Course Curriculum

M.TECH

IN

STRUCTURAL ENGINEERING

2016

Department of Civil Engineering

JAYPEE UNIVERSITY OF ENGINEERING & TECHNOLOGY

A.B. ROAD, RAGHOGARH, DT.-GUNA-473226 (M.P.), INDIA

2 year M.Tech. Course Curricula for Structural Engineering							
M.Tech. I semester-(M1)							
S.No.	Subject Code	Subject	Core/Elective	L	T	P	Credits
1	18M11CE115	Advanced Structural Analysis	Core	3	0	0	3
2	18M11CE117	Structural Dynamics	Core	3	0	0	3
3	18M11CE118	Design of Reinforced Concrete Structures	Core	3	0	0	3
4	18M11CE119	Modelling, Simulation and Computer Applications	Core	3	0	0	3
5	18M14XXxxx	Elective-I	Elective	3	0	0	3
6	18M17CE171	Concrete Structures Laboratory	Core	0	0	4	2
		Total		**15**	**0**	**4**	**17**

List of Electives-I			Core/Elective	L	T	P	Credits
1	14M14MA213	Advanced Numerical Techniques	Elective	3	0	0	3
2	18M14CE131	Stability of Structures	Elective	3	0	0	3
3	18M14CE132	Plastic Analysis of Structures	Elective	3	0	0	3
4	18M14CE133	Hydraulic Structures	Elective	3	0	0	3
5	18M14CE134	Geo-Environmental Engineering	Elective	3	0	0	3

2 year M.Tech. Course Curricula for Structural Engineering							
M.Tech. II semester-(M2)							
S.No.	Subject Code	Subject	Core/Elective	L	T	P	Credits
1	18M11CE216	Solid Mechanics in Structural Engineering	Core	3	0	0	3
2	18M11CE217	Design of Steel Structures	Core	3	0	0	3
3	18M11CE218	Earthquake Resistant Design of Structures	Core	3	0	0	3
4	18M11CE219	Theory of Plates and Shells	Core	3	0	0	3
5	18M14CE***	Elective-2	Elective	3	0	0	3
6	18M17CE271	CAD Laboratory	Core	0	0	4	2
		Total		**15**	**0**	**4**	**17**

List of Electives-II			Core/Elective	L	T	P	Credits
1	18M14CE231	Finite Element Methods	Elective	3	0	0	3
2	18M14CE232	Construction, Economics and Finance	Elective	3	0	0	3
3	18M14CE233	Ground Improvement Engineering	Elective	3	0	0	3
4	18M14CE234	Analysis and Design of Pavement Systems	Elective	3	0	0	3
5	18M14CE235	Soil Structure Interaction	Elective	3	0	0	3

2 year M.Tech. Course Curricula for Structural Engineering							
M.Tech. III semester-(M3)							
S.No.	Subject Code	Subject	Core/Elective	L	T	P	Credits
1	18M14CE***	Elective-3	Elective	3	0	0	3
2	18M14CE***	Elective-4	Elective	3	0	0	3
3	18M19CE391	Seminar	Core	0	0	0	2
4	18M19CE392	Dissertation Part-I	Core	-	-	24	12
		Total		**6**	**0**	**24**	**20**

List of Electives-III			Core/Elective	L	T	P	Credits
1	18M14CE335	Design of Industrial Structures	Elective	3	0	0	3
2	18M14CE336	Recent Advances In Construction Materials	Elective	3	0	0	3
3	18M14CE337	Pre-Stressed Concrete Design	Elective	3	0	0	3
4	18M14CE338	Composite Materials and Structures	Elective	3	0	0	3
5	18M14CE339	Analysis and Design of Tall Buildings	Elective	3	0	0	3
List of Electives-IV			Core/Elective	L	T	P	Credits
1	18M14CE436	Repair And Retrofitting of Structures	Elective	3	0	0	3
2	18M14CE437	Construction Methods And Equipments	Elective	3	0	0	3
3	18M14CE438	Quality and Safety Management in Construction	Elective	3	0	0	3
4	18M14CE439	Research Methodology	Elective	3	0	0	3

2 year M.Tech. Course Curricula for Structural Engineering							
M.Tech. IV semester-(M4)							
S.No.	Subject Code	Subject	Core/Elective	L	T	P	Credits
1	18M14CE***	Elective-5	Elective	3	0	0	3
2	18M14CE***	Elective-6	Elective	3	0	0	3
3	18M19CE491	Project Seminar	Core	0	0	0	2
4	18M19CE492	Dissertation Part-II	Core	-	-	-	14
		Total					**22**

List of Electives-V			Core/Elective	L	T	P	Credits
1	18M14CE531	Advanced Steel Design	Elective	3	0	0	3
2	18M14CE532	Wind Engineering	Elective	3	0	0	3
3	18M14CE533	Cable Stayed and Suspension Bridges	Elective	3	0	0	3
4	18M14CE534	Computer Application in Structural Analysis & Design	Elective	3	0	0	3
5	18M14CE535	Masonry Structures	Elective	3	0	0	3
List of Electives-VI			Core/Elective	L	T	P	Credits
1	18M14CE631	Design of Substructures	Elective	3	0	0	3
2	18M14CE632	Bridge Engineering	Elective	3	0	0	3
3	18M14CE633	Nanotechnology and Concrete	Elective	3	0	0	3
4	18M14CE634	Soil Dynamics and Machine Foundations	Elective	3	0	0	3

Course Description

Title of the course: Advanced Structural Analysis
Course Code: 18M11CE115
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: Basic Structural Analysis

Objective: To understand the different techniques for analysis of structures.

