foundations/nhi10016/nhi10016.pdf)

Hand books:

1)"Foundation Engineering Handbook," H.-Y. Fang, Editor, Van Nostrand Reinhold, Kulhawy, F.H. (1991). "Drilled Shaft Foundations." Chapter 14, 2nd Ed., New York, pp. 537-552.

e-Resources:

1)http://www.fhwa.dot.gov/engineering/geotech/library_listing.cfm … … (Free Reports)

2)www.Wikipedia.com

Lab Practice assignment for the term work:

Technical review and critique of a research article/paper on any one of the topics –

(1)Drilled Shaft (2) Caisson - Construction, Analysis, Design, Problems, Case Study

A detailed review and critique of a research article/paper in writing (5-10 pages) is expected from the students.

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501 010 –D- Elective I -Non Linear Structural Analysis(2 Credits course)

Module 1

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

Module 2

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

Module 3

Nonlinear Analysis of Trusses and Nonlinear Elastic Analysis of Frames - Derivation of non linear stiffness matrix, Matrix displacement method for nonlinear analysis of structures, Nonlinear analysis of plane frames.

Module 4

Nonlinear Static Analysis of Plates - Geometric and Material Nonlinearities, Governing Nonlinear Equations of Plates: Stress Function Approach, Displacement Equations Approach. Nonlinear Static Analysis of Plates - Boundary Conditions and method of solution, Large Deflection of Rectangular Plates.

Reference Books

1. M.Sathyamoorthy, 'Nonlinear Analysis of Structures', CRC Press, New York
2. K.I. Majid, 'Non Linear Structures', Butter worth Publishers, London.
3. N G R Iyengar, 'Elastic Stability of Structural elements', Macmillan India Ltd.

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501 010 –E-Elective II Foreign Language –II French-II (1 Credit course)

Module 1

French Grammar and Vocabulary: Unit-1, Lesson 2 of the Text Book (Grammar & Vocabulary), Unit-1, Lesson 1 of the Text Book, Exercise of Unit-1, Lesson 2 of the Text Book & workbook

Module 2

Advance Vocabulary, Writing & Speaking: Unit-1, Lesson 3 of the Text Book (Grammar & Vocabulary), Unit-1, Lesson 3 of the Text Book, Exercise of Unit-1, Lesson 3 of the Text Book & workbook, Revision & speaking practice

Reference

1. Jumelage-I Text Book by Manjiri Khandekar & Roopa Luktuke (Latest edition)
2. Jumelage-I workbook by Roopa Luktuke

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501 010 –F--Elective II Building Services and Maintenance (1 Credit course)

Module 1

Integrated design: factors affecting selection of services/systems, Provision of space in the building to accommodate building services, Structural integrity of building services equipment. Sound and vibration attenuation features, Provisions for safe operation and maintenance,Building services engineering system for intelligent buildings: Introduction to information transmission systems, communication and protection system, call systems, public address system and Building automation/management systems.

Module 2

The concepts and importance of energy conservation and energy efficiency for environmental protection, environmental protection and maintenance of building services systems, selection of environmentally friendly products and materials used in building services systems.

Co-ordination and management of design and installation of various building services systems during the design and construction stages in particular the builder's works. Computer-aided design and installations of building services. Testing and commissioning of building services systems: fire safety systems, vertical transportation equipment ventilation systems, etc. Sick building syndrome. The impacts of life-cycle-cost on planning and implementation. An appreciation of capital and operating costs. Implication of low cost, inefficient equipment, poor installation, inadequate access for maintenance.

Reference books

1. Buiding Services—S.M.Patil---(ISBN-978-81-7525-980-5), 1-C,102,Saamana Pariwar Society,Gen A.K.Vaidya Marg, Goregaon (E),Mumbai-65

2. Building Maintenance Management, 2ed,---Chanter, Wiley India

3. Miantenance of Buildings—A.C.Panchodhari—New Age International Publishers.

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501 010 –G-Elective II Green Building Design and Construction
(1 Credit course)

Module 1

Principles of Sustainability, Energy Conservation and Water Conservation

Introduction to Course, Sustainability, Major Environmental Challenges, Global Warming, Introduction to Green Buildings; LEED, Sustainable Urban Development.

