

COIMBATORE INSTITUTE OF TECHNOLOGY

(Government Aided Autonomous Institution Affiliated to Anna University, Chennai)

COIMBATORE - 641 014, TAMILNADU, INDIA

DIAMOND JUBILEE

(1956 - 2016)



DEPARTMENT OF CIVIL ENGINEERING

M.E. STRUCTURAL ENGINEERING

Curriculum and Syllabi

Under Choice Based Credit System

(For the students admitted during 2019 - 2020 and onwards)

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COIMBATORE INSTITUTE OF TECHNOLOGY

(Government Aided Autonomous Institution Affiliated to Anna University, Chennai)

VISION AND MISSION OF THE INSTITUTE

VISION

The Institute strives to inculcate a sound knowledge in engineering along with realized social responsibilities to enable its students to combat the current and impending challenges faced by our country and to extend their expertise to the global arena.

MISSION

The mission of CIT is to impart high quality education and training to its students to make them World-Class Engineers with a foresight to the changes and problems, and pioneers to offer innovative solutions to benefit the nation and the world at large.

**DEPARTMENT OF CIVIL ENGINEERING
COIMBATORE INSTITUTE OF TECHNOLOGY**

VISION AND MISSION OF THE DEPARTMENT OF CIVIL ENGINEERING

VISION

To provide quality education in Civil Engineering and to become a state-of-the-art source of world-class Civil Engineers and Researchers.

MISSION

To impart quality education with necessary skills to meet the requirements of the industry and to perform with professional ethics and an attitude for innovation in Civil Engineering through state-of-the-art technology.

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DEPARTMENT OF CIVIL ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The following Programme Educational Objectives are designed based on the department mission.

- PEO1** The graduates of this programme will have a strong base in analytical and technical knowledge to adapt them to work in interdisciplinary projects involving formulation, analysis, design and to meet challenges in real Civil Engineering projects.
- PEO2** The graduates of this programme will have the skill to involve themselves in basic and applied research and development activities in core areas by effectively handling complex Structural Engineering and inter-disciplinary projects.
- PEO3** The graduates of this programme will possess an attitude to update themselves in modern tools of structural analysis and design techniques in-line with global work environment.

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DEPARTMENT OF CIVIL ENGINEERING

PROGRAMME OUTCOMES

The Structural Engineering graduates after the completion of the programme will have the following capabilities:

- PO1** : An ability to independently carry out research / investigation and development work to solve practical problems
- PO2** : An ability to write and present a substantial technical report / documents
- PO3** : Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
- PO4** : Use different tools for Analysis and Design Structural Engineering domain.
- PO5** : Design and conduct experiments, analyze and interpret data, for development of simulation experiments.
- PO6** : Function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility.

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DEPARTMENT OF CIVIL ENGINEERING

COURSES OF STUDY

For the students admitted during 2019 - 2020 and onwards

Under Choice Based Credit System

Name of the degree : M.E. (Full-Time)

Specialization : M.E. Structural Engineering

Semester I

Course Code	Course Name	L	T	P	C	CY
19MCE11	Applied Mathematics	4	0	0	4	FC
19MCE12	Applied Elasticity and Plasticity	3	0	0	3	PC
19MCE13	Matrix Methods of Structural Analysis	3	0	0	3	PC
19MCE14	Advanced Reinforced Concrete Structures	3	0	0	3	PC
19MCE15	Advanced Steel Structures	3	0	0	3	PC
	Program Elective - I	3	0	0	3	PE
19MCE16	Computer Applications Laboratory	0	0	4	2	PC
	TOTAL CREDITS				21	

Semester II

Course Code	Course Name	L	T	P	C	CY
19MCE21	Structural Dynamics	3	0	0	3	PC
19MCE22	Finite Element Method	3	0	0	3	PC
19MCE23	Design of Foundation Structures	3	0	0	3	PC
	Program Elective - II	3	0	0	3	PE
	Program Elective - III	3	0	0	3	PE
	Program Elective - IV	3	0	0	3	PE
19MCE24	Advanced Structural Engineering Laboratory	0	0	4	2	PC
	TOTAL CREDITS				20	

Semester III

Course Code	Course Name	L	T	P	C	CY
	Program Elective - V	3	0	0	3	PE
	Program Elective - VI	3	0	0	3	PE
	Open Elective / Professional Elective - VII	3	0	0	3	OE
	One Credit Course	1	0	0	1	EEC
19MCE31	Practical Training	0	0	0	2	EEC
	TOTAL CREDITS				12	

Semester IV

Course Code	Course Name	L	T	P	C	CY
19MCE41	Project Work and Viva Voce	0	0	36	18	EEC
	TOTAL CREDITS				18	

Total number of credits : 71

LIST OF OPEN ELECTIVES

Course Code	Course Name	L	T	P	C	CY
19MCEOE01	Disaster Management	3	0	0	3	OE
19MCEOE02	Energy Efficient Building	3	0	0	3	OE
19MCMOE01	Landscaping and Architecture	3	0	0	3	OE
19MENOE01	Climate Change and Adaptation	3	0	0	3	OE

LIST OF ONE CREDIT COURSES

Course Code	Course Name	L	T	P	C	CY
19MCOC01	Practical Geotechnical Engineering	1	0	0	1	EEC
19MCOC02	Green Buildings	1	0	0	1	EEC
19MCOC03	Geoinformatics Laboratory	1	0	0	1	EEC
19MCOC04	Sustainable Architecture	1	0	0	1	EEC

LIST OF PROGRAM ELECTIVES

Course Code	Course Name	L	T	P	C	CY
19MCEE01	Stability of Structures	3	0	0	3	PE
19MCEE02	Advanced Concrete Technology	3	0	0	3	PE
19MCEE03	Experimental Techniques and Instrumentation	3	0	0	3	PE
19MCEE04	Earthquake Resistant Design of Structures	3	0	0	3	PE
19MCEE05	Structural Optimization	3	0	0	3	PE
19MCEE06	Health Monitoring of Structures	3	0	0	3	PE
19MCEE07	Prestressed Concrete Structures	3	0	0	3	PE
19MCEE08	Corrosion of Steel in Concrete Structures	3	0	0	3	PE
19MCEE09	Theory of Plates	3	0	0	3	PE
19MCEE10	Design of Concrete Bridges	3	0	0	3	PE
19MCEE11	Design of Steel Concrete Composite Structures	3	0	0	3	PE
19MCEE12	Offshore Structures	3	0	0	3	PE
19MCEE13	Shell Structures	3	0	0	3	PE
19MCEE14	Design of Tall Buildings	3	0	0	3	PE
19MCEE15	Wind and Cyclone Effects on Structures	3	0	0	3	PE
19MCEE16	Soil Structure Interaction	3	0	0	3	PE
19MCEE17	Mechanics of Composite Materials	3	0	0	3	PE
19MCEE18	Prefabricated Structures	3	0	0	3	PE

L : Lecture

T : Tutorial

P : Practical

C : Credits

CY : Category

PC : Program Core

PE : Program Elective

EEC : Employability Enhancement Course

OE : Open elective

OC : One credit course

19MCE11 - APPLIED MATHEMATICS

L	T	P	C
4	0	0	4

ASSESSMENT : THEORY

CATEGORY : Professional Core

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

CO1 : Use the knowledge of Laplace and Fourier transforms to solve one dimensional wave and heat equations

CO2 : Assimilate the ideas of Fourier transforms to solve the elliptic partial differential equations

CO3 : Apply the knowledge of extremising functionals

CO4 : Understand probability theory and apply the knowledge of standard distributions

CO5 : Comprehend two dimensional random variables and employ the principles of correlation

ONE DIMENSIONAL WAVE AND HEAT EQUATIONS

Laplace transform methods for one-dimensional wave equation - Displacements in a long string - longitudinal vibration of an elastic bar - Fourier transform methods for one-dimensional heat conduction problems in infinite and semi-infinite rods. (12)

ELLIPTIC EQUATION

Laplace equation - Properties of harmonic functions - Solution of Laplace's equation by means of Fourier transforms in a half plane, in an infinite strip and in a semi-infinite strip - Solution of Poisson equation by Fourier transforms method. (12)

CALCULUS OF VARIATIONS

Concept of variation and its properties - Euler's equation - Functional dependant on first and higher order derivatives - Functional dependant on functions of several independent variables - Variational problems with moving boundaries - Direct methods - Ritz and Kantorovich methods. (12)

PROBABILITY AND DISTRIBUTIONS

Probability - Conditional probability - Baye's theorem - One Dimensional Discrete Random Variable - Probability Mass Function - Probability Distribution Function - One Dimensional Continuous Random Variable - Probability Density Function - Moment Generating Function - Distribution: Binomial, Poisson, Normal and Exponential (12)

TWO DIMENSIONAL RANDOM VARIABLES

Joint distributions: Discrete and Continuous - Marginal Distribution Function - Conditional distribution - Covariance - Correlation Coefficient. (12)

TOTAL : 60

TEXT BOOKS

1. Sankara Rao.K, "Introduction to Partial Differential Equations", Prentice Hall of India Pvt. Ltd., New Delhi, 2011.
2. Papoulis and S. Unnikrishnan Pillai, "Probability, Random Variables and Stochastic Processes", 4th Edition, McGraw Hill, 2002.

REFERENCES

1. Gupta.A.S, "Calculus of Variations with Applications", Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
2. Andrews.L.C and Shivamoggi.B.K, "Integral Transforms for Engineers", Prentice Hall of India Pvt. Ltd., New Delhi, 2003.
3. Sheldon Ross, "A First Course in Probability", Pearson Education; 9th Edition, 2019.

19MCE12 - APPLIED ELASTICITY AND PLASTICITY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Core

COURSE OUTCOMES

At the end of the course the student will be able to:

CO1 : Apprehend the principles of elasticity, plasticity and fracture mechanics

CO2 : Solve Engineering problems related to thick cylinders, shafts and curved bars

CO3 : Use computer programming in solving problems related to plasticity and elasticity

ANALYSIS OF STRESS AND STRAIN

Elasticity approach - Definition and notation of stress - components of stress and strain - generalized Hooke's Law - Principal stresses and strains for three dimensional element Equations of equilibrium and compatibility conditions for 3-D problems in Cartesian and cylindrical co-ordinates - Transformation of stresses and strains - Boundary conditions. (8)

TWO DIMENSIONAL PROBLEMS IN CARTESIAN COORDINATES

Plane stress and plane strain problems with practical examples. Equations of equilibrium and compatibility conditions in Cartesian coordinates - Airy's stress function, bending of a cantilever of narrow rectangular cross-section under the action of couples, knife edge and varying distributed loads, bending of simply supported beams by uniform and uniformly varying loads. (8)

TWO DIMENSIONAL PROBLEMS IN POLAR COORDINATES

Equations of equilibrium and compatibility conditions in polar coordinates - axisymmetrical problems; thick cylinder under uniform pressure, shrink and force fits, circular arc beams subjected to pure bending - bending of curved bar - Stress concentrations due to circular hole in plate - effect of concentrated and uniformly distributed load on straight boundary of semi-infinite plates, stresses in circular disc subjected to diametrically opposite concentrated loads. (8)

TORSION

Torsion of various shaped bars, pure torsion of prismatic bars, prandtl's membrane analogy, strain energy and finite difference method, torsion of rolled profiles, stress concentrations at re-entrant corners, torsion of thin walled tubes and hollow shafts. Plastic torsion - Elastic - plastic torsion analysis - circular section - sand heap analogy. (8)

THEORY OF PLASTICITY

Stress - strain diagram - Ideal plastic body - Illustration of plastic Analysis - Yield criteria - Rankine's theory - St.Venant's theory - Tresca Criterion - Beltrami's theory - Von Mises criterion - Mohr's theory of yielding - Yield surface - Flow rule (stress - strain relation for perfectly plastic flow)- Prandtl Reuss equality - plastic work - stress - strain relation based on Tresca - plastic potential - uniqueness of a stress distribution - strain hardening - sand heap analogy. (8)

INTRODUCTION TO FRACTURE MECHANICS

Failure criteria and fracture toughness - stress intensity factor. (5)

TOTAL : 45

TEXT BOOKS

1. Ernest E. Sechler, "Elasticity Engineering", Dover Publications, New York, 1968.
2. Chen.W.F. and Henry.D.J, "Plasticity for Structural Engineers", Cengage Learning India Pvt. Ltd., , New Delhi, 2008.