Learning Outcome: The student will be able to analyze various types of statically determinate and indeterminate structures.

Course Content:

- Degree of static and kinematic indeterminacy
- Flexibility and Stiffness Matrices,
- System Approach
- Effect of temperature and pre-strain
- Storage requirement of stiffness matrix
- Effect of node and element numbering
- Computer Applications

Text Books / References:

1. Advanced Structural Analysis by Devdas Menon

2. Advanced Structural Analysis by Hamidreza Hashamdar, Zainah Binti Ibrahim, Mohammed Jameel

Course Description

Title of the course: Structural Dynamics
Course Code: 18M11CE117
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: Basic Structural Analysis

Objective: To understand the different techniques for analysis of structures subjected to dynamics.

Learning Outcome: The student will be able to analyze single degree and multi-degree freedom system.

Course Content:

- Concept of degrees of freedom and constraints
- Equations of motion
- Response of single degree of freedom systems to initial conditions
- Base Isolation
- Theory of vibration pick–ups
- Estimation of dynamic characteristics through experimental investigations
- Multi degree of freedom systems
- Orthogonality of mode shapes

Text Books / References:

1. Structural Dynamics, by Einar N. Strommen
2. Structural Dynamics: Theory and Computation by Mario Paz
3. Structural Dynamics: Theory and Computation by William Leigh, Mario Paz
4. Structural Dynamics For the Practising Engineer, New Edition by H. M. Irvine
5. Dynamics of Structures by Anil K. Chopra

Course Description

Title of the course: Design of Reinforced Concrete Structures
Course Code: 18M11CE118
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: Basic Structural Analysis

Objective: To understand the concepts of designing reinforced cement concrete structures.

Learning Outcome: The student will be able to design various types of reinforced cement concrete structures.

Course Content:

- Deflections of Reinforced Concrete Beams and Slabs
- Estimation of Crack Widths in Reinforced Concrete Beams
- Inelastic Analysis of Reinforced Concrete Beams and Frames
- Design of Shear Walls
- Deep Beams
- Design of Reinforced Concrete Members for Earthquake Resistance, Fire Resistance
- Software Applications, Virendeel Girders, Concrete Trusses.

Text Books / References:

1. Design of Reinforced Concrete Structures 1st Edition by N. Subramanian
2. Design of Reinforced Concrete Structures (IS:456-2000) 3rd Edition by N. Krishna Raju
3. Design Of Reinforced Concrete Structures by Ramamrutham
4. Limit State Design of Reinforced Concrete, 2nd Edition by P. C. Varghese
5. Practical Design of Reinforced Concrete Structures 1st Edition by Ghosh

Course Description

Title of the course: Modeling, Simulation and Computer Applications
Course Code: 18M11CE119
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To study the fundamentals of simulation as applicable in civil engineering structures.

Learning Outcome: The student will be able to appreciate the applications of simulation in structural engineering.

Course Content:

- Generalization of Finite Element concept
- Deterministic and stochastic models
- Concepts of simulation
- Constitutive model
- Optimization
- Introduction to linear and geometric programming
- Probability Distributions
- Generation of random numbers
- Queuing theory

Text Books / References:

1. Modeling and Simulation by Pratiksha, Saxena.
2. Modeling and Simulation: An Application-Oriented Introduction by Hans-Joachim Bungartz, Stefan Zimmer, Martin Buchholz
3. Computer Simulation and Modelling by Francis Neelam kavil.

Course Description

Title of the course: Concrete Structures Laboratory
Course Code: 18M17CE171
L-T Scheme: 4-0 **Course Credits: 2**

Objective: The purpose behind this course is to make the students familiar with the testing of cement and concrete.

List of Experiments

PART-A
1. Normal consistency & specific surface area of hydraulic cement.
2. Soundness test & Compressive strength of hydraulic cement.
3. LOI & percentage of silica & alumina of cement or pozzolona.
4. Free lime and sodium oxide & potassium oxide test of cement or pozzolona.
5. Marsh funnel viscosity test and specific gravity test.
6. Air Permeability test on cement mortar.

Assignment: Concrete Mix Design of required grade as per IS Codes.

PART-B
7. Air Entrainment test on freshly prepared concrete
8. Influence of W/C ratio on workability & strength.
9. Compressive strength of concrete of normal & accelerated cured concrete.
10. Non Destructive Testing (NDT) of Concrete.
11. Bend & rebend test of steel bars by Universal testing Machine (UTM).
12. Durability test of concrete by rapid chloride ion permeability test (RCPT).

Course Description

Title of the course: Advance Numerical Techniques
Course Code: 14M14MA213
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: Basic Numerical Techniques

Objective: This course has been prepared for students pursuing M.Tech. and Ph.D. programs. The main role of Numerical Methods is to approximate the accurate solutions of complex problems of engineering as well as any mathematical science. This course offers complete procedures for solving numerically various kinds of problems that appear in engineering and science in galore.

Learning Outcomes:

At the end of this course students will be acquainted with the basic concepts, techniques and mathematical rigor in numerical methods fully and their applications in a variety of contexts reflecting on real life problems.

Course Content:
Newton-Raphson Method for two or more variables
Jacobi Method,
Householder's Method for eigenvalues and vectors.
Interpolation using Divided Differences
Newton-Cotes integration formulae
Finite difference methods
Method of weighted residuals
Rayleigh- Ritz method

Reference Books:

1. Numerical Solution of Partial Differential Equations: Finite difference methods, by Smith, G.D., Third Edition, Oxford University Press 1985.
2. Applied Numerical Analysis, 6th Edition, by Gerald, C.F., Addition Wesley, 2002.
3. Elementary Numerical Analysis, An algorithmic Approach, 3rd edition, by Conte, S.D and deBoor, C., McGraw-Hill, New York, 1980.
4. Numerical Methods for Scientific and Engineering Computation, Jain, M.K., Iyenger, S.R.K.and Jain R.K., New Age, 2000.