Building energy system strategies, Energy Conservation in Buildings, HVAC Systems, Energy and Atmosphere - LEED Credits, eQuest Energy Simulations, Conducting an Energy Audit, Fossil Fuels vs. Renewable Energy.

Water Conservation in Buildings, Storm Water Harvesting and Management, Water cycle strategies

Module 2

Green Materials and Green building codes

Green Construction Materials, Materials and Resources - LEED Credits, Building Deconstruction, C&D Recycling, Indoor Environmental Quality – Basic, IEQ - LEED Credits, Building Commissioning, Materials selection strategies,Green building codes and standards, International Green Construction Code,Carbon accounting, Green Building Specifications

Reference Books

1.C.J. Kibert (2008) "Sustainable Construction: Green Building Design and Delivery", 3rd Ed., John Wiley, Hoboken, New Jersey
2.G.T. Miller Jr. (2004) "Living in the Environment: Principles, Connections, and Solutions", 14th Ed., Brooks Cole, Pacific Grove, California
3. Energy Conservation Building Code (ECBC)

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501 010 -H-Elective II Forensic Civil Engineering (1 Credit course)

Module 1

Introduction to forensic engineering, Forensic investigations-tools and techniques, Failures-types, causes and mechanisms ,Monitoring and instrumentation, Mitigation of failure

Module 2

Professional practice and ethics, Legal issues, Repairs and remediation, Risk and risk assessement, Assessement of damage,Forensic analysis of R.C.frames,Case studies.

References

Proceedings, Conference on Forensic Civil Engineering, Association of Consulting Civil Engineers(I),Banglore, August,2013

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501 010 –I-Elective II Performing Arts – Music and Dance
(Audit course--Non Credit course)

Module 1 :

Indian Music

Vocal, Instrumental, Sur, Laya, Tal. Ragas and their classification based on time and "Raasa-Nirmitee". Seasons and Ragas. Various "Bandishes" and "Gharanas" or styles. Light Indian Music-different types.
Experiencing ethos and bliss by listening to performances of various reputed artists. Experiencing oneness with nature and the super power by performing individually or in a group.

Module 2 : Indian Classical Dance

Types –Kathak, Bharatnatyam, Kuchipudi, Odissy etc. Importance of "Abhinaya" (acting) in dance. Role of "Taala" and "Laya" in dance. Various dance form. Various gharanas in traditional dance types Fusion with other dance styles. Experiencing the Indian cultural power through individual and group performances.

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Books/Audio CD

1.Hindustani Sangeet Paddhati by Pt.Vishnu Narayan Bhatkhande publ. Swarganga Foundation.
2.Jivi Jivai (Golden Voice Golden Years) Pt.Jasraj, Publ. Bandishes with notations composed by the author.
3.Pranav Bharati, by Pt.Ompraksh Thakur, publ. Swarganga foundation.
4.Rasa Gunjan by Pt.Birju Maharaj, Publ. Swarganag foundation
5.Anup Rag Vilas by Pt.Kumar Gandharava, Bandishes composed and sung by author mostly available on cassettes Swarganga Foundation.
6.The dance Orissi – Mohan Khokar published by (2010) Abhinav Publications, New Delhi
7.Introduction to Bharata's Natyashastra by Adya Rangacharya, Munshiram Manoharlal publication.
8. Art of Dancing classing and folk dance by priyabala Shah, Parimal publication
9.Tantra Mantra Yantra in Dance: An Exposition of Kathaka, by Ranjana Shrivastava, D.K.Prinword Pvt. Ltd.