REFERENCES

1. Timoshenko and Goodier.J.N, "Theory of Elasticity", Mc Graw Hill book co, New York, 1988.
2. Sadhu Singh, "Theory of Plasticity", Khanna Publications, New Delhi, 2000.
3. A.C.Ugural and S.K.Fenster, "Advanced Strength and Applied Elasticity", Edward Arnold Publishers Ltd., UK, 2003.
4. David Broek, "Elementary engineering fracture mechanics", Springer; 4th Edition, 2005

19MCE13 - MATRIX METHODS OF STRUCTURAL ANALYSIS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Core

COURSE OUTCOMES

At the end of the course the student will be able to

CO1 : Gain knowledge on basic concepts and characteristics of structures

CO2 : Apprehend the knowledge of analysis of structures using matrix methods

CO3 : Apply energy concepts to analyse the structures

CO4 : Apply matrix stiffness methods to solve problems in beams, frames & trusses

CO5 : Apply matrix flexibility methods to solve problems in beams, frames & trusses

BASIC CONCEPTS

Indeterminacy - Static, Kinematic - Generalized measurements - Degrees of Freedom - Constrained measurements - Behavior of Structures - Principle of Superposition - Equilibrium, Compatibility and Force displacement relations. (9)

STIFFNESS AND FLEXIBILITY

Stiffness and Flexibility matrices in Single, two and n-coordinates; Structures with Constrained measurements; Stiffness and flexibility coefficients - Basic Stiffness and basic Flexibility method applied to spring models. (9)

ENERGY CONCEPTS AND TRANSFORMATION OF INFORMATION

Strain energy; Stiffness and flexibility matrices for strain energy - Betti's law and its applications - Properties of stiffness and flexibility matrices - Contra gradient law- Co-ordinate transformations - Transformation of element matrices to structure matrices - orthogonal transformations. (9)

STIFFNESS METHOD

Development of the method - Structure stiffness matrix for beams, frames and trusses using displacement transformation matrix and coordinate transformation matrix - Internal forces due to thermal expansion and lack of fit - Direct stiffness methods- Static condensation - transfer matrix method - symmetry and anti-symmetry of structures - reanalysis technique -Analysis by substructures using the stiffness method. (9)

FLEXIBILITY METHOD

Flexibility Method applied to statically determinate and indeterminate structures; Choice of redundant; Primary structure- General formulation- Structure flexibility matrix using force transformation matrix - Internal forces due to thermal expansion and lack of fit. (9)

TOTAL : 45

TEXT BOOKS

1. Devdas Menon, "Advanced Structural Analysis", Narosa Publishing House, Daryaganj, New Delhi, 2009.
2. Moshe.F.Rubinstein, "Matrix Computer Analysis of Structures", Prentice Hall, 1986

REFERENCES

1. Pandit.G.S and Gupta.S.P, "Structural Analysis - a Matrix Approach", Tata Mc Graw Hill Publishing Company, 2008.
2. Rajasekaran.S and Sankarasubramanian.G, "Computational Structural Mechanics", Prentice Hall of India, New Delhi, 2006.
3. Weaver.J.R and Gere.J.M, "Matrix Analysis of Framed Structures", CBS Publishers, New Delhi, 2004.
4. Fleming.J.F, "Computer analysis of Structural Systems", Mcgraw Hill Book Co., 1989.

19MCE14 - ADVANCED REINFORCED CONCRETE STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Core

COURSE OUTCOMES

On completion of the course the students will be able to

CO1 : Acquire knowledge on strength and serviceability of reinforced concrete elements.

CO2 : Design special Reinforced Concrete elements such as deep beams, corbels, shear wall and grid floors.

CO3 : Apprehend the knowledge about Dead load, imposed load and wind load effects on structures

DESIGN OF RC ELEMENTS AND SERVICEABILITY CRITERIA

Review of limit state design of slabs, beams and columns according to IS codes. Calculation of Deflection and crack width for beams and slabs as per IS codes. (8)

DESIGN OF SPECIAL RC ELEMENTS

Design of RC walls - Ordinary and shear walls - Design of corbels - Design of deep beams - Detailing. (10)

FLAT SLABS AND GRID FLOOR

Design of flat slabs and flat plates - Limitations - Design of voided slabs - Analysis and design of Grid floors - Detailing. (10)

INELASTIC BEHAVIOUR OF CONCRETE BEAMS

Moment - Curvature relation of Reinforced Concrete Sections - Moment redistribution - Advantages and Disadvantages of Moment Redistribution (9)

DESIGN LOADS OTHER THAN EARTHQUAKE LOADS

Dead Loads - Imposed Loads (IS 875 Part 2) - Loads due to Imposed Deformations - General Theory of Wind Effects on Structures. (8)

TOTAL : 45

TEXT BOOKS

1. *P.C.Vargheese, "Advanced Reinforced Concrete Design", 2nd Edition, Prentice hall of India, New Delhi, 2009.*
2. *Park.R and Paulay.T, "Reinforced Concrete Structures", John Wiley and Sons, New Delhi, 1988.*
3. *Unnikrishnan Pillai and Devdos Menon, "Reinforced Concrete design", Tata McGraw Hill Publishers Company Ltd., New Delhi, 2009.*

REFERENCES

1. *Sinha.N.C and Roy.S.K, "Fundamentals of Reinforced Concrete", S.Chand and Company, New Delhi, 2003.*
2. *Dayaratnam.P, "Design of Reinforced Concrete Structures", Oxford & OBH Publishing Co. Pvt. Ltd., Calcutta, 2005.*
3. *P.Purushothaman, "Reinforced Concrete Structural Elements - Behaviour Analysis and Design", Tata McGraw Hill Publishing Company Limited, New Delhi, 1986.*
4. *Gambhir, "Design of Reinforced Concrete Structures", PHI Learning Ltd., New Delhi, 2008.*
5. *IS 456-2000 : Plain and Reinforced Concrete - Code of Practice.*
6. *IS 875 : Part 1 : Part 1 Dead loads - Unit weights of building material and stored materials (Incorporating IS:1911-1967).*

15MCE15 - ADVANCED STEEL STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Core

COURSE OUTCOMES

Students who successfully complete this course will be able to

- CO1 : Employ the code of practice for design of steel structural members.*
- CO2 : Analyze and design various elements of industrial steel buildings as per Indian standards using conventional and special sections*
- CO3 : Analyse the various steel lateral load resisting systems and their components.*
- CO4 : Different types of loads, detailed calculations and their effect on industrial and multi-story structures*
- CO5 : Analysis and design of advanced steel structural elements and their connections as per national code of practices for light gauge steel structures.*

LIMIT STATE DESIGN

Introduction to Limit state design -Ultimate and serviceability limit states - Design of tension, compression members - Design of beams - unstiffened and stiffened seated connections - framed connection - moment resistant connection - Tee stub and - end plate - Bracket connections (9)

INDUSTRIAL BUILDINGS

Types on loads on structures - Analysis and design of Industrial buildings and bents - sway and non sway frames - Analysis and design of gable frames -Design of Purlins, louver rails, gable column and wind girder. (9)

STEEL TOWERS

Transmission line towers - Micro Wave Towers - Loads on towers - Shape, Sag and Tension in Uniformly loaded conductors - Analysis of towers - Design of member in towers - Design of tower foundations. Design and Analysis of Steel Towers using Software packages. (9)

SPECIAL STRUCTURES

Analysis and design of trusses - forces in members - Design of self supporting chimney and guyed steel chimney- Stress due to wind and earthquake forces - Gust factor method - Design of foundation. (9)

LIGHT GAUGE STEEL STRUCTURES

Introduction to Direct Strength Method - Types of cross sections - Local Buckling and lateral buckling - Design of Compression and Tension members - Beams - Deflection of Beams - Combined stresses and connections. (9)

Total : 45

TEXT BOOKS

1. Subramanian.N, "Design of Steel Structures", Oxford University press, 2018.
2. Duggal, "Limit state design of Steel structures", Tata McGraw Hill, New Delhi, 2014.
3. Ramachandra V.Gehlot, "Design of Steel Structures" Vol.2, Scientific Publishers, Jodhpur. 2016.

REFERENCES

1. Dayaratnam, 'Design of steel structure', S.Chand & Co., Newdelhi, 2010.
2. IS 800 -2007, Indian Standard Code of practice for General Construction in Steel.
3. IS: 6533 Code of Practice for Design and Construction of steel chimney.
4. SP 6 : Part 1 : 1964 Handbook for structural engineers - Structural steel sections.
5. IS 802 : Part 1 : Sec 1 : 1995 Code of practice for use of structural steel in overhead transmission line towers, Part 1 Materials and Loads and permissible stresses Section 1 Materials and Loads
6. IS 6533 : Part 2 : 1989 Code of practice for design and construction of steel chimneys Part 2 Structural aspects.

19MCE16 - COMPUTER APPLICATIONS LABORATORY

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

CATEGORY : Professional Core

COURSE OUTCOME

On completion of the lab the student will be able to:

C01 : *Get hands on experience for analysis and design of reinforced concrete and steel structures using softwares*

C02 : *Perceive limitations of softwares for linear and non-linear systems*

1. Design of RCC and Steel elements by programs in Excel
2. Structural modeling - Analysis for vertical and horizontal loading
3. Buckling of columns and plates
4. Free and Forced vibration problems
5. Plane Stress and Strain problems
6. Non-Linear Finite Element Analysis

TOTAL : 30

REFERENCES

1. *STAAD.Pro - manual volume 1 and 2, Bentley Systems India, Private Limited, New Delhi.*
2. *ETABS - Integrated Building Design Software, CSI, Berkeley, California.*
3. *SAP 2000 - Linear and Non-Linear Static and Dynamic Analysis and Design, CSI, Berkeley, California.*
4. *SAFE - Analysis and Design of beams and slabs*

19MCE21 - STRUCTURAL DYNAMICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Core

COURSE OUTCOMES

After completion of the course the students will have the knowledge of

CO1 : vibration analysis of systems/structures with single degrees of freedom

CO2 : Vibration analysis of systems/structures with multiple degrees of freedom

CO3 : the methods of damping and continuous systems.

PRINCIPLES OF VIBRATION ANALYSIS

Mathematical models of single degree of freedom systems - Free and forced vibration of SDOF systems, Response of SDOF to special forms of excitation, Effect of damping, Transmissibility. (9)

DYNAMIC RESPONSE OF TWO DEGREE OF FREEDOM SYSTEMS

Mathematical models of two degree of freedom systems, Free and forced vibrations of two degree of freedom systems, Normal modes of vibration, Applications. (9)

DYNAMIC RESPONSE OF MULTI-DEGREE OF FREEDOM SYSTEMS

Mathematical models of Multi-degree of freedom systems, Orthogonality of normal modes, Free and forced vibrations of multi degree of freedom systems, Mode superposition technique, Applications. (9)

DYNAMIC RESPONSE OF CONTINUOUS SYSTEMS

Mathematical models of continuous systems, Free and forced vibration of continuous systems, Rayleigh - Ritz method - Formulation using Conservation of Energy - Formulation using Virtual Work, Applications. (9)

DIRECT INTEGRATION METHODS FOR DYNAMIC RESPONSE

Damping in MDOF systems, Nonlinear MDOF systems, Step-by-step numerical integration algorithms, Substructure technique. (9)

TOTAL : 45

TEXT BOOKS

1. Craig.R.R, "Structural Dynamics - An Introduction to Computer Methods", John Wiley & Sons,1995.
2. Clough.R.W and Penzien, "Dynamics of Structures", McGraw Hill Book Company, 2015.
2. Anil K Chopra, "Dynamics of Structures - Theory and Applications to Earth Quake Engineering", Prentice Hall, New Delhi, 2007.