Course Description

Title of the course: Stability of Structures
Course Code: 18M14CE131
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To understand the mechanisms to provide stability to the structures.

Learning Outcomes: At the end of the course, the student will be able to verify the stability of structures.

Course Content:

- Criteria for design of structures
- Classical concept of stability
- Stability of discrete systems
- Stability of continuous systems
- Stability of frames
- Stability of beams
- Introduction to inelastic buckling and dynamic stability.

Text Books / References:

1. Stability of Structures, By Z P Bazant and L Cedolin, 1990, Oxford University Press, Oxford.
2. Structural Stability Of Columns And Plates, By N G R Iyengar, 1986, Affiliated E-W Press, New Delhi.
3. Stability Of Structures Principles And Applications By Chai H. Yoo And Sung Lee
4. Stability Analysis And Design Of Structures By M.L. Gambhir
5. Stability Of Structures: Elastic, Inelastic, Fracture, And Damage Theories By Zdenek P. Bazant, Luigi Cedolin
6. Advanced Mechanics Of Solids And Structures By N. Krishna, Raju (1997)
7. Stability Of Structures By Allied Publishers

Course Description

Title of the course: Plastic Analysis of Structures
Course Code: 18M14CE132
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To explain the fundamentals of plastic analysis and use the same in practical applications.

Learning Outcomes: The student will develop know-how about plastic design of structures.

Course Content:

- Concept of plastic design
- Analysis of Indeterminate Structures
- Redistribution of moments
- Deflection
- Secondary Design Considerations
- Design of eccentrically loaded columns
- Shake down analysis
- Special considerations for design of structures using light gauge metals.

Text Books / References:

1. Plastic Analysis and Design of Steel Structures by M. Bill Wong
2. Plastic Analysis by Dr. Colin Caprani
3. Plastic Analysis And Design Of Steel Structures by M. Bill Wong

Course Description

Title of the course: Hydraulic Structures
Course Code: 18M14CE133
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To understand the fundamental design concepts of hydraulic structures.

Learning Outcomes: At the end of the course students will have in-depth knowledge of hydropower generation and the design of hydraulic structures.

Course Content:

- Advanced topics in the design and construction of dams:
- Gravity dams arch and buttress dams and earthen dams.
- Spillways
- Intake works
- Energy Dissipation Devices
- Theory of Seepage
- Pressures and floor thickness.
- Cross Drainage Works: Definitions, choice of type, hydraulic design considerations. Aqueducts their types and design

Text Books:

1. Design Of Small Dams - Bureau of Reclamation USA- Oxford & IBH , New Delhi
2. Water Power Engineering - Dandeker, Vikas Publishing House - New Delhi
3. Water Power Engineering, Bhattacharya, P. K., Khanna Publishers, New Delhi
4. Hydro-Electric and Pumped Storage Plants-M G Jog-John Wiley & Sons- New Delhi
5. Hydro-Electric Engineering Practice Vol 1- 3- J Guthrie, CBS - New Delhi
6. Handbook of Hydro Electric Engineering, P. S. Nigam, Nem Chand and Brothers, Roorkee.
7. Hydropower an Indian Perspective- Naidu, CBS Pub., New Delhi

Course Description

Title of the course: Geo-environmental Engineering
Course Code: 18M14CE134
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To explain the fundamentals of soil-waste interaction.

Learning Outcomes: The student will appreciate the impact of environment on the behavior Of structure.

Course Content:

- Sources and effects of subsurface contamination
- Soil-waste interaction
- Laboratory and field evaluation of permeability
- Types of landfills
- Engineering properties and geotechnical reuse of waste

Text Books / References:

1. Geoenvironmental Engineering: Principles and Applications By Lakshmi Reddi, Hilary I. Inyang
2. Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies by Hari D. Sharma, Krishna R. Reddy
3. Geoenvironmental Engineering: Integrated Management of Groundwater and contaminated land edited by Raymond Nen Yong, Hywel R. Thomas
4. Geoenvironmental Engineering and Geotechnics edited by Qiang He, Shui-Long Shen
5. Geoenvironmental Engineering By A.M.O. Mohamed, H.E. Antia
6. Geoenvironmental Engineering: Contaminated Soils, Pollutant Fate, and Mitigation By Raymond N. Yong

Course Description

Title of the course: Solid Mechanics in Structural Engineering
Course Code: 18M11CE216
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To explain the concepts behind the behavior of structures.

Learning Outcomes: At the end of the course, the student will understand the fundamentals of solid mechanics and its application to structural engineering.

Course Content:

- State of stress in a body
- Differential equations of equilibrium
- Generalized Hooke's law
- Basic equations of the theory of elasticity
- Rotating disks with uniform thickness
- Saint Venant's method
- Tresca and Von Mises yield criteria
- Visco-elastic behavior.

Text Books / References:

1. Mechanics of Solids by Singh, Arbind Kumar (2007)
2. Solid Mechanics by S.M.A, Kazimi (2003)
3. Advanced Mechanics of Solids by L S, Srinath
4. Mechanics Of Materials Vol-2: The Mechanics of Elastic and Plastic Deformation of Solids and Structural Materials by E.J, Hearn (1997)

Course Description

Title of the course: Design of Steel Structures
Course Code: 18M11CE217
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To understand the fundamentals of designing steel structures and the relevant codes of practice.