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501 010 –J-Elective II Principle Centered Leadership
(Audit course--Non Credit course)

Module 1 :

Motivation, Leadership and Competency

a) Motivation:--

Necessity, types, means of providing extrinsic motivation. Leadership. Qualities of a leader. Types of Leadership viz. Lassez Fairre, transactional, transformational. Principle centered leadership based on Stephen Covey habits.

b) Competency Mapping:-

Definition of competency. Generic, functional and Strategic Competencies. Importance of developing competencies. Identification of competency gaps at managerial cadre level through benchmarking requirements based on role, mapping and assessment. Training and Developmental programs for competency gap closure.

Module 2 :

Entrepreneurship and strategic Management

a) Entrepreneurship: - Qualities of an entrepreneur. Business ideas generation methods—creative imagination, brainstorming, newspaper exercise activity. Ideas evaluation based on John Mullion's 7 point test concept of a B—plan.

b)Strategic Management: --

Necessity in the context of global challenges. Objectives of strategic management. Forecasting abilities and methods. Developing organizations for the achievement of strategic objectives. Dealing with uncertainties.

Reference Books

1. Seven habits of highly effective people—Stephen Covey—Franklin Covey Publications
2. Living the seven habits Stephen Covey—Franklin Covey Publications
3. 8th Habit – from effectiveness to greatness Stephen Covey—Franklin Covey Publications
4. Human Resource Development In The Building Industry, Vinita Shah, published by NICMAR
5. Human Resources Management & Human Relations , V P Michael , Himalaya
6. Human Resource Management Biswajeet Pattanayak published by Prentice Hall
7. Construction project Management, integrated approach—Feedings First Indian Reprint 2011—Yesdee publications
8. Cases in Strategic Management, Amita Mital , Tata Mcgraw Hill

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University of Pune
M.E. (Civil) (Structures)--2013Course
Semester II
1Credit =15 Hrs.

501 011- Lab.Practice–II

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**Term work : 50 marks**
Credits : 4	**Oral : 50 marks**

The lab. practice-II will be based on completion of assignments / practicals / reports of site visits, confined to the courses in that semester.

The term work will consist of --

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

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

iii) Finite Element Method – Software applications of any one of following cases using either SATDD-Pro / Anysis / Etabs / SAP .

- a) Plane stress / plane strain problem
- b) Axisymmetric problem
- c) Three dimensional problem
- d) Plate or shell structures

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 one of the topics – (1)Drilled Shaft (2) Caisson - Construction, Analysis, Design, Problems, Case Study

vi) A detailed review and critique of a research article/paper in writing (5-10 pages) is expected from the students

vii)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

University of Pune
M.E. (Civil) (Structures)--2013Course)
Semester II
1Credit =15 Hrs.
501 012 - Seminar – I

Teaching Scheme	Examination Scheme
Pract. 4 hrs./week	Oral : 50 Marks,
	TW :: 50 Marks
	Credits 4

The seminar I shall be on state of the art topic of own choice approved by the guide
Term work of the seminar should consist of 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
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.
It is desired that based on the seminar work, a paper be prepared and presented in a state / national conference.

At the end of first year, the students are required to undergo through a field training of minimum 2 weeks duration. The presentation and separate report of the vacational training will be submitted along with report of seminar II.

University of Pune
M.E. (Civil) (Structures)--2013Course)
Semester III
1Credit =2Modules=15 Hrs.

601 013-Earthquake Engineering and Disaster Management

Teaching Scheme **Examination Scheme**
Lectures: 4 hours/week **In semester Exam. : 50 marks**
Credits 4 **End Semester Exam. : 50 marks**
Duration of End Sem.Exam:3Hrs

Module 1:

Introduction to Disaster and its Management

Definition of Disaster, Types of Disasters i.e. Natural and Man Made Disasters. Natural: Earthquake, Volcanoes and TsunamisMan Made: Fire, Blast etc.

Module 2:

Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities. Effect on structural elements.

Module 3:

Design of RCC Structures

Design of multi-story RC structure with foundation as per latest IS: 1893 by Equivalent static lateral load method and Response Spectrum Method.