REFERENCES

1. Mario Paz, "Structural Dynamics - Theory of Computation", Kluwer Academic Publication, 2004.
2. Smith.J.W, "Vibration of Structures", Chapman and Hall, 2004.
3. Singiresu S. Rao, "Mechanical Vibrations", Pearson Education Inc., New Delhi, 2004.
4. "Fundamentals of Structural Dynamics", Textbook by Roy R. Craig, Jr., Andrew J. Kurdila, John Wiley & Sons, 2006

5. *"Basic Structural Dynamics", Book by Farzad Naeim and James C. Anderson, John Wiley & Sons, 2012*
6. *Sanguthevar Rajasekaran, "Structural Dynamics of Earthquake Engineering: Theory and Application Using Mathematica and Matlab", Woodhead Publishing, 2009*
7. *NPTL online resources*
<https://nptl.ab.in/courses/105/101/105101006/>
<https://nptl.ac.in/courses/105/106/105106151/>
<https://nptl.ac.in/courses/105/104/105104189/>

19MCE22 - FINITE ELEMENT METHOD

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Core

COURSE OUTCOMES

On completion of the course the students will be able to

CO1 : Apprehend the knowledge of basis of Finite Element Method

CO2 : Formulate element problems for structural engineering problems

CO3 : Apply Finite Element Method for common structural engineering problems

INTRODUCTION AND BASICS

General description - Basic element shapes - Discretization process - Node numbering - Mesh generation - Energy principles - Variational methods - Raleigh Ritz method - Galerkin Method - Least squares approach. (7)

ANALYSIS OF TRUSSES

Stiffness matrix for an axial element - axial stiffness - transformation of vectors - plane truss analysis - solution for axially loaded problems (7)

ANALYSIS OF BEAMS AND FRAMES

Stiffness matrix for beam element - transformation of vectors - plane frame analysis - beam stiffness - solution for beam problems - Two Dimensional beam element - rigid plane frames - inclined or skewed supports - analysis of grids. (8)

PLANE STRESS AND PLANE STRAIN PROBLEMS

Basic concepts of plane stress and plane strain - derivation of stiffness matrix for constant - strain, linear strain triangular elements - rectangular elements - iso parametric elements - Lagrange and Serendipity elements - Numerical Integration static condensation - axisymmetric elements (8)

PLATE BENDING PROBLEMS

Basic concepts - derivation of element stiffness matrix - four noded, eight noded rectangular and isoparametric elements - shear deformation in plates - computer applications. (7)

OTHER APPLICATIONS

Three dimensional stress analysis - Torsion problems - Free vibration analysis - Buckling problems - Heat transfer - Fluid flow problems - Thermal analysis - Finite element packages. (8)

TOTAL : 45

TEXT BOOK

1. Daryl L. Logan, "Finite Element Method", Thomson Canada Ltd., India Edition, 2016.

REFERENCES

1. Singiresu.S.Rao, "The Finite Element Method in Engineering", Butterworth-Heinemann, India Edition, 2001.
2. Krishnamoorthy.C.S, "Finite Element Analysis", Tata Mc Graw Hill Publishing Co., New Delhi, 2008.
3. Rajasekaran.S, "Finite Element Analysis in Engineering Design", S.Chand and Company Ltd., 2003.
4. Larry.J.Segerlind, "Applied Finite Element Analysis", John Wiley and Sons, New York, 2010.
5. Robert.D.Cook, David.S.Malkus, "Concepts and Applications of Finite Element Analysis", John Wiley and Sons, India Edition, 2007.

19MCE23 - DESIGN OF FOUNDATION STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Core

COURSE OUTCOME

On completion of the course the students will be able to

CO1 : Apprehend the concepts of design of foundation structures

CO2 : Acquire knowledge about various Indian Standards for shallow and deep foundations

CO3 : Solve practical geotechnical problems and special problems

SHALLOW FOUNDATIONS

Bearing capacity and settlement - Spread footings - contact pressure - Structural design of individual footings, pedestals, combined footings (Rectangular and trapezoidal), Strap footings - Eccentrically loaded footings - Mat foundations. (9)

PILE FOUNDATIONS

Types of piles - Static and dynamic pile formula - Pile load tests - Negative skin friction - Pile groups - Efficiency of pile group - Settlement of piles - Batter piles - Analysis of pile groups - Structural design of piles and pile caps. (9)

RETAINING STRUCTURES

Stability of walls - Design of cantilever and counter fort walls - design of gravity walls - Cantilever sheet pile walls - Anchored bulkhead - Cofferdams - Braced cofferdams - Stability of bottom excavation - Anchorages - Walls and Tie rods. (9)

WELL FOUNDATIONS

Types of wells or caissons - components - Shapes of wells - Forces acting - Construction and sinking - Design of drilled caissons. (9)

MACHINE FOUNDATIONS AND FOUNDATIONS ON EXPANSIVE SOILS

Introduction to vibrations - Design criteria for satisfactory action of a machine foundation - Soil spring constants - Determination - Types of foundations - Design of Block foundation. Identification of swelling - Field conditions - consequences of swelling - Design. (9)

TOTAL : 45

REFERENCES

1. Joseph E. Bowles, "Foundations Analysis and Design", McGraw Hill Co., 2001.
2. Teng, Wayne C, "Foundation Design", Published by Prentice hall of India, New Delhi, 1965
3. Gopal Ranjan and Rao ASR, "Basic and Applied soil Mechanics", New Age International Publishers, 2004.
4. Gulhati & Datta, " Geotechnical Engineering" ,Tata McGraw Hill, New Delhi,2005
5. Sam & Das, "Theory and Practice of Foundation Design", Prentice hall of India, New Delhi, 2006

19MCE24 - ADVANCED STRUCTURAL ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

ASSESSMENT : PRACTICAL

CATEGORY : Professional Core

COURSE OUTCOMES

On completion of the course the students will be able to:

CO1 : Design a concrete mix and evaluate the Strength of the Concrete

CO2 : Cast and test the RC beam for flexure, shear and the RC column for axial load

CO3 : Perform static cyclic load testing of Steel frame and analyse the results

CO4 : Determine the strength and quality of concrete using Schmidt Rebound Hammer and Ultrasonic Pulse Velocity Tester

CO5 : Perform Dynamic testing of cantilever steel beam and determine the damping coefficients

LIST OF EXPERIMENTS FOR ADVANCED STRUCTURAL ENGINEERING LABORATORY

S.No.	Name of the Experiment
I	Study of Equipment & Mix Design
1	Study of Instruments used for measuring Forces, Deflections, strains and vibrations
2	Design of concrete mix as per IS 10262 and ACI 211.1-91
II	Tests on Fresh Concrete
3	Slump Test, Compaction Factor Test
III	Tests on RC Beams
4	Casting and testing of simply supported reinforced concrete beam for flexure and shear
IV	Tests on RC Column
5	Casting and Testing of Reinforced Concrete column
V	Tests on Steel Beam
6	Testing of Simply Supported Steel beam for flexure
VI	Test on Steel Frame
7	Static cyclic testing of single bay two storied steel frames
VII	Tests on Hardened Concrete and Durability Tests
8	Compressive Strength, Split Tensile Strength and flexural Strength of concrete
9	Rapid Chloride Penetration Test, Half-cell Potential Test and Rebar Locator
VIII	Non - Destructive Testing
10	Ultrasonic Pulse Velocity Test
11	Rebound Hammer Test
12	Winsor Pin Test
13	Core Cutting Test
IX	Testing of cantilever steel beam under dynamic loading
14	To determine the damping coefficients from free and forced vibrations

TOTAL : 30

REFERENCES

1. T P Ganesan, "Model Analysis of Structures", University Press India Private Limited, Hyderabad , 2013
2. IS 10262: 2019 Recommended guidelines for concrete mix design.
3. IS 456- 2000 Indian Standard Code of Practice for Plain and Reinforced Concrete, BIS, New Delhi.
4. ACI: 211.1 - 91 Standard Practice for selecting Proportions for Normal, Heavy weight and Mass concrete.
5. "Guidebook on Non-Destructive Testing of Concrete Structures", International Atomic Energy Agency, Vienna, 2002
6. Santhakumar A R "Concrete Technology", Oxford Higher Education, New Delhi, 2011
7. Neville.A.M., "Properties of Concrete", ELBS, 2011.
8. Shetty. M. S, "Concrete Technology", S. Chand and Company, New Delhi, 2010
9. Krishnasamy K.T., "Concrete Technology", Dhanpat Rai, New Delhi, 2012.
10. 4. Gambhir M.L., "Concrete Technology", Tata McGraw Hill Publishing Company Limited, New Delhi, 2009.

19MCE31 - PRACTICAL TRAINING

L	T	P	C
0	0	0	2

ASSESSMENT : PRACTICAL

CATEGORY : Employability Enhancement Course

COURSE OUTCOME

On completion of the project work students will be able to

- *Apprehend the field / industrial oriented problems in structural engineering, the inter-disciplinary advances and provide solutions to the problems*

The students undergo Inplant training for four weeks period in selected industries / organization with approval of the Head of the Department.

This training makes them to learn trends and technologies in industry.

Learn/doing part of design work in Steel / Concrete / Composite / Prestressed / Prefabricated structures.

The students are expected to submit a report within a stipulated time covering the various technical aspects and the observation made during industry training period.

19MCE41 - PROJECT WORK AND VIVA-VOCE

L	T	P	C
0	0	36	18

ASSESSMENT : PRACTICAL

CATEGORY : Employability Enhancement Course

COURSE OUTCOME

On completion of the project work students will be in a position to

- *Carry out analytical and / or experimental research on a real time and inter disciplinary projects and bring out sustainable solutions*

COURSE CONTENT

Identification of thrust areas

Problem Identification

Scope & Objective of research

Literature survey

Methodology specifying the process / specifications / parameters

List of alternate methodology if available

Justification for the methodology adopted

Time line of activities

Carrying out experimental / theoretical work as per the specified time line of activities

A presentation including all the above along with final results and conclusions

Consolidated report preparation.

19MCEE01 - STABILITY OF STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Core

COURSE OUTCOMES

On completion of the course the students will be able to:

- CO1 : Understand the basic concepts of structural stability.
- CO2 : Execute the different buckling analysis methods for column with various boundary conditions.
- CO3 : Examine the buckling analysis of beam-column and frames with different load conditions.
- CO4 : Acquire knowledge about torsional buckling, flexural buckling and lateral buckling of beams
- CO5 : Apply the different methods to analyze the buckling of thin plates

BASIC CONCEPTS

Static equilibrium - Classification of buckling problems - concept of equilibrium, energy, imperfection and vibration approaches to stability analysis - Eigen value problem- Governing differential equation for columns - Analysis for various boundary conditions - Equilibrium method. (9)

BUCKLING ANALYSIS METHODS (COLUMN)

Approximate methods: Energy methods (Rayleigh Ritz, Galerkins approach) - Numerical methods (Finite difference method - NewMark's method) - Effect of shear on buckling - Beams on elastic foundation. (9)

BEAM COLUMNS

Stability analysis of beam column with concentrated load, distributed load and end couples -Failure of beam columns. Buckling of frames-Modes of buckling-Calculation of critical load in frames. (Moment distribution, Slope deflection and stiffness methods). (9)

TORSIONAL, FLEXURAL AND LATERAL BUCKLING IN BEAMS

Pure torsion- Torsional buckling-Torsional and flexural buckling - Lateral buckling of beams - Narrow rectangular beams - Symmetrical sections - Design simplifications for lateral buckling. (9)

BUCKLING OF PLATES

Buckling of thin plates-Governing differential equation - Analysis by equilibrium & energy approach - Approximate and numerical techniques - Composite plates - Inelastic buckling of plates - Post buckling behavior of plates (9)

TOTAL : 45

TEXT BOOKS

1. Chajes. A, "Principles of Structural Stability Theory", Prentice Hall, Inc., New Jersey, 1974.
2. H.G.Allen & P.S.Bulson, "Background to Buckling", Mc Graw Hill Co., 1980.
3. Timoshenko.S.P and Gere.J.M, "Theory of Elastic Stability", McGraw Hill Company, 2012

REFERENCES

1. Zdeneic P Basanth & Luigi Cedolin, "Stability of Structures", World Scientific Co., Singapore, 2010
2. Iyenger,N.G.R., "Structural stability of columns and plates", Affiliated East West Press Pvt. Ltd., New Delhi, 2007.
3. Ashwini kumar, "Stability theory of structures", Allied Publishers Ltd, New Delhi, 2003.
4. Gambhir, "Stability Analysis and design of structures", Springer, New York, 2004.

19MCEE02 - ADVANCED CONCRETE TECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Core

COURSE OUTCOMES

On completion of the course the students will be able to:

CO1 : Understand the overview of concrete behavior and various NDT Test methods

CO2 : Familiarize about the various admixtures

CO3 : Identify the properties and applications of various types of special concretes

CO4 : Acquire knowledge in concreting under different exposure conditions.

CO5 : Understand the durability properties of concrete.