Learning Outcomes: At the end of the course, the student will be able to design steel structures.

Course Content:

- Properties of steel
- Design of steel structures-design criteria
- Local buckling of compression flange & web
- Method of design
- Strength Criteria
- P-M interaction
- Connections

Text books / references:

1. Design of Steel Structures Vol.1 by Ram, Chandra
2. Design of Steel Structure by Subramanian. N (2008)
3. Design of Steel Structures by I C, Syal (2005)
4. Design of Steel Structures by L.S, Negi (1997)
5. Design of Steel Structures Vol. 2 by Ram, Chandra

6. Design of Steel Structures by William T. Segui
7. Design of Steel Structures by B.C, Punmia (1998)

Course Description

Title of the course: Earthquake Resistant Design of Structures
Course Code: 18M11CE218
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To understand the fundamentals of designing structures subjected to earthquake loading and the relevant codes of practice.

Learning Outcomes: At the end of the course, the student will be able to design structures subjected to earthquake loading.

Course Content:

- Behavior of buildings and structures during past earthquakes and lessons learnt goals of earthquake resistant design.
- Linear static procedure for seismic load calculation – IS 1893 – 2002
- Multimodal and Multidirectional response spectrum analysis
- Geotechnical and architectural considerations
- Study of IS 13920 – 1993
- Earthquake resistant measures in masonry buildings.

Text Books / References:

1. Earthquake Resistant Design Of Structures By Pankaj Agarwal
2. Earthquake Resistant Design Of Structures By S.K, Duggal (2007)

Course Description

Title of the course: Theory of Plates and Shells
Course Code: 18M11CE219
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To study the fundamentals behavior of plates and shells and the theories involved therein.

Learning Outcomes: The student will be able to explain the fundamentals of plates and shells.

Course Content:

- First and second fundamental forms
- Equations of Gauss and Codazzi
- Membrane theory of shells
- Strain-displacement relations
- Bending theory of shells
- Bending theory of flat plates
- Double Fourier series
- Reissner-Mindlin-Naghadi type theories

Text Books / References:

1. Mechanics of Laminated Composite Plates and Shells, Theory and Analysis By J.N, Reddy (2004).
2. Theory of Plates and Shells, (Engineering Societies Monographs) By S. Timoshenko, S. Woinowsky-Krieger.
3. Theory of Plates and Shells by Stephen Timoshenko, S. Woinowsky-Krieger Mcgraw-Hill, 1959.

Course Description

Title of the course: CAD laboratory
Course Code: 18M17CE271
L-T-P Scheme: 0-0-4 **Course Credits: 2**

Prerequisites: None

Objective: The purpose behind this course is to make the students familiar with the software available in structural engineering.

List of Experiments

1. Spreadsheet for calculating and drawing shear force and bending moment diagrams of determinate beams.
2. Spreadsheet for designing a singly reinforced beam.
3. Spreadsheet for designing a doubly reinforced beam.
4. Primavera – Creating and analyzing a project – Project 1 part 1
5. Primavera – Creating and analyzing a project – Project 1 part 2
6. Primavera – Creating and analyzing a project – Project 2 part 1
7. Primavera – Creating and analyzing a project – Project 2 part 2
8. STAAD.Pro – Analysis of beams and plane frames
9. STAAD.Pro – Analysis of Trusses
10. STAAD.Pro – Analysis of a building for Gravity loads
11. STAAD.Pro – Analysis of a building for Wind loads
12. STAAD.Pro – Analysis of building for Earthquake load

Course Description

Title of the course: Finite Element Methods
Course Code: 18M14CE231
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To understand the fundamentals of finite element method and its applications to civil engineering structures.

Learning Outcomes: At the end of the course, the student will be able to apply the concepts of finite element method for the analysis of structures.

Course Content:

- Structural stiffness analysis
- The structural element
- Transformation of co-ordinates
- Finite elements of a column
- Plane stress and plane strain
- Two Dimensional Isoparametric Elements
- Assessment of accuracy
- Bending of plates
- Techniques for Nonlinear Analysis

Text Books / References:

1. Finite Element Method: A Practical Course by G.R.Liu (2003)
2. Finite Element Method by O.C, Zienkiewicz (1977)
3. Basic Principles Of Finite Element Method by K.M.Entwistle (2006)
4. Introduction To The Finite Element Method by Richard D, Klafter (2008)
5. Finite Element Methods for Engineers by Dixit, U.S. (2009)
6. Scaled Boundary Finite Element Method by John. P , Wolf (2003)
7. Finite Element Method Of Engineers by K.H, Huebner (2010)
8. Finite Element Method In Machine Design by Ramamurti, V (2009)

Course Description

Title of the course: Construction, Economics and Finance
Course Code: 18M14CE232
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To understand economic aspects involved in constructing structures.

Learning Outcome: The student will be able to accurately estimate the cost of structures.

Course Content:

- Construction accounting
- Engineering economics
- Time value of money
- Incremental rate of return
- Benefit-cost analysis
- Break even analysis
- Taxation and inflation
- Budgeting and budgetary control
- Practical problems and case studies.

Text Books / References:

1. Construction Economics: A New Approach by Danny Myers
2. Economics and Finance for Engineers and Planners: Managing Infrastructure By Neil S. Grigg
3. Construction Project Management: Theory and Practice by Jha Kumar Neeraj, Kumar Neeraj Jha.

Course Description

Title of the course: Ground Improvement Engineering
Course Code: 18M14CE233
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To understand the fundamentals of different ground improvement methods and its applications to civil engineering structures.

Learning Outcome: The student will be able to appreciate the advantages of ground improvement methods from the structural engineering perspective.