Module 4:

Design of Steel Structures

Introduction to Time history method,Capacity based design of soft story RC building, design of Shear Walls. Ductile detailing as per latest IS:13920.

Module5 :

Blast Loading

Introduction to Blast Loading, Blast Wind, Clearance Time, Decay Parameter, Drag Force, Ductility Ratio, Dynamic Pressure, Equivalent Bare Charge, Ground Zero, Impulse, Mach Number, Overpressure, Reflected Overpressure,Shock Wave Front, Side-on Overpressure Transit Time,Yield.

Module 6:

General Characteristics of Blast and Effects on structures, Blast force, Blast load on above and below ground structures, Response of structural elements, Time period of structural members, Design Stresses for Steel and Reinforced Concrete, Load combinations, Design of structure for blast loading.

Module7 :

Fire Analysis of steel structure subjected to fire, Design consideration of structural steel members as per IS-800: 2007.

Module 8 :

Post Disaster Measures

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. Introduction to Base Isolation systems. IS code provisions for retrofitting of masonry structures, failure modes of masonry structures and repairing techniques.

Reference Books:

i. P. Agarwal and M. Shrikhande – Earthquake Resistant Design of Structures, Prentice-Hall Publications.
ii. Earthquake resistant design of building strucures building----Hosure, Wiley India**.**
iii. Seismic Design of Reinforced Concrete and Masonry Buildings---Paulay, Wiley India
iv. IS:1893 – Indian Standard Criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards, New Delhi.
v. IS:13935 – Repair and Seismic Strengthening of Buildings – Guidelines, 1993
vi. IS: 4326 – Earthquake Resistant Design and Construction of Buildings – Code of Practice, 1993

vii. IS: 13828 – Improving Earthquake Resistance of Low Strength Masonry Buildings, 1993
viii. IS : 4991 – 1968 - Criteria For Blast Resistant Design of Structures for Explosions above ground.
ix. IS: 800 2007 - Code for general construction in steel structures
x. IS:13827 - Improving Earthquake Resistance of Earthen Buildings, 1993
xi. IS:13920 – Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Force, 1993
xii. IS: 3370- Indian Standard code of practice for concrete structures for storage of liquids, Bureau of Indian Standards, New Delhi.
xiii. Clough and Penzin – Dynamics of Structures, Mc-Graw Hills Publications.
xiv. Jai Krishna, A.R. Chandrashekharan and B Chandra – Elements of Earthquake Engineering, South Asian Publishers Pvt. Ltd.
xv. Joshi P S et al. - Design of Reinforced Concrete Structures for Earthquake Resistance Published by Indian Society of Structural Engineers, 2001

University of Pune
M.E. (Civil) (Structures)--2013Course)
Semester III
1Credit =15 Hrs.

601 014-Structural Design of Concrete and Prestressed Bridges

Teaching Scheme	**Examination Scheme**
Lectures: 4 hours/week	**In semester Exam. : 50 marks**
Credits 4	**End Semester Exam. : 50 marks**
	Duration of End Sem.Exam:3Hrs

Module 1:
Introduction to bridge engineering, classification and components of bridges, layout, planning.Structural forms of bridge decks, beam and slab decks, cellular decks.
Module 2:
Standard specification for bridges, IRC loadings for road bridges, loading standards for railway bridges.
Module 3:
Design of slab culvert, box culvert and skew bridge.
Module 4:
Introduction to Courbon's method, Henry-Jaegar method and Guyon-Massonet method. Design of T-beam PC bridges using Courbon's method.
Module 5:
Structural classification of Rigid Frame bridge, analysis and design of Rigid Frame bridge.
Module 6:
Classification and design of bearings. Expansion joints. Forces acting on abutments and piers,
Module 7:
Analysis and design, types and design of wing walls.
Module 8:
Bridge foundations, design of open well, pile and caisson foundation.