INTRODUCTION

Concrete -Quasi-brittle nature of concrete- Micro-cracking, crack propagation - stress concentration at openings -Destructive, semi-destructive & Non-destructive testing methodology - Rebound hammer test - Ultrasonic Pulse Velocity (UPV) Test - Penetration resistance test - Pull-out Test - Pull-off Method - Break-off test - Cover Measurement - Half-cell electrical potential method - Introduction to Microscopic Analysis. (9)

CONCRETE ADMIXTURES

Chemical Admixtures- Hydration of chemical admixture, Plasticizers and super Plasticizers and their effect on concrete property in fresh and hardened state, Marsh Cone test for optimum dosage of super plasticizer, retarder, accelerator, Air-entraining admixtures, and new generation super plasticiser.

Mineral Admixture-Fly ash, Silica fume, GGBS and their effect on concrete property in fresh state and hardened state. (9)

SPECIAL CONCRETES

Fibre Reinforced Concrete - High performance concrete - Ultra high strength concrete - Self Compacting Concrete - Polymer Concrete - Sulphur concrete - Geo polymer concrete - Recycled aggregate concrete - Bacterial concrete - Nanoconcrete (9)

CONCRETING UNDER SPECIAL CIRCUMSTANCES

Underground construction - Concreting in marine environment - Underwater construction - Extreme weather concreting (9)

DURABILITY OF CONCRETE

Factors affecting durability - Tests on permeability - water absorption - chemical Attack- Sulphate attack - carbonation - chloride penetration - fire - frost action (9)

TOTAL : 45

TEXT BOOKS

1. Santhakumar.A.R, "Concrete Technology", Oxford University press, New Delhi 2018
2. Gambhir.M.L, "Concrete Technology", Tata McGraw Hill Book Co. Ltd., Delhi, 2014.
3. Neville.A.M, "Properties of Concrete", Pearson Education Ltd., New Delhi, 2013.

REFERENCES

1. Metha.P.K and Montreio.P.J.M, "Concrete Microstructure, Properties and Materials", Prentice Hall, 2005.
2. Gupta.B.L and Amit Gupta, "Concrete Technology", Standard Publishers and Distributers, New Delhi, 2004.
3. Shetty.M.S, "Concrete Technology", S.Chand and Company, New Delhi, 2013
4. IS 456-2000: Plain and Reinforced Concrete - Code of Practice

19MCEE03 - EXPERIMENTAL TECHNIQUES AND INSTRUMENTATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Elective

COURSE OUTCOMES

On completion of the course the students will be able to:

- CO1 : Carry out experiments related to strain measurements*
- CO2 : Analyse and interpret the outputs using vibration measurements*
- CO3 : Carry out experiments related to acoustics and wind measurements*
- CO4 : Assess the damage to the structure due to corrosion and cracks*
- CO5 : Use Non-Destructive Testing to evaluate structural adequacy*

FORCE AND STRAIN MEASUREMENTS

Strain gauges, principles, types, performance and uses. Photo elasticity - principle and applications. Moire Fringe - Hydraulics jacks and pressure gauges - Electronic load cells - Proving Rings - Calibration of Testing Machines - Long term Monitoring - Vibrating wire sensors - fibre optic sensors (9)

VIBRATION MEASUREMENTS

Characteristics of structural vibrations - Linear Variable Differential Transformer (LVDT) - Transducers for velocity and acceleration measurements. Vibration meter - Seismographs - Vibration Analyzer - Display and recording of signals - Cathode Ray Oscilloscope - XY Plotter - Chart plotters- Digital Data Acquisition Systems. (9)

ACOUSTICS AND WIND MEASUREMENTS

Principles of Pressure and Flow measurements - Pressure Transducer - sound level meter - venturimeter and flow meters - wind tunnel and its use in structural analysis- structural modelling - direct and indirect model analysis. (9)

DISTRESS MEASUREMENTS

Diagnosis of distress in structures - crack observation and measurement - Corrosion of reinforcement in concrete - Half cell, construction and use - Damage assessment - controlled blasting for demolition. (9)

NON DESTRUCTIVE TESTING METHODS

Load testing on structures, buildings, bridges and towers - Rebound Hammer - acoustic emission - holography - use of laser for structural testing - Brittle coatings, Ultrasonic testing principles and applications. Advanced NDT methods - Ultrasonic pulse echo, impact echo, impulse radar techniques, GECOR, Ground Penetrating Radar (GPR) (9)

TOTAL : 45

TEXT BOOKS

1. *J.W.Dalley and W.F.Riley, "Experimental Stress Analysis", McGraw Hill Book Company, New York, 1991.*
2. *Sadhu Singh, "Experimental Stress Analysis", Khanna Publishers, New Delhi, 2014.*
3. *L.S.Srinath et.al, "Experimental Stress Analysis", Tata McGraw Hill Co, New Delhi, 1984.*

REFERENCES

1. *D.E.Bray and R.K.Stanley, "Non-Destructive Evaluation", McGraw Hill Publishing Co., New York, 1989.*
2. *Ganesan.T.P, "Model Analysis of Structures", University Press, India, 2000.*
3. *F.K.Garas, J.L.Clarke and G.S.T Armer, "Structural Assessment", Butterworths London, 1987.*
4. *John Turner and Martyn Hill, "Instrumentation for Engineering and Scientists", Oxford University Press, 1999.*
5. *R.S.Sironi, H.C.Radha Krishna, "Mechanical Measurements", New Age International (P) Ltd, 1997.*

19MCEE04 - EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : PROFESSIONAL ELECTIVE

COURSE OUTCOMES

At the end of the course the students will be able to:

- CO1* : Apply concepts of Structural dynamics to find response of free and forced vibration for a given SDOF and MDOF Systems
- CO2* : Evaluate seismic forces for various structures as per Indian standards
- CO3* : Design of RC structures for seismic resistance as per Indian Standards
- CO4* : Apply concepts of repair and rehabilitation to earthquake affected structures to improve the seismic resistance of RC and Masonry Structures

EARTHQUAKE GROUND MOTION

Basic Seismology - General features of Tectonics of Seismic Regions- Earthquake Terminology - Definitions -Earthquake History - Behaviour of Buildings, Dams and Bridges in Past Earthquakes - Seismographs - Accelerographs - Theory of Vibrations - Damped and undamped system - free and forced vibrations - SDOF and MDOF systems (9)

EARTHQUAKE RESPONSE

Earthquake Response to Elastic and Inelastic Buildings - Application to Response Spectrum Theory - Base excited motion - ground motion parameters - Modal response contribution - modal participation factor - response history - spectral analysis - multiple support excitation - earthquake response to continuous systems on rigid base - approximate methods for lateral load analysis - Pushover Analysis. (9)

IS CODE PROVISIONS

Design Criteria - Strength, Deflection, Ductility and Energy Absorption - Cyclic Behaviour of Structures- Criteria for earthquake resistant design of structures as per IS 1893 Part I and II, Construction of Buildings as per IS 4326 - Ductile Detailing of Structures as per IS 13920. (9)

EARTHQUAKE RESISTANT DESIGN OF RC STRUCTURES

Analysis and Design of Frames for Lateral Loads - Capacity Design - Shear Wall - Design of Rectangular and Flanged Shear Walls - Ductile Detailing of Frames for Earthquake Forces - Strengthening of Existing Buildings - Retrofitting and Rehabilitation. Analysis and Design of Buildings for Earthquake Loads. (9)

EARTHQUAKE RESISTANT DESIGN OF MASONRY STRUCTURES AND VIBRATION CONTROL TECHNIQUES

Behaviour of Masonry and Earthen Structures as per IS 13827 and IS13828. Guideline for earthquake resistant design of masonry structures. Retrofitting and Rehabilitation of earthquake resistant masonry buildings. Basic concept, principle and applications of seismic base isolation, Passive control and active control systems. (9)

Total : 45

TEXT BOOKS

1. Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design Structures", Prentice Hall of India Private Ltd., New Delhi-110001, 2006.
2. Paulay.T and Priestley.M.J.N, "Seismic Design of Reinforced Concrete and Masonry Buildings, John Wiley and Sons Inc., New York, 1992.
3. S.K.Duggal, "Earthquake Resistant Design of Structures", Oxford University Press, 2008.

REFERENCES

1. Anil K.Chopra, "*Dynamics of Structures - Theory and applications to Earthquake Engineering*", Prentice Hall of India Pvt. Ltd., New Delhi, 2002.
2. Miha Tomazevic, "*Earthquake Resistant Design of Masonry Buildings*", Imperial College Press, 1999.
3. IS 1893:2016 Part I Criteria for earthquake resistant design of structures.
4. IS 1893: 2016 Part II Criteria for Earthquake Resistant Design of Structures: Part 2 Liquid Retaining Tanks
5. IS 4326: 1993 Code of practice for earthquake resistant design and construction of buildings.
6. IS 13827: 1993 Improving earthquake resistance of earthen buildings - Guidelines.
7. IS 13828: 1993 Improving earthquake resistance of low strength masonry buildings - Guidelines.
8. IS 13920: 2016 Ductile detailing of reinforced concrete structures subjected to seismic forces - Code of practice.

19MCEE05 - STRUCTURAL OPTIMIZATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Elective

COURSE OUTCOMES

At the end of the course the students will be able to:

CO1 : Understand the basic concepts in optimization.

CO2 : Gain knowledge about various optimization techniques for optimal design of structural elements.

CO3 : Understand the linear programming methods for plastic design of frames.

CO4 : Understand the optimization theorems for trusses and frames.

CO5 : Gain knowledge about non - traditional optimization methods and its applications.

BASIC PRINCIPLES AND CLASSICAL OPTIMIZATION TECHNIQUES

Definition - Objective Function; Constraints - Equality and inequality - Linear and non-linear, Side, Non-negativity, Behaviour and other constraints - Design space - Feasible and infeasible - Convex and Concave - Active constraint - Local and global optima. Differential calculus - Optimality criteria - Single variable optimization - Multivariable optimization with no constraints - (Lagrange Multiplier method) - with inequality constraints (Kuhn - Tucker Criteria). (9)

LINEAR AND NON-LINEAR PROGRAMMING

LINEAR PROGRAMMING: Formulation of problems - Graphical solution - Analytical methods - Standard form - Slack, surplus and artificial variables - Canonical form - Basic feasible solution - simplex method - Two phase method - Penalty method - Duality theory - Primal - Dual algorithm. **NON LINEAR PROGRAMMING:** One Dimensional minimization methods: Unidimensional - Unimodal function - Exhaustive and unrestricted search - Dichotomous search - Fibonacci Method - Golden section method - Interpolation methods. Unconstrained optimization Techniques. (9)

GEOMETRIC PROGRAMMING

Posynomial - degree of difficulty - reducing G.P.P to a set of simultaneous equations - Unconstrained and constrained problems with zero difficulty - Concept of solving problems with one degree of difficulty. (9)

DYNAMIC PROGRAMMING

Bellman's principle of optimality - Representation of a multistage decision problem - concept of sub-optimization problems using classical and tabular methods. (9)

STRUCTURAL APPLICATIONS

Methods for optimal design of structural elements, continuous beams and single storied frames using plastic theory - Minimum weight design for truss members - Fully stressed design - Optimization principles to design of R.C. structures such as multistorey buildings, water tanks and bridges. (9)

TOTAL : 45

REFERENCES

1. Spunt, "Optimization in Structural Design", Civil Engineering and Engineering Mechanics Services, Prentice-Hall, New Jersey, 2005.
2. Iyengar.N.G.R and Gupta. S.K, "Structural Design Optimization", Affiliated East West Press Ltd, New Delhi, 1997
3. Rao, S.S., "Optimization Theory and applications", Limited, New Delhi, 2004.
4. Richard Bronson, "Operation Research", Schaum's Outline series, Mac Graw Hill Book Co, Singapore, 1997.
5. Pun, "Introduction to Optimization in Practice", John Wiley Eastern Limited, New Delhi, 2001.

19MCEE06 HEALTH MONITORING OF STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Elective

COURSE OUTCOMES

On completion of the course the students will be able to:

CO1 : Apprehend the assessment procedure for evaluating damaged structures.

CO2 : Apprehend the causes of cracks and design and construction errors.

CO3 : Perceive the materials and techniques for repair of distressed structures.

CO4 : Analyse and adopt strengthening techniques for the structural elements of deteriorated structures.

CO5 : Apply knowledge to execute various engineered demolition techniques for dilapidated structures.