Course Content:

- Engineering properties of soft, weak and compressible deposits
- Principles of treatment-loading (static and dynamic)
- Electro-kinematic stabilization
- Physical and Chemical improvement
- Soil reinforcement
- Vertical drains, Ground anchorage, rock bolting, soil nailing, deep mixing with lime cement. Emerging trends and case studies.

Text Books / References:

1. State Of The Art: High Embankments On Soft Ground - Part B - Ground Improvement , IRC (1995)
2. Ground Improvement, Second Edition By Michael P. Moseley, Klaus Kirsch.
3. Ground Improvement, Third Edition Klaus Kirsch (Editor), Alan Bell.
4. Ground Improvement Techniques By Purushothama, Raj (2007)
5. Ground Improvement: Case Histories (Elsevier Geo-Engineering Book) By Cholachat Rujikiatkamjorn, Professor Buddhima Indraratna, Professor Jian J Chu
6. http://www.myopencourses.com/subject/ground-improvement-techniques-1

Course Description

Title of the course: Analysis and Design of Pavement System
Course Code: 18M14CE234
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To learn the fundamentals for designing of highway and to implement them for developing a computer based system for fast and efficient design.

Learning Outcome: At the end of course, the students shall be able to design the highways by using latest techniques.

Course Content:

- Subsystems of Pavement Design
- Basis of Pavement Design
- Development of various design methods for highway and airport pavements
- Materials of Construction and Construction procedures for different types
- Soil Stabilizations methods
- Computer Programming for various pavement analysis and design methods
- Design alternatives-Analysis

Text Books:

1. Principles of pavement design: by Yoder E.J. Published by john wiley and sons, USA
2. Highway Engineering by 'A.K.Justo & S.K.Khanna' Nemchand Publ. Roorkee.

Reference Books:

1. Highway Design and Construction RJ Salter - 1988 - Basingstoke: Macmillan
2. Highway Design and Construction Bruce, Arthur, International Textbook C
3. Flexibility in Highway Design Garvey, Jane F., Acting Federal Highway Administrator
4. IRC: 37 -2012, Guidelines for the design of flexible pavements.
5. IRC: 58 -2011, Guidelines for the design of plain jointed rigid pavements for highways
6. IRC: 81-1997, Guidelines for strengthen of flexible road pavements using Benkelman beam deflection technique.

Course Description

Title of the course: Soil Structure Interaction
Course Code: 18M14CE235
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To study the interaction of soil with structures and understand how it affects the design of structures.

Learning Outcome: The student will be able to design sub-structures with due considerations to the interaction of soil.

Course Content:

- Contact pressure distribution
- Limit analysis of rafts and foundations
- Soil structure interaction studies pertaining to buried structures
- Analysis and design of deep foundations
- Modern trends in the design of earth retaining structures and case studies.

Text Books / References:

1. Soil-Structure Interaction: Numerical Analysis And Modelling By J.W. Bull, CRC Press, 09-Dec-1993
2. Soil-Structure Interaction Of Buildings With Different Stiffness By Bharti, Chandan (2010)
3. Seismic Soil Structure Interaction: New Evidence and Emerging Issues, Geotechnical Earthquake Engineering and Soil Dynamics, By Gazetas G., Mylonakis G. (1998). ASCE II, 1119–1174.
4. Dynamic Soil Structure Interaction, Prentice Hall Englewood Cliffs, By Wolf J.P., (1985). New Jersey

Course Description

Title of the course: Seminar
Course Code: 14M19CE391 **Course Credits: 2**

Student will be given projects in the area of subjects taught upto that semester. The student will do a project based on literature review, small experiments wherever possible and prepare a report. There will be one mid term evaluation, a presentation at the end followed by a viva-voce examination.

Course Description

Title of the course: Project, Part-I
Course Code: 14M19CE392 **Course Credits: 12**

Students will complete project work in the area of environmental engineering under the supervision of guide. The students will do project based on literature review; experiments if possible and write a thesis report. Total credits assigned for project work are 26. Twelve credits will be evaluated in the third semester and will be carried over to fourth semester for final evaluation of project work.

Course Description

Title of the course: Design of Industrial Structures
Course Code: 18M14CE335
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: This course aims at providing an insight to the students regarding the various theories and concepts used to design industrial structures.

Learning Outcome: The student will be able to design industrial structures.

Course Content:

- Planning of industrial structures
- Design of braced and un-braced industrial portals in steel
- Design of gantry girder
- Design of single and multi bay industrial sheds in steel and concrete.
- Design of chimneys
- Design of masts and cooling towers
- Design of storage structures
- Design of large span roof structures and suspension roof structures
- Machine foundations

Text Books / References:

1. Construction Management and Design Of Industrial Concrete And Steel Structures By Mohamed A. El-Reedy.

2. IS: 802 (Part-III) 1978, Code Of Practice for Use of Structural Steel In Overhead Transmission Line Tower, Bureau Of Indian Standards, New Delhi.

3. IS: 4091-1979, Code Of Practice for Design and Construction of Foundations for Transmission Line Towers and Poles, Bureau Of Indian Standards, New Delhi.

4. IS: 6533 (Part-2) 1989, Indian Standard Code Of Practice For Design And Construction Of Steel

5. Chimney, Bureau of Indian Standards, New Delhi.

6. IS: 6332-1984, Code Of Practice For Construction Of Floors And Roofs Using Precast Doubles - Curved Shell Units, Bureau Of Indian Standards, New Delhi

7. IS: 2204-1962, Code Of Practice For Construction Of Reinforced Concrete Shell Roof, Bureau Of Indian Standards, New Delhi

Course Description

Title of the course: Recent Advances in Construction Materials
Course Code: 18M14CE336
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To understand the newer materials available in civil engineering.