Reference Books

1. D. Johnson Victor - Essentials of Bridge Engineering Fifth Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
2. T.R. Jagadeesh, M.A. Jayaram - Design of Bridge Structures, Prentice-Hall of India
3. N. Krishna Raju - Design of Bridges, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
4. David Lee – Bridge Bearings and Expansion Joints,E & FN Spon
5. V.K. Raina – Concrete Bridge Practice Analysis, design and Economics, Tata McGraw Hill
6. IRC Codes – IRC: 5, IRC: 6, IRC: 18, IRC: 27, IRC: 45, IRC: 78, IRC: 83
7. Joseph E. Bowles – Foundation Analysis and Design, McGraw-Hill International Edition
8. Nainan P. Kurian – Design of Foundation Systems, Narosa Publishing House

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University of Pune
M.E. (Civil) (Structures)--2013Course)
Semester III
1Credit =15 Hrs.

601 015: Elective –III

Teaching Scheme **Examination Scheme**
Lectures: 5 hours/week **In semester Exam: 50 Marks**
Credits 5 **End Sem. Exam. : 50 marks**
Duration of End Sem.Exam:3Hrs

Select any combination having total of 5 credits from following technical / interdisciplinary courses ---

Code	**2 Credits Course** *L*	**Code**	**1 Credit Course**	**Code**	**Audit Course (No Credit Course)**
601 015A	Bio Mechanics and Bio Materials	**601 015E**	Design of Composite Construction	**601 015H**	Chess
601 015B	Adv analysis of steel Frames	**601 015F**	Foreign Language-III	**601 015I**	Abacus
601 015C	Theory of Plasticity	**601 015G**	Safety Practices in construction.		
601 015D	Design of Concrete Plate and Shell Structures				

601 015-A- Elective –III Bio Mechanics and Bio Materials
(2 Credit Course)

Module 1:

A)Structure of biomaterials, classification of bio materials, mechanical properties, isoelasticity, elasticity of non-Hookean materials..

B)Metallic Biomaterials and ceramic biomaterials ,Polymeric Biomaterials, Composite Biomaterials, Bio degradable Polymeric Biomaterials. stainless steel Co-Cr-alloys Ti & its alloys, medical applications, corrosion of metallic implants. Non-absorbable or relatively

Module 2:

Hard Tissue replacement, Preservation techniques for Biomaterials. Hip Joint Prosthesis fixation : Problems and possible solutions. Polymeric Biomaterials and composite biomaterials, medical applications, deterioration of polymers.

Module 3:

Introduction to Biomechanics of Human movement. Fundamentals of Biomechanics .Mechanical properties of cartilage. Structure and properties of articular cartilage, mechanical properties of

Bone tissue. Mechanics of musculoskeletal system, response of tissue to forces,stress,strain, stiffness, mechanical strength, viscoelasticity.

Module 4:

Biomecnics of Bone tissue Linear Kinetics and kinematics of joints elobow, Hip, Knee joint; Evaluation of joint forces and moments. Equilibrium of joint, fundamental concepts of Gait analysis.

Design of artificial fixation devices. Orthopedic fixation devices. Fundamentals of design of joint prosthesis. Mechanical testing of joint prosthesis Principles involved in study of rehabilitation engineering.

Reference books

1. Y. C. Fung, Bio-mechanics,Mechanical Properties of Living Tissues Edition 2, 1993.
2. Dowson D.V., Wright, Introduction to Biomechanics of joints and joint replacement, Mechanical
Engineering Publication 1987.
3. Van. C.Mow, Antony Ralcliffe, Savio, Bio-mechanics of diarthrodial joints, Springer Verlag 1990.
4. Frederick H.Silver, Bio-materials Medical Devices and Tissue Engineering, Chapman & Hall
5. Park Joon Bu, Bio-Materials Science & Engineering, Plenum Press 1990.
6. Buddy D. Ratner & Allen S.Hoffman, Bio-Materials Science an Introduction to Materials in Medicine, Academic Press 1996.
7. Hand book of Biomedical Engineering, Kline Jacob Academic Press 1988.

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601 015-B-Elective –III Advanced Analysis of Steel Frames
(2 Credit Course)

Module 1:

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.