DIAGNOSTICS

Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance, various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration. (9)

SERVICEABILITY AND DURABILITY OF CONCRETE

Quality assurance for concrete construction, concrete properties - Strength, permeability, thermal properties and cracking - Effects due to climate, temperature, chemicals, corrosion - Design and construction errors - Effects of cover thickness and cracking. (9)

MATERIALS FOR REPAIR

Special concretes-sulphur infiltrated concrete, Fibre reinforced concrete, polymer concrete, foamed concrete, vacuum concrete, - special mortar-concrete chemicals - special elements for accelerated strength gain, Expansive cement, Ferro cement -Rust eliminators and polymer coating for rebars during repair-mortar and dry pack, Guniting and Shotcrete, Epoxy injection. (9)

TECHNIQUES FOR REPAIR OF STRUCTURES

Mortar repair for cracks, shoring and underpinning-Methods of corrosion protection,-corrosion inhibitors, corrosion resistant steels and cathodic protection- Repair of structures distressed due to earthquake - Strengthening using FRP- Strengthening and stabilization techniques for repair. (9)

DEMOLITION OF STRUCTURES

Planning - Precautionary measures- principles of structural demolition- Methods of demolition - dismantling of structures - Engineered demolition techniques for structures-demolition of special structures - Waste Handling. (9)

TOTAL : 45

TEXT BOOKS

1. Denison Campbell, Allen and Harold Roper, "Concrete Structures, Materials, Maintenance and Repair", Longman Scientific and Technical UK, 1991.
2. Allen R.T and Edwards S.C, "Repair of Concrete Structures", Blakie and Sons, UK,1987.
3. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, Standard Publications, 2009

REFERENCES

1. Guha.P.K, *"Maintenance and Repairs of Buildings"*, New Central Book Agency (P) Ltd, Kolkata, 2011.
2. Raikar, R.N., *"Learning from failures - Deficiencies in Design, Construction and Service"* - R&D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
3. Santhakumar A.R., *"Concrete Technology"* Oxford University Press, Printed in India by Radha Press, New Delhi, 2007.
4. Peter H. Emmons, *"Concrete Repair and Maintenance Illustrated"*, Galgotia Publications pvt. Ltd., 2001.
5. Mehta, P.K and Monteiro. P.J., *Concrete- Microstructure, Properties and Materials*, 4th Edition
6. M.S.Shetty, *Concrete Technology - Theory and Practice*, S.Chand and Company, NewDelhi, 2005.
7. SP: 25 - 1984, *"Handbook on Causes and Prevention of Cracks in Buildings, Bureau of Indian Standards"*, New Delhi, 1999.

19MCEE07 - PRESTRESSED CONCRETE STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Elective

COURSE OBJECTIVE

To study the principle of prestressing, analysis and design of prestressed concrete structures.

COURSE OUTCOMES

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

CO1 : Determine the losses in prestressed concrete members.

CO2 : Design the prestressed concrete beams for flexure and shear using limit state method of design.

CO3 : Design the end blocks, tension and compression members.

CO4 : Design the Composite prestressed concrete beams and shear connectors.

CO5 : Analyze the continuous prestressed concrete beams.

PRINCIPLES OF PRE-STRESSING

Difference between reinforced and prestressed concrete. Principles of prestressing - Methods and systems of prestressing - Principles of Electrothermal prestressing & chemical prestressing - Classification of prestressed concrete structures - Materials - High strength concrete and High tensile steel - stress - strain diagrams. Losses in Prestress: Loss due to elastic shortening in pretensioned and post tensioned beams. Loss due to creep, shrinkage, relaxation, friction - Approximate percentage of various losses in pretensioned and post tensioned beams. (9)

DESIGN OF FLEXURAL MEMBERS

Design of prismatic prestressed concrete members for bending - Magnel's graphical method - check for ultimate load stage (Limit State Design) - Non prismatic members (Design principles only) - Simple cable profiles - calculation of deflections (9)

DESIGN FOR SHEAR TORSION AND END BLOCK

Design of beams for shear and Torsion at working and ultimate loads. Design of Anchorage Zone by Guyon's method - Concept of Mangel's method - IS 1343 recommendations. Design of end blocks (9)

DESIGN OF TENSION, COMPRESSION AND COMPOSITE MEMBER

Design of tension members - Design of columns subjected to bending moment and axial compression. Composite prestressed concrete beams - Design procedure - calculation of stresses at important stages both for propped and unpropped constructions - Design of shear connectors - Shrinkage Stresses. (9)

DESIGN OF CONTINUOUS BEAMS

Statically indeterminate structures - concept of concordant cable and linear transformations - sketching of pressure lines for continuous beams and single span single storey rigid frame. Design principles of Partially prestressed concrete structures - circular prestressing - Design of a circular tank for circular and vertical prestressing. Determination of Concordant Cable profile. (9)

TOTAL : 45

TEXT BOOKS

1. Krishna Raju.N, "Prestressed Concrete", Tata Mc Graw Hill Publishing Company Ltd, New Delhi, 2012.
2. Rajagopalan.N, "Prestressed Concrete", Alpha Science International Ltd., UK, 2005.

REFERENCES

1. Dayaratnam.P, *"Prestressed Concrete Structures"*, Oxford and India Book House Ltd., Chennai, 2014.
2. Lin.T.Y and Ned H Burns, *"Design of Prestressed Concrete Structures"*, John Willey and Sons, NewYork, 1982.
3. Sinha. N.C and Roy. S.K, *"Fundamentals of Prestressed Concrete"*, S. Chand and Company, New Delhi, 2011.
4. Kachaturian and Gurfinkel, *"Prestressed Concrete"*, McGraw Hill, New York, 1961.
5. IS 1343-2012: *Code of Practice for Prestressed Concrete*.

19MCEE08 - CORROSION OF STEEL IN CONCRETE STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Elective

COURSE OUTCOMES

On completion of the course the students will be able to:

CO1 : Perceive about phenomenon of corrosion and its propagation

CO2 : Monitor corrosion using various techniques

CO3 : Apprehend the different types of protective measures

INTRODUCTION

Corrosion of steel reinforcement in concrete, definition of corrosion, forms of corrosion, phenomenon of corrosion, corrosion initiation-environment-cover thickness-quality of cover concrete -type of steel and critical chloride-presence of cracks, corrosion propagation - electrochemical process - physical process, theory of reinforcement corrosion-basic corrosion cell-anode and cathode-electrolyte- corrosion potential and rate of corrosion. (9)

IDENTIFICATION AND APPRAISAL OF CORROSION

Corrosion process and mechanism - approach to investigation-visual observation and documentation, insitu testing of concrete-rebound hammer test, cover meter survey-ultrasonic pulse velocity (UPV) test - core sampling and testing, insitu testing of steel rebar -carbonation test and pH value, chloride content- half cell potential survey-resistivity mapping -measurement of corrosion rate. (9)

MONITORING OF CORROSION

Methods used for monitoring corrosion - open circuit potential measurement, resistivity measurement, corrosion cell ratio, electrical resistance probe method, polarization resistance technique, impedance technique, guard ring technique, electrochemical noise analysis. (9)

PROTECTIVE MEASURES

Coating to reinforcement-metallic coatings-epoxy coatings-cement based coatings -coating to prestressing steel, galvanized reinforcement, stainless steel, non-ferrous reinforcement and coating to concrete surface, improving the concrete, corrosion resistant steel. (9)

INHIBITORS FOR CONCRETE

Definition of inhibitor-anodic and cathodic inhibitors-rice husk ash, fly ash, electrochemical removal of chloride from concrete, non-metallic materials, carbon FRP, Glass FRP, parafil tendons. (9)

TOTAL : 45

TEXT BOOKS

1. John P.Broom field, "Corrosion of steel in concrete", E&FN spon, London and New York, 2006.
2. Amir Poursaee, "Corrosion of steel in concrete", Wood Head Publishing series, Elsevier, 2016.
3. Luca Bertolini, "Corrosion of steel in concrete", Wiley-VCH, 2016.

REFERENCE

1. Kumar Mehta, P., "Concrete-Structure, Properties and Materials", Prentice - Hall, INC, Englewood Cliffs, New Jersey 07632 - 1986.

19MCEE09 - THEORY OF PLATES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Elective

COURSE OUTCOMES

On completion of the course the students will be able to:

CO1 : Apprehend the small and large deflection theory of plates with various boundary conditions

CO2 : Acquire knowledge in bending of plates

CO3 : Analyze plates of rectangular shape with different loading and boundary conditions using classical, approximate and numerical methods.

CO4 : Apply approximate / numerical methods to analyze the plates of different shapes.

CO5 : Acquire knowledge in large deflection theories.

INTRODUCTION AND SMALL DEFLECTION THEORY

Introduction - Thin and thick plates - Plate behaviour - Material behaviour - Isotropic and orthotropic Materials, Differential equation of plates in Cartesian co-ordinate system - boundary conditions - Rigorous solution - Navier's Method - Levy's Method. (9)

SYMMETRICAL BENDING OF CIRCULAR PLATES

Differential equation for symmetrical bending of laterally loaded circular plates - Simply supported edges-Clamped edges - Circular plate with a circular hole at the center - Circular plate concentrically loaded. (9)

APPROXIMATE METHODS

Energy methods - Galerkin's Method - Ritz Method, Method of Images - Plate strip - Influence surfaces - Membrane and Various Analogies - Simultaneous Bending and Stretching. (9)

NUMERICAL METHODS

Finite difference method - Improvements for solution, matrix displacement analysis of Grids - introduction to Finite Element Method (9)

PLATES OF OTHER SHAPES

Triangular plates - Elliptic plates - Sector plates - Skew plates - Plates on elastic foundation - Continuous plates.

ADVANCED TOPICS

Large Deflection theory - Thermal stresses - Multilayered plates. - Mindlin's theory of plates - Flat slabs -Engineering approach to design of Rectangular floor slabs. (9)

TOTAL : 45

TEXT BOOKS

1. Rudolph Szilard, "Theory and Analysis of Plates - Classical and Numerical Methods", Prentice Hall, 1995.
2. Timoshenko.S and Krieger.S.W, "Theory of Plates and Shells", Mc-Graw Hill Book Company, New York, 1990.

REFERENCES

1. Donnel.L.H, "Beams, Plates and Shells", McGraw Hill Inc., 1976.
2. Chandrashekhara, K., "Theory of plates" , University Press(India) limited, Hyderabad, 2001
3. Bairagi.N.K, "A Text Book of Plate Analysis", Khanna Publishers, New Delhi, 1996.

19MCEE10 - DESIGN OF CONCRETE BRIDGES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Elective

COURSE OUTCOMES

On completion of the course the students will be able to:

CO1 : Apprehend the planning and investigation of bridges.

CO2 : Design the superstructure of bridge using different methods.

CO3 : Design the substructure of bridges.

INTRODUCTION TO THE CONCRETE BRIDGES

Introduction -Classification - Investigations and planning - choice of type - IRC Specifications for road bridges - standard live loads - other forces acting on the bridges - load distribution theories for short and long span bridges - general design considerations. (9)

DESIGN OF RCC BRIDGES

Design of RCC solid deck slab bridges - Design of RCC Tee beam deck slab bridges (9)

DESIGN OF PRESTRESSED CONCRETE BRIDGES

Design of PSC deck slab bridges - Design of PSC girder bridges (9)

OTHER TYPES OF CONCRETE BRIDGES

Design principles of precast PSC bridges, box girder bridges and long span bridges (9)

BEARINGS AND SUBSTRUCTURES

Design of RC, steel and elastomeric pad bearing - Design of abutment and pier - Design of well foundation. (9)

TOTAL : 45

TEXT BOOKS

1. Raina.V.K, "Concrete Bridge Practice", Tata McGraw Hill Publishing Co, New Delhi, 2007.
2. Krishnaraju.N, "Design of Bridges", Oxford Publishing Co, 2015.

REFERENCES

1. Ponnuswamy.S, "Bridge Engineering", Tata McGraw Hill, New Delhi, 2008.
2. IRC 5:2016 Standard Specifications and code of practice for Road Bridges. Section I-General Features and Design
3. IRC 6:2014 Standard Specifications and code of practice for Road Bridges. Section I-Loads and stresses.
4. IRC 78:2014 Standard Specifications and code of practice for Road Bridges. Section VII-Foundation and substructures.
5. IRC 83:2015 Standard Specifications and code of practice for Road Bridges. Section IX-Metallic Bearings
6. IRC 112:2011.Code of practice for concrete road bridges

19MCEE11 - DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Elective

COURSE OUTCOMES

On completion of the course the students will be able to:

CO1 : Analyse steel concrete composite structures

CO2 : Design composite structures and its connections

CO3 : Conduct case studies related to steel concrete composite constructions of buildings

INTRODUCTION

Introduction to steel - concrete composite construction - theory of composite structures - Introduction to steel - concrete - steel sandwich construction. (9)

DESIGN OF COMPOSITE BEAMS

Behavior of composite beams, design of composite beams. (9)

DESIGN OF COMPOSITE COLUMNS AND TRUSSES

Steel concrete composite columns - design of composite trusses. (9)

DESIGN OF CONNECTIONS

Types of connections, Design of connections in the composite structures - shear connection, Design of connections in composite trusses. (9)

COMPOSITE BOX GIRDER BRIDGES

Introduction - behaviour of box girder bridges - design concepts.