Learning Outcome: The student will be updated with the know-how about new materials in civil engineering.

Course Content:

- Foams and light weight materials
- Types of fibers
- Properties of fiber reinforced concrete
- Industrial waste materials in concrete
- High strength concrete
- Corrosion of concrete in various environments
- Architectural use and aesthetics of composites
- Adhesives and sealants

Text books / references:

1. Advances in Construction Materials 2007 by Christian U. Grosse.
2. Advanced Civil Infrastructure Materials Science, Mechanics and Applications by H Wu

Course Description

Title of the course: Pre-Stressed Concrete Design
Course Code: 18M14CE337
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: Develop professional level competence in the design of commonly used pre-stressed concrete structures.

Learning Outcome:
Students have the ability to carry out design of commonly used pre-stressed concrete systems using fundamental principles as well as design aids.

Course Content:

- Types of pre-stressing
- Systems of pre-stressing
- Loss of pre-stress
- Critical load condition
- Design by load balancing method
- Continuous beams with variable section
- Pre-stressing cable at the centroidal axis
- Pre-stressed Concrete Pavements
- Folded plates and Shells, Arches, Dams, Rigid frames, Cylindrical tanks.

Text Books / References:

1. Pre-stressed Concrete Design, Second Edition by M.K. Hurst, CRC Press.
2. Design of Pre-stressed Concrete by R. I. Gilbert, Neil C. Mickleborough CRC Press.
3. Pre-stressed Concrete Design by Melvin Keith Hurst Chapman and Hall.
4. Modern Pre-stressed Concrete Design by G. S. Ramaswamy Pitman.
5. Design of Pre-Stressed Concrete Structures by Lin, T.Y. And Burns, N.H
6. Design Of Pre-Stressed Concrete Structures by Krishna Raju

Course Description

Title of the course: Composite Materials and Structures
Course Code: 18M14CE338
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To understand the basic concepts of composite materials and their practical applications in structural engineering.

Learning Outcome:
Students have the ability to carry out the analysis and design of composite materials with due regards to material property, orientation and dimensions of the composites.

Course Content:

- Classification of Composite Materials
- Role of matrix in composite materials
- Metal Matrices and Ceramic matrices
- Role of interface in the fiber matrix composite.
- Characterization of composites
- Analysis of an Orthotropic Lamina and laminated Composites
- Experimental Characterization of Composites.
- Codal specifications for composite structures, case study.

Text Books / References:
1. Mechanics Of Composite Materials And Structures by Madhujit, Mukhopadhyay (2009)
2. Structural Composite Materials By F.C. Campbell
3. Composite Materials And Structures By P. K. Sinha

Course Description

Title of the course: Analysis and Design of Tall Buildings
Course Code: 18M14CE339
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To explain the fundamentals of studying the behavior of tall buildings and the methods used for the analysis and design of such structures.

Learning Outcome:
At the end of the course, students will be able to fully analyze and design tall structures.

Course Content:

- Principles of Planning
- Types of structural systems for tall buildings
- Shear Walls and their arrangement
- Loads on Tall Buildings
- Codal Provisions
- Analysis off Tall Buildings with and without Shear Walls
- Design of Tall Buildings.

Text Books / References:

1. Reinforced Concrete Design Of Tall Buildings By Bungale S. Taranath
2. High Rise Building Structures By Schuellar, W
3. Structural Analysis & Design Of Tall Buildings By B.S. Taranath
4. Handbook of Concrete Structures by M. Fintal.
5. Tall Building Structures: Analysis & Design By B. Stafford Smith & A. Coule
6. Advances in Tall Buildings, CBS Publishers and Distributors Delhi, 1986.

Course Description

Title of the course: Repair and Retrofitting of Structures
Course Code: 18M14CE436
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To develop skills to understand the techniques of retrofitting of structural elements.

Learning Outcome:
At the end of the course, students will have in-depth knowledge of retrofitting of various structures.

Course Content:

- Principles of retrofitting
- Criteria for repair and retrofitting
- Design considerations
- Codes of practices for repair and retrofitting
- Retrofitting of bridges and dams and heritage structures
- Retrofitting of structures by seismic base isolation, case studies of retrofitting of structures.

Text Books / References:
1. Case Studies of Rehabilitation, Repair, Retrofitting, and Strengthening of Structures by M.Fujita, T.Takanashi, K.Kuzume, T.Ueda, A.Kobayashi, D.Joray, M.Diggelmann, C.Bob, S.Dan, C.Badea, A.Gruin, L.Iures, A.B.Ajdukiewicz, J.S.Hulimka, G.Hong, Y.Chung, H.Chung, I.Vilonen P.Stefanovic.
2. Concrete Repair, Rehabilitation and Retrofitting II: 2nd International Conference on Concrete Repair, Rehabilitation and Retrofitting, ICCRRR-2, 24-26 November 2008, Cape Town, South Africa, Published: November 13, 2008 by CRC Press Content:476 Pages Editor(s):Mark G. Alexander, Hans-Dieter Beushausen, Frank Dehn, Pilate Moyo
3. Case Studies of Rehabilitation, Repair, Retrofitting, and Strengthening of Structures by International Association for Bridge and Structural Engineering, Publisher IABSE, 2010

Course Description

Title of the course: Construction Methods and Equipments
Course Code: 18M14CE437
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To understand the construction techniques and equipments for effective construction.

Learning Outcome:
At the end of the course the student will be able to make educated judgment regarding the utilization of construction techniques and equipments for safe, speedy and economic construction with due regards to quality.