Module 2:
First order elastic (FOE) & first order inelastic(FOIE) (Plastic) analysis of rectangular portal frames. Elastic & limit state of strength of frame.

Module 3:
Second order considerations in elastic analysis of frames P-δ & P-Δ effect. Critical load of single bay, single storey portal frame using P-δ & P-Δ effect; classical & semi geometrical approach.Direct second order elastic analysis (SOE), international codal provisions, application for simple frame.

Module 4:
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 of member due to plasticity at hinge. Advantages of advanced analysis.
Design of frame using advanced analysis. Use of suitable software illustrating difference in analytical results among all methods such as FOE, FOIE, SOE, SOIE.

Reference Books :
1 “Stability Analysis & design of Structures” M.L. Gambhir, Springer, SIE
2 “Stability of structures” , Ashwini Kumar, Allied Publishers Ltd.
3.“Advanced Analysis of steel frames, Theory Software and application”, W F Chen, S. Toma, CRC press, Tokyo
4.“ Plastic Analysis and Design of Steel Structures”, M Bill Wong, Elsevier
5.“ LRFD steel design using Advanced Analysis”, W F Chen, S. Kim, CRC press.

General Reading Suggested:
Codes:
1.IS: 800 - 2007 Code of Practice for General Construction in Steel
2.AISC Steel Construction Manual

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601 015-C- Elective –III Theory of Plasticity
(2 Credit Course)

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Module 1:
Basic equations of theory of elasticity: Index notation, equations of equilibrium, constitutive relations for isotropic bodies, strain-displacement relations, compatibility, displacement and traction boundary conditions, admissibility of displacement and stress fields, plane stress and plane strain problems.

Module 2:
Plastic behaviour in simple tension, generalisation of results in simple tension, yield surfaces, uniqueness and stability postulates, convexity of yield surface and normality rule, limit surfaces.Initial Yield Surfaces for Polycrystalline Metals: Summary of general form of plastic constitutive equations, hydrostatic stress states and plastic volume change in metals, shear stress on a plane, thevon Mises initial yield condition, the Tresca initial yield condition, consequences of isotropy.

Module 3:
Plastic Behaviour under Plane Stress Conditions: Initial and subsequent yield surfaces in tension-torsion, the isotropic hardening model, the kinematic hardening model, yield surfaces made of two or more yield functions, piecewise linear yield surfaces, elastic perfectly plastic materials. Plastic Behaviour of Bar Structures - Behaviour of a three bar truss, behaviour of a

beam in pure bending, simply supported beam subjected to a central point load, fixed beams of an elastic perfectly plastic material, combined bending and axial force.

Module 4:

Theorems of Limit Analysis - Alternative statement of the limit theorems, the specific dissipation function, cold bending of bar beyond elastic limit, spring back, plastic bending with strain hardening material, plastic bending of wide plate.

Limit Analysis in Plane Stress and Plane Strain: Discontinuities in stress and velocity fields, the Tresca yield condition in plane stress and plane strain, symmetrical internal and external notches in a rectangular bar, the punch problem in plane strain, remarks on friction.

Reference Books

1. Martin, J.B., Plasticity, Fundamentals and General Results, MIT Press, London.
2. Kachanov, L.M., Fundamentals of the Theory of Plasticity, Mir Publishers, Moscow.
3. Chakrabarty, J, Theory of Plasticity, McGraw Hill, New York.
4. Hill, R., Mathematical Theory of Plasticity, Oxford University Press.
5. Chen, W.F., and Han, D.J., Plasticity for Structural Engineers, Springer Verlag.
6. Timoshenko, Theory of Plasticity, McGraw Hill

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601 015-D- Elective –III Design of Concrete Plate and Shell structures
2 Credit Course

Module 1 :

Types of plates, scope and assumptions, Simpson and Iteration method of analysis and design, Ridge load resolution, edge shear, stress distribution, deflection and rotations, joint moment effect, design of north-light folded plate

Module 2 :