General case studies on steel - concrete composite construction in buildings - seismic behavior of Composite structures. (9)

TOTAL : 45

TEXT BOOK

1. Johnson.R.P, "Composite structures of steel and concrete", Blackwell Scientific Publications (Third Edition), UK, 2013.

REFERENCES

1. Owens.G.W and Knowels.P, "Steel Designers manual", (Fifth Edition), Steel Concrete Institute (UK), Oxford Blackwell Scientific Publications, 1992.
2. Proceedings of workshop on "Steel Concrete Composite Structures", conducted at Anna University, 2007.
3. IRC 24:2010 Standard Specifications and code of practice for Road Bridges. Section V- Steel Road Bridges.
4. Insdag - Proceedings conducted in IIT M 2002.

15MCEE12 - OFFSHORE STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Elective

COURSE OUTCOMES

On completion of the course the students will be able to:

CO1 : Apprehend the static and dynamic effect of wind on structures

CO2 : Understand the basics of wave generation process and wave theories

CO3 : Analyse the forces in off shore structures

CO4 : Formulate the structural modeling of offshore structures

CO5 : Design various components of offshore structures

WIND EFFECTS

Wind on Structures - Rigid Structures - Flexible Structures -Static and dynamic effects (9)

WAVE HYDRODYNAMICS

Wave generation and propagation of small and finite amplitude wave theories - wave energy and pressure distribution. (9)

WAVE LOADING

Wave forces on structures - Environmental loadings - use of Morrison equation. (9)

OFFSHORE STRUCTURE MODELLING

Different types of structures, Foundation modeling, static methods of analysis, Dynamics of Offshore Structures. (9)

DESIGN OF OFFSHORE STRUCTURES

Loads, design of platforms, Derricks, Helipads, Design principles and examples of Jacket towers, Mooring cables. (9)

TOTAL : 45

TEXT BOOKS

1. Chakrabarti.S.K, "Hydrodynamics of Offshore Structures", Computational Mechanics Publications, 1987.
2. Thomas M.Dawson, "Offshore Structural engineering", Prentice Hall Inc Englewood Cliffs, N.J., 1983.

REFERENCES

1. API, Recommended Practice for Planning, Designing and Construction, Fixed Offshore Platforms, American Petroleum Institute Publication, RP2A, Dalls, Tex, 2000.
2. PeterSachs, "Wind forces in Engineering", Pergomon press, New York, 1972.
3. Ippen.J, "Esterany and Coast line hydrodynamics", McGraw Hill Book, Co., 1966.

19MCEE13 - SHELL STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Elective

COURSE OBJECTIVE

Study the behaviour and design of shells, folded plates and application of software.

COURSE OUTCOMES

On completion of the course the students will be able to:

CO1 : Apprehend the structural behaviour of shells and folded plates

CO2 : Analyse and design cylindrical shells

CO3 : Design double curvature shells using membrane theory

CO4 : Analyse and design doubly curved shells

CO5 : Analyse and design folded plates

INTRODUCTION

Structural behavior of shells and folded plates - Theory of surfaces - Generation of surfaces - Classification - IS code provisions.

ANALYSIS OF CYLINDRICAL SHELLS

Membrane theory; Bending theory; Beam - Arch approximation; Continuous Cylindrical shells - Long and Short shells. Shells with and without edge members - Multibarrel shells. (10)

DESIGN OF CYLINDRICAL SHELLS

Design by ASCE Manual No.31 tables - Shells of various boundary conditions - North light shells - proportioning shells - Reinforcement in shell and edge members - Prestressing of edge members - Review of recommendations of codes - Constructional aspects - Design of Traverses. (10)

SHELLS OF DOUBLE CURVATURE

Membrane theory for shells of revolution - Membrane theory for general shells of double curvature - Synclastic and anticlastic shells - Approximate bending theory of shallow shells - Design of H.P cooling tower shells.. (9)

DESIGN OF DOUBLY CURVED SHELLS

Hyperbolic paraboloid roofs - Determination of forces in shells and edge members - Design of umbrella and inverted umbrella roof - Design of conoidal shells - Skew Hypars - H.P shells on parabolic directrix boundary - New Shell forms - Funicular shells. (10)

FOLDED PLATES

Various steps in the analysis - Analysis by ASCE Task committee method - Analysis by Finite Strip approach-Design of reinforcement - Transverses. (6)

TOTAL : 45

TEXT BOOKS

1. G.S.Ramaswamy, "Design and Construction of concrete shell roofs", CBS publishers and distributors, New Delhi, 2005.
2. Vasanth.S.Kelkar & Robert T.Sewell, "Fundamentals of the Analysis and Design of shell structures", Prentice hall,inc,New Jersey,1987

REFERENCES

1. Billington.D.F, "*Thin shell concrete roofs*", Mc Graw Hill Book Company, New York, 1982.
2. Chatterjee.B.K, "*Theory and design of concrete shells*", Champman and Hall Ltd., London, 1988.
3. K.Chandrashekara, "*Analysis of thin concrete shells*, Tata McGraw Hill Book Co., 1986.
4. N.K.Bairagai, "*Shell Analysis*", Khanna Publishers, New Delhi, 1990.

19MCEE14 - ANALYSIS AND DESIGN OF TALL BUILDINGS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Elective

COURSE OUTCOMES

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

CO1 : Apprehend the design concepts and the different types of loading

CO2 : Analyse the components of tall structures for various effects

CO3 : Design the various structural systems used in the construction of tall structures

STRUCTURAL SYSTEMS AND CONCEPTS

History - structural systems and concepts - criteria and loading - materials and construction - Structural steel system - reinforced concrete - pre-stressed concrete - composite system - gravity and lateral systems-loads - gravity - wind - earthquake - temperature load - creep - shrinkage - fire loading - blast loading. (9)

GRAVITY SYSTEMS AND LATERAL SYSTEMS - DESIGN AND BEHAVIOUR

Floor systems in concrete and steel - one way and two way slabs - flat slabs with capitals - prestressed concrete floor - shell systems- bearing walls - composite steel concrete floors - columns - open web truss- system in steel - stub girder system. Static and dynamic approach, analytical method, Wind Tunnel, Earthquake loading - Equivalent lateral-load analysis- Response spectrum method, Combination of loads. (9)

SHEAR WALL

Moment resisting frame - braced - shear trusses -shear wall- frame system - framed tube - outrigger - bundled tube system - diagonal trussed tube - mega tube system - approximate methods of analysis - design of frames for lateral load - p- delta effects - detailing of shear walls for ductility. (9)

FRAMED TUBE SYSTEM AND OUTRIGGER

Behaviour - approximate methods - preliminary design - design of frame work - design of transfer girders. Behaviour - approximate methods - belt trusses - columns - dynamics of outrigger systems. (9)

DESIGN OF CONNECTIONS

Behaviour of connections - design of moment connections- simple and semi-rigid - beam - column connections- braced frame connection - connections in outriggers - connections for plastic design - design of connection for ductility. (9)

TOTAL : 45

TEXT BOOKS

1. Taranath.B.S, "Analysis and Design of Tall Buildings", McGraw-Hill co, 2011.
2. Ramaswamy.S.D and Yam.C.T, "Proceedings of the International Conference on Tall Buildings", Singapore , 1984.
3. Smith.B.S and Coull.A, "Tall Building Structures Analysis and Design", John Wiley and Sons, Inc, 2011.

REFERENCES

1. Fintel, M., "Hand Book of Concrete Engineering", Van Nostrand Reinhold co 1974.
2. Mehta, J.B., "High Rise Buildings"., M/S Skyline, 1978.
3. Coull,A., and Smith,S.B. "Tall Buildings", Pergamon Press, London, 1997.
4. Beedle, L.S.,"Advances in Tall Buildings CBS publishers and Distributors, Delhi, 1996.
5. Bangash, M.Y.H. "Prototype Building Structures - Analysis and Design", Thomas Telford, 1999.

19MCEE15 - WIND AND CYCLONE EFFECTS ON STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : PROFESSIONAL ELECTIVE

COURSE OBJECTIVE

To study the concept of wind and cyclone effects, analysis and design of structures.

COURSE OUTCOMES

On completion of the course the students will be able to:

CO1 : Apprehend the knowledge of wind force measurement.

CO2 : Outline the wind tunnel studies and its applications.

CO3 : Interpret the effect of wind on special structures.

CO4 : Design buildings, chimneys, roofs and shelters for wind forces.

CO5 : Design the components of cyclone resistant structures.

INTRODUCTION

Terminology - Spectral studies: Wind Characteristics- Interpretation of the Wind Response spectrum, Gust wind speed, Gust factor: Methods for wind load as per IS Codal Provision. Wind velocity: wind velocity ratio, characteristics of wind velocity, wind velocity measurement methods- Return Period: Weibull Parameter- Method of measurement, variation of speed with height, shape factor, aspect ratio, drag effects. (8)

WIND TUNNEL STUDIES

Wind Tunnel: Types-Terrain Types based on Wind Speed - Modeling requirements, Interpretation of results, Aero - elastic models and their applications. (5)

EFFECT OF WIND ON STRUCTURES

Wind on structures: rigid and flexible structures- static and dynamic effects- model analysis eigen frequencies-wind flow around tall buildings - cladding pressures -pressure distribution on buildings of rectangular cross section, full scale pressure measurement studies (12)

DESIGN OF SPECIAL STRUCTURES

Design of structures for wind loading- as per IS, ASCE and NBC code provision. Design of Chimneys- Tall buildings- Transmission towers -Industrial sheds. (12)

CYCLONE EFFECT ON STRUCTURES

Cyclone effect on low rise, sloped roof structures and tall buildings- effect of cyclones on claddings- design of cladding - Use of codal provisions. (8)

TOTAL : 45

TEXT BOOKS

1. Cook.N.J, "The Designer's Guide to Wind Loading of Building Structures", Butterworths, 1990.
2. Kolousek. et.al, "Wind Effects on Civil Engineering Structures", Elsevier Publications, 1984.

REFERENCES

1. Peter Sachs, "Wind Forces in Engineering", Pergamon Press, New York, 1972.
2. Lawson.T.V, "Wind Effects on Building", Vol.I and II, Applied Science Publishers, London, 1980.
3. The Indian code of practice for wind load on buildings and structures (IS-875 Part-3 1987)

19MCEE16 - SOIL STRUCTURE INTERACTION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Elective

COURSE OUTCOMES

At the end of the course, students will be able to

CO1 : Apply various soil response models applicable to soil-foundation interaction analysis.

CO2 : Find elastic solutions for problems of pile, pile-raft system.

CO3 : Use software packages to analyze soil-foundation system including laterally loaded piles.

SOIL - FOUNDATION INTERACTION

Introduction to soil - Foundation interaction problems, Soil behaviour, Foundation behaviour, Interface, behaviour, Scope of soil-foundation interaction analysis, soil response models. Winkler, Elastic continuum, Two parameter elastic models, Elastic - plastic behaviour, Time dependent behaviour. (9)

BEAMS ON ELASTIC FOUNDATION - SOIL MODELS

Infinite beam, Two parameters, Isotropic elastic half space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness - Analysis through application packages. (9)

PLATE ON ELASTIC MEDIUM

Infinite plate, Winkler, Two parameters, Isotropic elastic medium, Thin and thick plates, Analysis of finite plates, rectangular and circular plates, Numerical analysis of finite plates, simple solutions, Analysis of braced cuts - Application packages. (9)

ELASTIC ANALYSIS OF PILE

Elastic analysis of single pile, Theoretical solutions for settlement and load distribution, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap - Pile raft - Application packages. (9)

LATERALLY LOADED PILE

Load deflection prediction for laterally loaded piles, subgrade reaction and elastic analysis, Interaction analysis, pile-raft system, solutions through influence charts - Application packages. (9)

TOTAL : 45

REFERENCES

1. Saran, S., *Analysis and design of substructures*, Taylor & Francis Publishers, 2006.
2. Hemsley, J.A., *Elastic Analysis of Raft Foundations*, Thomas Telford, 1998.
3. Poulos, H.G., and Davis, E.H., *Pile Foundation Analysis and Design*, John Wiley, 2008.
4. McCarthy, D.F., *Essentials of Soil Mechanics and Foundations: Basic Geotechnics*, Sixth Edition, Prentice Hall, 2002.
5. Selvadurai, A.P.S., *Elastic Analysis of Soil Foundation Interaction*, Elsevier, 1979.
6. Scott, R.F., *Foundation Analysis*, Prentice Hall, 1981.
7. *Structure Soil Interaction - State of Art Report*, Institution of structural Engineers, 1978.
8. *ACI 336, Suggested Analysis and Design Procedures for Combined Footings and Mats*, American Concrete Institute, Delhi, 1988.

