DEENBANDHU CHHOTU RAM UNIVERSITY OF SCEINCE & TECHNOLOGY, MURTHAL

SONEPAT

SCHEME OF STUDIES & EXAMINATIONS

M.Tech in CIVIL ENGINEERING (Structural Engineering) Ist Semester

Credit based Scheme 2013-14

SN	Course Code	Course Title	Teaching Schedule		Sessional Marks	Examination Marks		Total	Credit	Duration of Examination
			L	P		Theory	Practical			
1.	CES 501	Advanced Structural Analysis	4	-	25	75	-	100	4	3
2.	MEM 503	Numerical and Optimization Method	4	-	25	75	-	100	4	3
3.	CES 505	Advanced Concrete Technology	4	-	25	75	-	100	4	3
4.	CES 507	Dynamics of Structures	4	-	25	75	-	100	4	3
5.	CES 509	Computer Aided Design Methods	4	-	25	75	-	100	4	3
6.	CES 511	Advanced Concrete Technology Lab	-	3	20	-	30	50	1.5	3
7.	MEM 513	Numerical & Optimization Lab	-	3	20	-	30	50	1.5	3
		Total	20	6	165	375	60	600	23	

Note: Students will be allowed to use Non-Programmable Scientific Calculator. However, sharing of calculator will not be permitted in the examination.

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SCHEME OF STUDIES & EXAMINATIONS

M.Tech in CIVIL ENGINEERING (Structural Engineering) IInd Semester

Credit based Scheme 2013-14

SN	Course Code	Course Title	Teaching Schedule		Sessional Marks	Examination Marks		Total	Credit	Duration of Examination
			L	P		Theory	Practical			
1.	CES 502	Theory of Plates & Shells	4	-	25	75	-	100	4	3
2.	CES 504	Prestressed Concrete Structures	4	-	25	75	-	100	4	3
3.	CES 506	Structural Stability	4	-	25	75	-	100	4	3
4.		Elective - I	4	-	25	75	-	100	4	3
5.		Elective - II	4	-	25	75	-	100	4	3
6.	CES 508	CAD in Structural Engineering	-	3	20	-	30	50	1.5	3
		Total	20	3	145	375	30	550	21.5	

Elective - I		**Elective - II**	
CES 510	Advanced Concrete Structures	CES 520	Random Vibrations and Structural Reliability
CES 512	Advanced Solid Mechanics	CES 522	Expert System in Civil Engineering
CES 514	Design of Tall Buildings	CES 524	Advanced Foundation Engineering
CES 516	Finite Element Method	CES 526	Probabilistic Methods in Civil Engineering
CES 518	Disaster Mitigation & Management	CES 528	Construction and Maintenance Management

Note:

1. Students will be allowed to use Non-Programmable Scientific Calculator. However, sharing of calculator will not be permitted in the examination.
2. The choice of students for any elective shall not be binding on the department.

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SCHEME OF STUDIES & EXAMINATIONS

M.Tech in CIVIL ENGINEERING (Structural Engineering) IIIrd Semester

Credit based Scheme 2013-14

S N	Course Code	Course Title	Teaching Schedule		Sessional Marks	Examination Marks		Total	Credit	Duration of Examination
			L	P		Theory	Practical			
1.	CES 601	Bridge Engineering	4	-	25	75	-	100	4	3
2.	CES 603	Advanced Structural Design & Detailing	4	-	25	75	-	100	4	3
3.		Elective III	4	-	25	75	-	100	4	3
4.	CES 605	Project	-	3	50	-	50	100	3	-
5.	CES 607	Seminar	-	2	50	-	-	50	2	-
6.	CES 609	Dissertation Phase I	-	6	100	-	-	100	6	
		Total	12	11	325	225	50	550	23	

Elective III	
CES 611	Composite Materials
CES 613	Design of Offshore Structures
CES 615	Non Destructive Testing of Materials
CES 617	Failure Analysis of Structures

Note:

1. Students will be allowed to use Non-Programmable Scientific Calculator. However, sharing of calculator will not be permitted in the examination.
2. The choice of students for any elective shall not be binding on the department.
3. Dissertation coordinator will be assigned the load of 1 hrs per week excluding his own guiding load. However, the dissertation guiding teacher will be assigned a load of one hr per candidate per week subject to the maximum of two period of teaching load irrespective of number of students/groups under him/her.

DEENBANDHU CHHOTU RAM UNIVERSITY OF SCEINCE & TECHNOLOGY, MURTHAL

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SCHEME OF STUDIES & EXAMINATIONS

M.Tech in CIVIL ENGINEERING (Structural Engineering) IVth Semester

Credit based Scheme 2013-14

SN	Course Code	Course Title	Teaching Schedule		Sessional Marks	Examination Marks		Total	Credit	Duration of Examination
			L	P		Theory	Practical			
1.	CES 602	Dissertation	-	20	50	-	100	150	20	3
		Total	-	20	50	-	100	150	20	

Note:

1. Dissertation coordinator will be assigned the load of 1 hrs per week excluding his own guiding load. However, the dissertation guiding teacher will be assigned a load of one hr per candidate per week subject to the maximum of two period of teaching load irrespective of number of students/groups under him/her.

CES-501 ADVANCED STRUCTURAL ANALYSIS

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

Unit I

Review of basic concepts in structural analysis: structure (structural elements, joints and supports, stability, rigidity and static indeterminacy, kinematic indeterminacy); loads (direct actions, indirect loading); response (equilibrium, compatibility, force-displacement relations); levels of analysis; analysis of statically determinate structures (trusses, beams, frames); applications of principle of virtual work and displacement-based and force-based energy principles; deriving stiffness and flexibility coefficients; Review of Force methods: Statically indeterminate structures (method of consistent deformations; theorem of least work); Review of Displacement Methods: Kinematically indeterminate structures (slope-deflection method; moment distribution method).