Design of flat and concave plate circular in shape resting on ring beam, Continuous folded plate design

Module 3 :

Membrane and bending theory of shells,Theories in Matrix form, Boundary conditions, Shell Parameter selection, Stress resultant calculation, Reinforcement parameters and details, composition of Ferro-cement shells

Module 4:

Design by Beam theory, Beam and arch analysis, modified beam method, Design of Multiple bay cylindrical shell, Design of North light cylindrical shell, continuous cylindrical shell, hyperbolic paraboloid shell, Design of Pre-stressed cylindrical shell and dome, selection of optimum pre-stressing force, effect of pre-stressing force on stress distribution in shell

Reference Books :

1.G. S. Ramaswamy, ‘Design and construction of concrete shell roofs’, CBS publication
2.Naaman `Ferrocement Construction `
3.S. Timoshenko and W. Krieger, Theory of Plates and Shells, McGraw Hill.
4.Ansel C. Ugural‘Stresses in Plates and Shells’, McGraw Hill
5.Chandrashekhara K., ‘Analysis of Concrete Shells’, New Age International Edition
6.Chandrashekhara K., ‘Analysis of Plates’, New Age International Edition
6.S. S. Bhavikatti, ‘Theory of plates and shells’, New Age International Publication

7.T.Y. Lin & Ned H. Burns – Design of Prestressed Concrete Structures, John Wiley Publication
8.N. Krishna Raju – Prestressed Concrete, Tata McGraw Hill Publication Co

Codes:

IS: 456: Indian Standard code of practice for plain and reinforced concrete, Bureau of Indian Standards, New Delhi.
IS: 1343: Indian Standard code of practice for Prestressed concrete, Bureau of Indian Standards, New Delhi.
IS: 1893: Indian Standard Code of practice for criteria for Earthquake resistant design of structures, Bureau of Indian Standards, New Delhi.
IS: 875 – 1964 Code of Practice for Structural Safety of Building: Loading Standards.

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601 015-E-Elective III Design of Composite Construction (1 Credit course)

Module 1:

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

Module 2:

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.
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.

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

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601 015-F-Elective III Foreign Language-- French-III (1 Credit course)

Module 1:

French Grammar and Vocabulary: Unit-1, Lesson 4 of the Text Book (Grammar & Vocabulary), Unit-1, Lesson 4 of the Text Book, Revision & speaking practice

Module 2:

Advance Vocabulary, Writing & Speaking, Exercise of Unit-1, Lesson 4 of the Text Book & workbook , Practicing Simple conversation in French, Revision & practice of conversation (Simple questions & answers)

Reference: Jumelage-I Text Book by Manjiri Khandekar & Roopa Luktuke
Jumelage-I workbook by Roopa Luktuke

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601 015—G--Elective III Safety Practices in Construction
(1 Credit course)

Module 1:
Introduction to Construction Safety And Safety Technology--Introduction to construction safety; historical background and current perspective; Government's policy in industrial safety; safety & health legislation in India, Construction Sites (Safety) Regulations; Codes of practice; Potential hazards/risks associated with construction sites and high risk activities such as the use of hoist, Working at height and working in confined space. Safety in typical civil structures – Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring. Safety in Erection and closing operation - Construction materials –Specifications – suitability – Limitations – Merits and demerits – Steel structures – Concrete structure.
Workplace ergonomics including display screen equipment and manual handling, personal protective equipment, first aid and emergency preparedness, fire safety, electrical hazards.
Module 2:
Construction Safety Management and Accident Prevention
Safety training; safety policy; safety committees; safety inspection; safety audit; reporting accidents and dangerous occurrences.
Accident Prevention: Principles of accident prevention; job safety analysis; fault tree analysis; accident management

References
1. Accident Prevention Manual for Industrial Operations, NSC, Chicago, 1982.
2. Fulman, J.B., Construction Safety, Security, and Loss Prevention, John Wiley and Sons,1979.