19MCEE17 - MECHANICS OF COMPOSITE MATERIALS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Elective

COURSE OBJECTIVE

To study the behaviour of composite materials and to investigate the failure and fracture characteristics

COURSE OUTCOMES

On completion of the course the students will be able to:

CO1 : Describe the composite materials and their construction.

CO2 : Apprehend the stress strain relationship of orthotropic and anisotropic materials

CO3 : Analyze laminated composites

CO4 : Assess the failure criterion and fracture mechanics of composites

CO5 : Describe the application of composite materials and its design

INTRODUCTION

Introduction to Composites, Classifying composite materials, commonly used fiber and matrix constituents, Composite Construction, Properties of Unidirectional Long Fiber Composites, Short Fiber Composites. (9)

STRESS STRAIN RELATIONS

Concepts in solid mechanics, Hooke's law for orthotropic and anisotropic materials, Linear Elasticity for Anisotropic Materials, Rotations of Stresses, Strains, Residual Stresses. (9)

ANALYSIS OF LAMINATED COMPOSITES

Governing equations for anisotropic and orthotropic plates. Angle-ply and cross ply laminates. Static, dynamic and stability analysis for simpler cases of composite plates. Inter laminar stresses. (9)

FAILURE AND FRACTURE OF COMPOSITES

Netting Analysis, Failure Criterion, Maximum Stress, Maximum Strain, Fracture Mechanics of Composites, Sandwich Construction. (9)

APPLICATIONS AND DESIGN

Metal and Ceramic Matrix Composites, Applications of Composites, Composite Joints, Design with Composites, Review, Environmental Issues. (9)

TOTAL : 45

TEXT BOOKS

1. Daniel and Ishai, "Engineering Mechanics of Composite Materials", Oxford University Press, 2013.
2. Jones.R.M, "Mechanics of composite materials", McGraw-Hill, Koghkusha, International Students Edition, Tokyo, 2015.
3. E. J. Barbero, "Introduction to Composite Materials Design", CRC Press, Inc., 2017

REFERENCES

1. Agarwal.B.D and Broutman.L.J, "Analysis and Performance of fiber composites", John- Wiley and Sons,2006.
2. Michael W.Hyer, "Stress Analysis of Fiber-Reinforced Composite Materials", McGraw Hill, 2009.
3. Mukhopadhyay.M, "Mechanics of Composite Materials and Structures", University Press, India, 2005.
4. A. K. Kaw, "Mechanics of Composite Materials", CRC Press, Inc., 2005.

19MCEE18 - PREFABRICATED STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Elective

COURSE OUTCOMES

On completion of the course the students will be able to:

CO1 : Explain the need of prefabricated systems and materials.

CO2 : Apprehend the design principles and the technologies used in fabrication.

CO3 : Describe the prefabricated components.

CO4 : Analysis and design of various members and the connections for the joints of Prefabricated Structures.

CO5 : Apprehend production process, handling and installation of elements.

INTRODUCTION

Prefabrication- Need of prefabrication - Comparison with monolithic construction - Advantages and Disadvantages - Methods of prefabrication - site and plant prefabrication -Types of precast systems, Precast concrete - Materials- Cement, SCM, Aggregate, Water, chemical Admixtures, Pigments, reinforcement, Prestressing Tendons, Concrete and properties, Grout and mortars. (9)

DESIGN PRINCIPLES

General Civil Engineering requirements, specific requirements for planning and layout of prefabrication plant. IS Code specifications. Modular co-ordination, standardization, Tolerance. safety factors, material properties, Deflection control, Lateral load resistance, Location and types of shear walls. (9)

PREFABRICATED COMPONENTS

Beams-Columns- Roof units -types of roof slabs and insulation requirements, - Floor units- Types of floor slabs, one way and two way prefabricated slabs - Staircase slab - Wall panels- Types of wall panels, Curtain, Partition and load bearing walls, Eccentricity and stability of wall panels, sandwich wall panels. Prefabricated structures - Long wall and cross wall large panel buildings, framed buildings with partial and curtain walls- footings. (9)

ANALYSIS, DESIGN AND JOINTS IN STRUCTURAL MEMBERS

Loads-Load combination, - load transfer between different components, vertical loads - Analysis of precast frames - Ultimate strength calculations in shear and flexure. Connection in precast building - Description of joints, their behaviour and reinforcement requirements, Leak prevention, joint sealants - Floor to Beam Connections, Beam to Column Connections, Column to column Connections, Column to foundation connections. (9)

PRODUCTION TECHNOLOGY, HANDLING AND ERECTION

Choice and planning of production setup - Manufacturing methods - Production process-Moulds - Acceleration of concrete hardening, Curing, Storage of precast elements, Handling Equipments and Handling Devices, transportation, erection, Equipments for hoisting and erection - Vacuum lifting pads - Installation of precast elements - Column, Wall, Beam and Slab. (9)

TOTAL : 45

TEXT BOOKS

1. L. Makk, "Prefabricated Concrete for Industrial and Public Structures", Publishing House of the Hungarian Academy of Sciences, Budapest, 2007.
2. K.M. Elliott, "Precast concrete structures", Butterworth Heinmann, 2002.

REFERENCES

1. B. Lewicki, *"Building with Large Prefabricates"*, Elsevier Publishing Company, Amsterdam, London, New York, 1998.
2. T. Koncz, *"Manual of Precast Concrete Construction"*, Vol. I, II, III & IV, Berlin, 1971. *Handbook on precast concrete for buildings ICI BULLETIN 02*.
3. Warszawski, A., *"Industrialization and Robotics in Building"*, - A managerial approach, Harper and Row, 1990.
4. Ganesan and Latha *"Prefabricated structures"* Sree Kamalamani publications Chennai 2014.
5. *Structural Design Manual, "Precast Concrete Connection Details"*, Society for the Studies in the use of Precast Concrete, Netherland Betor Verlag, 2009.
6. CBRI, *"Building materials and components"*, India, 1990. Gerostiza C.Z., Hendrikson C. and Rehat D.R., *Knowledge based process planning for construction and manufacturing*, Academic Press Inc., 1994.

19MCEO01 - DISASTER MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Identify natural and manmade disasters

CO2 : Explain in detail about causes and effects of natural and manmade disasters.

CO3 : Apply geospatial techniques (including GIS) that can enhance vulnerability assessments

CO4 : Identify and analyse the factors that give rise to differential vulnerabilities and levels of community resilience and suggest necessary mitigation plans

CO5 : Assess and manage these vulnerabilities through disaster planning and policy-making.

NATURAL DISASTERS

Cyclones, Floods, Drought and Desertification - Earthquake, Tsunami, Landslides and Avalanche. (9)

MAN MADE DISASTERS

Chemical industrial hazards, major power breakdowns, traffic accidents, Fire, War, Atom bombs, Nuclear disaster- Forest Fire- Oil fire -accident in Mines. (9)

GEOSPATIAL TECHNOLOGY

Remote sensing, GIS and GPS applications in real time disaster monitoring, prevention and rehabilitation- disaster mapping. (9)

RISK ASSESSMENT AND MITIGATION

Hazards, Risks and Vulnerabilities - Disasters in India, Assessment of Disaster Vulnerability of a location and vulnerable groups- Preparedness and Mitigation measures for various Disasters- Mitigation through capacity building -Preparation of Disaster Management Plans. (9)

DISASTER MANAGEMENT

Legislative responsibilities of disaster management- Disaster management act 2005- post disaster recovery & rehabilitation, Relief & Logistics Management; disaster related infrastructure development- Post Disaster, Emergency Support Functions and their coordination mechanism - Role of Engineers in Disaster Management. (9)

Total : 45

TEXT BOOKS

1. R.Subramanian "Disaster Management " Vikas Publishing House Pvt. Ltd, New Delhi, 110055, 2018.
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2017.

REFERENCES

1. Disaster Management in India- A Status Report- Published by the National Disaster Management Institute, Ministry of Home Affairs, Govt. of India, 2004.
2. Murthy D. B. N., "Disaster Management: Text and Case Studies", Deep and Deep Publications (P) Ltd., New Delhi, 2007.
3. Sundar I. and Sezhayan T., "Disaster Management", Sarup and Sons, New Delhi, 2007.
4. Singhal J.P. "Disaster Management", Laxmi Publications, 2010.
5. Khanna B K, "All You Wanted To Know About Disasters", New India Publishing Agency, New Delhi, 2005.
6. Ramana Murthy, "Disaster Management", Dominant, New Delhi, 2004.
7. RajdeepDasgupta, "Disaster Management and Rehabilitation", Mittal Publishers, New Delhi, 2007.

19MCEOE02 - ENERGY EFFICIENT BUILDINGS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

At the end of the course the student will be able to:

CO1 : Perform energy audits in any type of building and suggest the conservation measures.

CO2 : Identify energy efficient landscape and building envelopes

CO3 : Understand natural heating and cooling system for efficient buildings CO4:Acquire knowledge about heat transmission and estimation of building loads CO5: Integrate the renewable energy systems in the buildings

INTRODUCTION

Conventional versus Energy Efficient buildings - Historical perspective - Water - Energy - IAQ- requirement analysis - Future building design aspects - Criticality of resources and needs of modern living. (9)

LANDSCAPE AND BUILDING ENVELOPES

Energy efficient Landscape design - Micro-climates - various methods - Shading, water bodies- Building envelope: Building materials, Envelope heat loss and heat gain and its evaluation, paints, Insulation, Design methods and tools. (9)

HEATING, VENTILATION AND AIR-CONDITIONING

Natural Ventilation, Passive cooling and heating - Application of wind, water and earth for cooling, evaporative cooling, radiant cooling - Hybrid Methods - Energy Conservation measures, Thermal Storage integration in buildings. (9)

HEAT TRANSMISSION IN BUILDINGS

Surface co-efficient : air cavity, internal and external surfaces, overall thermal transmittance, wall and windows; Heat transfer due to ventilation/infiltration, internal heat transfer; Sol-air temperature; Decrement factor; Phase lag. Design of day lighting; Estimation of building loads: Steady state method, network method, numerical method, correlations; Computer packages for carrying out thermal design of buildings and predicting performance. (9)

PASSIVE COOLING & RENEWABLE ENERGY IN BUILDINGS

Passive cooling concepts : Evaporative cooling, radiative cooling; Application of wind, water and earth for cooling; Shading, paints and cavity walls for cooling; Roof radiation traps; Earth air tunnel. Introduction of renewable sources in buildings, solar water heating, small wind turbines, stand-alone PV systems, Hybrid system - Economics. (9)

Total : 45

TEXT BOOKS

1. Krieder J. and Rabi A., "Heating and Cooling of buildings: Design for Efficiency", Mc Graw Hill, 1994.
2. Ursala Eicker, "Solar Technologies for buildings", Wiley publications, 2003.