Course Content:

- Factors affecting selection of equipment
- Construction engineering fundamentals
- Analysis of production outputs and costs
- Earth moving, Erection
- Concrete construction (including batching, mixing, transport and placement) and Tunneling.

TEXT BOOKS / REFERENCES:

1. Construction Planning, Equipment, and Methods by Robert L, Peurifoy (2005)
2. Construction Equipment and Methods: Planning, Innovation, Safety by Leonhard E. Bernold

Course Description

Title of the course: Quality and Safety Management in Construction
Course Code: 18M14CE438
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To explain the fundamentals of quality and safety in construction industry.

Learning Outcome:
The student will develop a keen acumen for quality construction with due regards to safety and economy.

Course Content:

- Planning and control of quality during design of structures.
- Quality assurance during construction.
- Inspection of materials and machinery
- Concept and philosophy of total quality management (TQM).
- Training in quality and quality management systems (ISO-9000).
- Concept of safety.
- Management of accidents/injuries and provision of first aid.
- Provisional aspect of safety.

Text books / references:

1. Integrated Management Systems for Construction: Quality, Environment and Safety Alan Griffith Pearson Prentice Hall, 2011
2. Quality Management in Construction by Brian Thorpe, Peter Sumner
3. Construction Safety Management by Raymond Elliot Levitt
4. Modern Construction Project Management, Second Edition: The Commercial...By S.L. Tang, S.W. Poon, Syed M. Ahmed, Francis K.W. Won

Course Description

Title of the course: Research Methodology
Course Code: 18M14CE439
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To gain the technical know-how about research in field of structural engineering.

Learning Outcome:
The student will be able to take up small research projects and carry out the work effectively and systematically.

Course Content:

- Conceptualization of an innovative project,
- Literature search and analysis
- Research and experiment design
- Developing a research plan
- Sampling methods
- Processing and statistical analysis
- Critical assessment and evaluation of research and project proposals
- Report writing and interpretation, preparation, presentation and submission of manuscript, translation of a research project into a commercial venture-case studies.

TEXT BOOKS / REFERENCES:

1. Research Methodology: Methods And Techniques By C. R.Kothari (2004)
2. Research Methodology By P.R, Sharma (2010)
3. Research Methodology by R, Panneerselvam. (2004, 2012)
4. Research Methodology Concepts and Cases by Deepak, Chawla. (2011)

Course Description

Title of the course: Project Seminar
Course Code: 14M19CE491 **Course Credits: 2**

Student will be given projects in the area of subjects taught upto that semester. The student will do a project based on literature review, small experiments wherever possible and prepare a report. There will be one mid-term evaluation, a presentation at the end followed by a viva-voce examination.

Course Description

Title of the course: Project, Part-II
Course Code: 14M19CE392 **Course Credits: 14**

Twelve credits will be evaluated in the third semester and will be carried over in this semester for final evaluation of project work.

Course Description

Title of the course: Advanced Steel Design
Course Code: 18M14CE531
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To gain the technical expertise in the design of complex steel structures.

Learning Outcome:
The student will be able to design steel structures such as towers, tanks and industrial buildings.

Course Content:

- Plastic Design
- Plastic Analysis of Frames
- Industrial Frames
- Transmission Line Towers
- Steel Tanks and Stacks
- Elevated Circular Tanks
- Aluminum Structures; Residual Stresses

Text Books / References

1. Advanced Steel Structures Design by Segui, William T
2. Advanced Analysis in Steel Frame Design by Andrea E. Surovek,
3. Advanced Steel Structures by Wei Lu Pentti Mäkeläinen
4. Advanced Analysis and Design for Fire Safety of Steel Structures, Series: Advanced Topics in Science and Technology in China by Li, Guoqiang, Wang, Peijun
5. Advanced Analysis and Design of Steel Frames by Gou-Qiang Li, Jin-Jin Li

Course Description

Title of the course: Wind Resistant Design of Structures
Course Code: 18M14CE532
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To understand the fundamental concepts of design of structures subjected to wind loads..

Learning Outcome:
The student will be able to perceive the effects of wind on the design of structures.

Course Content:

- Short and long term statistics of wind
- Wind mechanics; effect of wind on tall structures; buildings, chimneys; Towers
- Wind tunnel testing
- Different codes of practices related to wind
- Application of relevant IS codes to practical design
- Wind gust loading
- Aerodynamics damping
- Aerodynamics instability
- Design wind pressure and pressure coefficients,
- Vortex shedding, gust factors.

Text Books / References:

1. Wind and Earthquake Resistant Buildings: Structural Analysis and Design by Bungale S. Taranath

2. Wind Resistant Design of Bridges by Fujino, Yozo, Kimura, Kichiro, Tanaka, Hiroshi

Course Description

Title of the course: Cable Stayed and Suspension Bridges
Course Code: 18M14CE533
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To study the behavior of cable stayed and suspension bridges.

Learning Outcome:
At the end of the course, the student will be able to analyze and design cable stayed and suspension bridges.

Course Content:

- Structural behavior
- Analysis of a loaded cable
- Cables with ends at different level
- Cable subjected to temperature stresses
- Influence lines for bending moment and shear force-temperature stresses in stiffening girder. Construction and case studies.
- Comparison of cable stayed and suspension bridges.

Text Books / References:

1. Cable Stayed, Supported and Suspension Bridges by P. Dayaratnam, G.P. Garg, R.N. Raghavan

Course Description

Title of the course: Computer Applications in Structural Analysis and Design
Course Code: 18M14CE534
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To develop skills related to computer applications for the analysis and design of structures.

Learning Outcome:
At the end of the course, the student will be able to use specific software for the analysis and design of structures and obtain satisfactory the results.