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601 015—H--Elective III CHESS
(Audit course--Non Credit course)

Module 1
Introduction of chess game, What is chess board, the place of chess board , Chess pieces position & its moves, The concept of attacking, , The concept check with different pieces, Mate/Checkmate, Castling, Pawn Promotion, Notation, Stalemate, Pointing
Module 2
End game, attacking a piece, Opening principles, Piece exchange, Pin, Defining the draws in Chess
Reference: As specified by the instructor

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601 015—I--Elective III ABACUS
(Audit course--Non Credit course)

Module 1

Introduction of Abacus, addition & subtraction with help of help of small friends, big friends & big family, Concept of visualization, Multiplication & Division

Module 2

Additional & Subtraction with decimal concept, Determine cube root & square root

Reference: As specified by the instructor

UNIVERSITY OF PUNE
M.E. (CIVIL) (Structures)
SEMESTER III
1Credit =15 Hrs.
601 016--Seminar – II

Teaching Scheme	Examination Scheme
Pract. 4 hrs./week	Oral : 50 Marks,
	TW :: 50 Marks
	Credits 4

Seminar II shall be on the topic relevant to latest trends in the field.
Term work should consist of ---

I) Spiral bound report preferably, printed on both the sides of paper on the topic of dissertation work and should be submitted in a standard format having the following contents.

i) A report on training undergone on a construction project site/organization/for a period of minimum 15 days, including the data collection necessary for the project work.

ii) A report on the topic of dissertation, containing the following:

a) Literature review and problem statement formulation.

b) Research Methodology and proposed schedule of completion of project work.

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.

II) Spiral bound report preferably, printed on both the sides of paper on vacational training of 2 weeks

UNIVERSITY OF PUNE
M.E. (CIVIL) (Structures)
SEMESTER III
1Credit =15 Hrs.

601 017- Project Stage I

Teaching Scheme	Examination Scheme
Pract. 8 hr./week	Oral: 50 marks,
	TW ; 50 marks
	Credits 8

The project work will start in semester III, and should preferably be a live problem in the industry or macro-issue of industry and should involve scientific research, design, collection, and analysis of data, determining solutions and must preferably bring out the individuals contribution.

The dissertation stage I report should be presented in a standard format, in a spiral bound hard copy, preferably printed on both the sides of paper, containing the following contents.

i. Introduction including objectives, limitations of study.
ii. Literature Survey, background to the research.
iii. Problem statement and methodology of work
iv. Theoretical contents associated with topic of research
v. Field Applications, case studies
vi. Data collection from field/organizations or details of experimental work/analytical work
vii. Part analysis / inferences
viii. Details of remaining work to be completed during the project work stage II
ix. References

Students should prepare a power point presentation to be delivered in 25 minutes and should be able to answer questions asked in remaining five minutes.(It is preferred that at least one paper on the research area be presented in a conference or published in a referred journal.)

UNIVERSITY OF PUNE
M.E. (CIVIL) (Structures)
SEMESTER IV
1Credit =15 Hrs.

601 018 -Seminar – III

Teaching Scheme	Examination Scheme
Pract. 5 hrs./week	TW : 50 marks
Credits : 5	Oral / Presentation-50 marks

Term work should consist of a spiral bound report on the topic of dissertation work,preferably typed on both the sides of pages and should be submitted in a standard format.
Seminar III will be assessed based on the requirements of completion of project work for the project stage II.
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.

UNIVERSITY OF PUNE
M.E. (CIVIL) (Structures)
SEMESTER - IV
1Credit =15 Hrs.

601 019 Project Work Stage II

Teaching Scheme	Examination Scheme
Pract. 20 hrs./week	Oral/Presentation : 50 Marks
Credits : - 20	TW : 150 Marks

The final dissertation should be submitted in black bound hard copy as well as a soft copy on CD.
(The due weightage will be given for the paper(s) on topic of project presented in a conferences or published in referred journals.)
The Term Work of Dissertation of semester IV should be assessed jointly by the pair of internal and external examiners, along with oral examination of the same.