REFERENCES

1. Guide book for National Certification Examination for Energy Managers and Energy Auditors (Could be downloaded from www.energymanagertraining.com)

19MCMOE01- LANDSCAPE AND ARCHITECTURE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

- CO1 : Present architectural designs associated with spaces, mass, visual and emotional effects and design components.*
- CO2 : Familiarize students with various elements landscape architecture and the principle of landscape design.*
- CO3 : Provide an overview of ecological balance and impacts of human activities and stress the need for environmental protection and landscape consideration.*
- CO4 : Develop and strengthen the competency in dealing with the analytic, artistic and technical aspects of designing open spaces at different scales.*

OVERVIEW OF ARCHITECTURE

Definition of architecture - Introduction to architecture - Elements of architecture - - Need and fulfillment - Architecture design - An analysis - Integration of aesthetic and function - Mass and space, visual and emotional effects of geometric forms and their derivatives - Space - Form - Composition - Dimension - Proportion, scale, Balance, Rhythm, Symmetry, Hierarchy, Pattern and axis with building examples - Concept development. (9)

ELEMENTS IN LANDSCAPE DESIGN

Ecology, ecological balance - Hard and soft landscape elements; Plant materials - Classification, Characteristics, use and application in landscape design; Water and landform. (9)

GARDEN DESIGN

Landscape and garden design in history - Japanese, Italian Renaissance and Moghul gardens in India, Study of notable examples, spatial development in landscape design. (9)

SITE PLANNING

Organization of spaces - Circulation, built form and open spaces, site planning and micro climate, site planning of neighborhood parks, children's play area and campus development. (9)

LANDSCAPING OF FUNCTIONAL AREAS

Urban open spaces and principles of urban landscape; Street landscaping; Landscape design for waterfront areas and functional areas in urban centers; Green roofs and walls. (9)

Total : 45

TEXT BOOKS

1. Michael Laurie, "An Introduction to Landscape Architecture", Elsevier, 1986
2. Geoffrey and Susan Jellicoe, "The Landscape of man", Thames and Hudson, 1987
3. Ven Meiss, "Elements of Architecture", Van Nostrand Publications, London 1986

REFERENCES

1. Ching, Francis D. K. Architecture--form, Space, & Order. Hoboken, NJ: John Wiley & Sons, 2007. Print.
2. TSS for Landscape Architecture, Mc Graw Hill Inc., 1995
3. Grant W Reid, Form concept, form in landscape design, Van Nostrand Reinhold Company, 1993

19MENOE01- CLIMATE CHANGE AND ADAPTATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

At the end of the course, the student will be able to:

CO1 : Understand earth's climate system and the concept of global warming

CO2 : Infer the causes for climate change on the earth's surface

CO3 : Comprehend the impact of climate change on society

CO4 : Apply the various climate change adaptation and mitigation measures

CO5 : Evaluate the role of clean technology in climate change adaptation

EARTH'S CLIMATE SYSTEM

Introduction - weather and climate - Climate in the spotlight-The Earth's Climate Machine - Climate Classification - Global wind systems - Trade Wind Systems - Trade Winds and the Hadley Cell - Cloud formation and Monsoon Rains - Storms, Hurricanes and Tornado - The Hydrological Cycle - Global Ocean Circulation - El Nino - LA Nino effect - Solar Radiation - The Earth's Natural Green House Effect - Green House Gases and Global Warming (9)

OBSERVED CHANGES AND ITS CAUSES

Observation of Climate Change - Changes in pattern of temperature, precipitation and sea level rise - Observed effects of Climate Changes - Drivers of Climate Change - Climate Sensitivity and Feedbacks - The Montreal Protocol - UNFCCC - IPCC - Evidences of Changes in Climate and Environment - on a Global Scale and in India - Climate Change modeling. (9)

IMPACTS OF CLIMATE CHANGE

Impacts of Climate Change on various sectors - Agriculture, Forestry and Ecosystem - Water resources - Human Health - Industry, Settlement and Society - Methods and Scenarios - Projected Impacts for different regions - Uncertainties in the Projected Impacts of Climate Change - Risk of irreversible changes. (9)

CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES

Adaptation Strategy/options in various sectors - Water - Agriculture - Infrastructure and Settlement including coastal zones. Human Health - Tourism - Transport - Energy - Key Mitigation Technologies and practices - Energy supply - Transport - Buildings - Industry - Agriculture - Forestry - Carbon sequestration - Carbon Capture and Storage (CCS) - Waste (MSW & Biowaste, Biomedical, Industrial waste - International and Regional co-operation. (9)

CLEAN TECHNOLOGY AND ENERGY

Clean Development Mechanism - Carbon Trading - Examples of future Clean Technology - Biodiesel - Natural Compost - Eco-friendly Plastic - Alternate Energy - Hydrogen - Bio-fuels - Solar Energy - Wind - Hydroelectric Power. (9)

Total : 45

TEXT BOOKS

1. Dash Sushil Kumar, "Climate Change - An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.
2. IPCC Fifth Assessment Report.
3. Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", IHE, The Netherlands, October,2009.

REFERENCES

1. Anil Maranda, *Climate Change and Sustainable Development: Prospects for Developing Countries*, Routledge, 2002.
2. Al core "inconvenient truth" - a Global Warming, video form, Documentary, May 2006.
3. Heal, G. M., *Interpreting Sustainability*, in *Sustainability: Dynamics and Uncertainty*, Kluwer Academic Publ., 1998.
4. Jepma, C.J., and Munasinghe, M., *Climate Change Policy - Facts, Issues and Analysis*, Cambridge University Press, 1998.
5. Munasinghe, M., *Sustainable Energy Development: Issues and Policy in Energy, Environment and Economy: Asian Perspective*, Kleindorfer P. R. et. al (ed.), Edward Elgar, 1996.

19MCOC01 - PRACTICAL GEOTECHNICAL ENGINEERING

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

At the end of this laboratory, the students will be able to

CO1 : Plan and conduct appropriate soil exploration method based on site condition.

CO2 : Classify soils based on their index properties

CO3 : Understand strength and settlement characteristics of soils.

CO4 : Compute Safe Bearing Capacity of soils and select appropriate foundations.

LIST OF EXPERIMENTS

1. Soil Exploration and Site Characterization. (3)
2. Assessment of Index Properties of Soil. (3)
3. Assessment of Flow and Consolidation Properties of Soil. (3)
4. Assessment of Shear Strength Parameters of Soil. (3)
5. Assessment of Bearing Capacity of Soil. (3)

REFERENCES

1. "Soil Engineering Laboratory Instruction Manual", Published by the Department of Civil Engineering. CIT, Coimbatore, 2008.
2. Head, K.H., "Manual of Soil Laboratory Testing (Vol-1 to 3)", John Wiley & Sons, Chichester, 1998.
3. Lambe T.W., "Soil Testing for Engineers", John Wiley & Sons, New York, 1990.
4. IS Code of Practice 2720 - Indian Standard Code of Practice for Methods of Tests for soil.
5. Saibaba Reddy, E. and Rama Sastri, K., "Measurement of Engineering Properties of Soils", New Age International, 2002.

19MCOC02 - GREEN BUILDINGS

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

At the end of the course the student will be able to:

CO1 : Acquire knowledge about energy impact in buildings

CO2 : Identify different energy analysis method and standards

CO3 : Understand energy quality management in buildings.

INTRODUCTION

Life Cycle impacts of materials and products - sustainable design concepts - strategies of design for the Environment -The sun-earth relationship and the energy balance on the earth's surface, climate, wind - Solar radiation and solar temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings - Thermal properties of building materials. (5)

ENERGY EFFICIENT BUILDINGS

Passive cooling and day lighting - Active solar and photovoltaic- Building energy analysis methods- Building energy simulation- Building energy efficiency standards- Lighting system design- Lighting economics and aesthetics- Impacts of lighting efficiency - Energy audit and energy targeting- Technological options for energy management. (5)

INDOOR ENVIRONMENTAL QUALITY MANAGEMENT

Psychometry- Comfort conditions- Thermal comfort- Ventilation and air quality-Air conditioning requirement- Visual perception- Illumination requirement-Auditory requirement- Energy management options- Air conditioning systems- Energy conservation in pumps- Fans and blowers- Refrigerating machines - Heat rejection equipment- Energy efficient motors- Insulation. (5)

Total : 15

TEXTBOOKS

1. Kibert, C. "Sustainable Construction: Green Building Design and Delivery", John Wiley & Sons, 2016
2. Edward G Pita, "An Energy Approach- Air-conditioning Principles and Systems", Pearson Education, 2018

REFERENCES

1. Colin Porteous, "The New Eco-Architecture", Spon Press, 2002.
2. Energy Conservation Building Codes: www.bee-india.nic.in
3. Lever More G J, "Building Energy Management Systems", E and FN Spon, London, 2000.
4. Ganesan T P, "Energy Conservation in Buildings", ISTE Professional Center, Chennai, 1999.
5. John Littler and Randall Thomas, "Design with Energy: The Conservation and Use of Energy in Buildings", Cambridge University Press, 1984.

19MCOC03- GEO INFORMATICS LABORATORY

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 : The students will be able to carry out remote sensing and GIS applications of various industrial needs.

CO2 : The students will be able to demonstrate the various environmental change detections.

CO3 : The students will be able to be instrumental for decision support system.

GIS INTRODUCTION

Exploring - GIS functions - features - layers - map scale - connecting to folder - reordering of layers - symbolize layer - identify features - using of identify tool - hyperlink tool - zoom pan tools - map document saving (5)

GIS MAP

Layer attribute table - feature attribute relationship- creating map layout - making map layout in reverse - pinning down geographic data (5)

GEOGRAPHY STUDY

Vector and raster data - geographic data work with item description - query based on attributes and locations - analyze data using buffer and overlay - applying gis analysis process (5)

Total : 15

TEXT BOOKS

1. *Floyd F.Sabins, J.R., WH, "Remote Sensing Principles Interpretation", Freeman and Company and Francis Company, France, 1996.*
2. *Lillesand, Thomas.M and Raiph W.Kiefer, "Remote Sensing and Image Interpretation", John Wiley Sons, 2002.*

REFERENCES

1. *Burrough.P.A., "Principles of GIS for Land Resources Assesment, Oxford Publication, 1998.*
2. *Thomas.M.Lillesand and Ralph.W.Kiefer, Remote Sensing and Image Interpretation, John Wiley and Sons, Inc, 2003.*

19MCOC04 - SUSTAINABLE ARCHITECTURE

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

At the end of the course, the student will be able to:

CO1 : Understand the concept of sustainable architecture.

CO2 : Analyze Impact and perform energy audit for the building

CO3 : Apply the various water and waste management sustainable methodology.

SUSTAINABLE CONCEPTS - PEOPLE, ENVIRONMENT AND BUILDING

Introduction -sustainable development goals- Components and factors governing sustainable development- Relationship between people and environment, impact of people on environment and vice versa, extent of the energy and environmental crises facing the world, Need for implementing energy efficiency on an international, national and individual basis in the context of the building industry & environmental issues. Introduction to Indoor environment - spatial environment, Thermal environment, visual environment, sonic environment and olfactory environment. (5)

ENERGY AUDIT & ENVIRONMENTAL IMPACT ASSESSMENT

General Aspects of Energy Management & Energy Audit. Energy Efficiency in Thermal Utilities and Energy Efficiency in Electrical Utilities , Energy Performance Assessment for building envelope, fenestration and embodied energy.- Introduction and components such as physical, biological and socio-economical of Environmental impact assessment (EIA) in India based on the Environmental Protection Act (EPA), 1986 , Ministry of Environment and Forest (MoEF) January 1994 for Environmental Clearance (EC) known as EIA Notification, 1994 (5)

WASTE UTILIZATION & MANAGEMENT, WATER AND BUILT FORMS

The primary goal is to provide a comprehensive understanding of waste management from an environmental public health perspective. Sustainable techniques in municipal solid waste management. Recycling and Reuse. Energy development and Management of urban waste services.- water demand, growing water misuse, pollution, threat to environment, social implications, sustainability of water recourses, ground water management, issues related to urban water supply. (5)

Total : 15

TEXT BOOKS

1. *Jacqueline Hoyer, Wolfgang Dickhaut, Lukas Kronawitter, Björn Weber "Water Sensitive Urban Design": Principles and Inspirations for Sustainable Storm water Management in the City of theFuture, ISBN 978-3-86859-106-4 03. 2011.*
2. *S. BrySarte, "Sustainable Infrastructure The Guide to Green Engineering and Design", Publisher: Wiley, ISBN: 978-0470453612, September 2010.*

REFERENCES

1. *Baker Nick and Steamers Koen, "Energy and Environment in Architecture", E & FN Spon, London, 1999.*
2. *Goulding, John, R., Lewis, Owen, J., and Steemers, Theo, C, "Energy in Architecture", Bastford Ltd., London, 1986.*
3. *Givoni, B., "Man, Climate and Architecture", Elsevier, Amsterdam, 1986*
4. *MoncefKrtati, "Energy Audit of Building Systems: an Engineering approach" CRC Press, LLC, Florida 2000.*