Course Content:

- Engineering design principles
- System and Software Requirements Analysis
- Design and Implementation of Software
- Object oriented design
- Software Quality Assurance
- Application Software in Civil Engineering STAAD III, STAAD PRO, ATENA, ADINA, ANSYS, DIANA

Text Books / References:

1. Computer Aided Optimum Design Of Structures By: C. A. Brebbia, S. Hernandez, A.J. Kassab
2. Computer Analysis & Reinforced Concrete Design Of Beams By Fady R. S. Rostom

Course Description

Title of the course: Masonry Structures
Course Code: 18M14CE535
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To develop fundamental concepts of construction and behavior of masonry structures.

Learning Outcome:
The student will be able to analyze and design masonry structures.

Course Content:

- Properties of constituents: units
- Masonry bonds and properties
- Stresses in masonry walls
- Behavior Masonry Buildings
- Behavior of masonry infill's in RC frames
- Seismic evaluation and strengthening of masonry buildings: methods

Text Books / References:

1. Manual On Maintenance Engineering: Repair And Maintenance Of Civil Works And Structures By B.S, Nayak (2003)
2. Design of Masonry Structures by A.W. Hendry, B.P. Sinha, S.R. Davies CRC Press, 02-Sep-2003
3. Simplified Design of Masonry Structures by James Ambrose
4. Masonry Structural Design by Richard Klingner

Course Description

Title of the course: Design of Substructures
Course Code: 18M14CE631
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To develop fundamental concepts of Design of Substructures.

Learning Outcome:
The student will be able to analyze and design Substructures.

Course Content:

- Introduction to shallow, mat and deep footings
- Design of strap, Raft and combined footings
- Design of pile footings
- Soil-Structure interaction
- Evaluating the liquefaction potential
- Mitigation of Liquefaction Hazard by Structural Design

Text Books / References:

1. Analysis And Design Of Substructures Limit State Design by Saran, Swami (2006)
2. Analysis And Design Of Substructures, 2/E (Google eBook) by Saran Oxford and IBH Publishing, 01-Jan-2006 - 872 pages
3. Analysis and Design of Substructures: Limit State Design 2nd Edition by Swami Saran Publisher: Oxford & IBH Publishing Co. Pvt Ltd

Course Description

Title of the course: Bridge Engineering
Course Code: 18M14CE632
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To develop fundamental concepts analysis and design of bridge structures.

Learning Outcome:
At the end of the course, the student will be able to explain the components of bridges and analyze and design bridges.

Course Content:

- Components of a bridge
- Investigation of Bridges
- Standard Specifications
- Reinforced Concrete Bridges
- Types of piers and abutments
- Various types of expansion bearing and fixed bearings
- Introduction to construction, inspection and maintenance of bridges.

Text Books / References:

1. Bridge Engineering by S, Ponnuswamy (1999,2012)
2. Design Of Bridge Structures by Jagadeesh, T.R.
3. Essentials Of Bridge Engineering by D.Johnson, Victor (2012)
4. Design Of Modern Steel Railway Bridges by John F. Unsworth (2010)
5. Standard Specifications And Code Of Practice For Road Bridges Section V Steel Road Bridges (Limit State Method) by Indian Roads Congress (2010)

Course Description

Title of the course: Nanotechnology and Concrete
Course Code: 18M14CE633
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To introduce the student with the advancements in concrete technology.

Learning Outcome:
At the end of the course, the student will be able to appreciate the applications of nanotechnology in civil engineering.

Course Content:

- Concrete durability
- High performance concrete
- Nanostructure materials
- Nanotechnology
- Possible performance and fabrication techniques.
- Sustainable development
- Transportation infrastructure**.**

Text Books / References:

1. Concrete: Microstructure, Properties, And Materials P. Kumar Mehta, J. M. Monteiro Properties Of Concrete, 4/E Neville
2. Nanotechnology Of Concrete: Recent Developments And Future Perspectives Konstantin Sobolev, Surendra P. Shah, ACI Committee 236, Material Science Of Concrete American Concrete Institute, 2008
3. Springer Handbook Of Nanotechnology By Bharat Bhushan
4. Nanotechnology: Fundamentals And Applications By Karkare.
5. Nanotechnology In Construction Peter Bartos, Royal Societ
6. Advanced Nanotechnology By Shiv Kant Prasad
7. Handbook Of Nanostructured Materials Andnanotechnology Vol. 4 By Hari. Singh, Nalwa(Editor) (2000)
8. Nanotechnology: A Gentle Introduction To The Next Big Idea By Mark,Ratner (2003)
9. Nanotechnology: Fundamentals And Applications By Manasi, Karkare (2008)

Course Description

Title of the course: Soil Dynamics and Machine Foundations
Course Code: 18M14CE634
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: None

Objective: To develop fundamental concepts of soil behavior under dynamic conditions.

Learning Outcome:
At the end of the course, the student will be able design machine foundations with reference to the dynamic properties of soil.

Course Content:

- Nature of dynamic loads
- Theory of vibrations
- Indian Standard Code of Practice
- Dynamic analysis for vertical loads
- Laboratory studies on liquefaction
- Criteria for a satisfactory machine foundation
- Design procedure for Block Foundation
- Vibration Isolation & Screening of Waves.

TEXT BOOKS / REFERENCES:
1. Soil Dynamics And Machine Foundations 2nd Edition By Swami Saran
2. Foundation For Machines, By S. Prakesh & V.K Puri, Mcgraw-Hill 1993
3. Hand Book Of Machine Foundations, By Srinivasulu, P & Vaidyanathan Mcgraw-Hill, 1996