Unit II

Matrix concepts and Matrix analysis of structures:Matrix; vector; basic matrix operations; rank; solution of linear simultaneous equations; eigen values and eigenvectors.Introduction; coordinate systems; displacement and force transformation matrices; Contra-gradient principle; element and structure stiffness matrices;Element and structure flexibility matrices; equivalent joint loads; stiffness and flexibility approaches.

Matrix analysis of structures with axial elements: Introduction: Axial stiffness and flexibility; stiffness matrices for an axial element (two dof), plane truss element (four dof) and space truss element (six dof);One-dimensional axial structures: Analysis by conventional stiffness method (two dof per element) and reduced element stiffness method (single dof); Analysis by flexibility method;Plane trusses: Analysis by conventional stiffness method (four dof per element) and reduced element stiffness method (single dof); Analysis by flexibility method; Space trusses: Analysis by conventional stiffness method (six dof per element) and reduced element stiffnessmethod (single dof).

Unit III

Matrix analysis of beams and grids:Conventional stiffness method for beams: Beam element stiffness (four dof); generation of stiffness matrix for continuous beam; dealing with internal hinges, hinged and guided-fixed end supports; accounting for shear deformations; Reduced stiffness method for beams: Beam element stiffness (two dof); dealing with moment releases, hinged and guided-fixed end supports; Flexibility method for fixed and continuous beams: Force transformation matrix; element flexibility matrix; solution procedure (including support movements); Stiffness method for grids: Introduction; torsional stiffness of grid element and advantage of torsion release; analysis by conventional stiffness method using grid element with six dof; analysis by reduced stiffness method (three dof per element)

Unit IV

Matrix analysis of plane and space frames: Conventional stiffness method for plane frames: Element stiffness (six dof); generation of structure stiffness matrix and solution procedure; dealing with internal hinges and various end conditions; Reduced stiffness method for plane frames: Element stiffness (three dof); ignoring axial deformations; dealing with moment releases, hinged and guided-fixed end supports; Flexibility method for plane frames: Force transformation matrix; element flexibility matrix; solution procedure (including support movements); Ignoring axial deformations; Stiffness method for space frames: Introduction; element stiffness matrix of space frame element with 12 dof and 6 dof; coordinate transformations; analysis by reduced stiffness method (six dof per element);

Analysis of elastic instability and second-order effects: Effects of axial force on flexural stiffness: Review of buckling of ideal columns; flexural behaviour and stiffness measures for beam-columns - braced and unbraced, under axial compression; Solution by slope deflection method: Slope deflection equations for prismatic beam columns using stability functions; modifications for pinned and guided-fixed-end conditions; fixed-end moments in beam-columns; Solution by matrix method: Stiffness matrix for prismatic beam-column element; estimation of critical elastic buckling loads; second-order analysis

References

1. Analysis of Framed Structures J.M. Gere & W. Weaver
2. Structural Analysis G.S. Pandit & S.P.Gupta

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-503 NUMERICAL & OPTIMIZATION METHODS

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

UNIT-I

ERRORS IN NUMERICAL CALCULATIONS: Introduction, Numbers and their accuracy, Absolute, relative and percentage errors and their analysis, General error formula.

INTERPOLATION AND CURVE FITTING: Taylor series and calculation of functions, Introduction to interpolation, Lagrange approximation, Newton Polynomials, Chebyshev Polynomials, Least squares line, curve fitting, Interpolation by spline functions.

UNIT-II

NUMERICAL DIFFEERENTIATION AND INTERGRATION: Approximating the derivative, Numerical differentiation formulas, Introduction to Numerical quadrature, Newton-Cotes formula, Gaussion-Quadrature

Solution of Linear systems and nonlinear equations: Direct Methods, Gaussian elimination and pivoting, Matrix inversion, UV factorization, iterative methods for linear systems, Bracketing Methods for locating a root, Initial approximations and convergence criteria, Newton-Raphson and Secant methods

UNIT-III

SOLUTION OF DIFFERENTIAL EQUATIONS: Introduction to differential equations, Initial value problems, Euler's methods, Runge-Kutta methods, Taylor series methods, Predictor-Corrector methods, Finite-difference method

PARTIAL DIFFERENTIAL EQUATIONS, EIGEN VALUES AND EIGEN VECTORS: Solution of hyperbolic, parabolic and elliptic equations, eigen value problem, Power and inverse power methods, Jacobi's method for eigen value problems.

UNIT-IV

OPTIMIZATION METHODS: Optimal problem formulation, Engineering optimization problems; optimization algorithms: Single-Variable optimization algorithms, optimality criteria, Bracketing methods, Region-elimination methods, Point estimation method,

MULTI-VARIABLE OPTIMIZATION ALGORITHMS: Optimality criteria, Uni-directional search, Direct search methods: Evolutionary methods, Simplex search method, Gradient based methods: Cauchy's method, Application to Mechanical Engg. Problems, Non-traditional optimization algorithms, Genetic algorithms (GA), GA for constrained optimization, other GA operators, Multi objective Optimization, Concept of Pareto Optimality, Global optimization.

References:

1. Numerical Methods for Mathematics, Science and Engineering by John H.Mathews, PHI New Delhi.
2. Applied Numerical Methods-Carnahan, B.H. Luthar, H.A. and Wilkes, J.O., Pub.-J. Wiley, New York.
3. Numerical Solution of Differential Equations, by M.K. Jain,Published by Wiley Eastern, New York.
4. Introductory Methods of Numerical Analysis by S.D. Sastry, Published by Prentice Hall of India.
5. Numerical Methods-Hornbeck, R.W., Pub.-Prentice Hall, Englewood Cliffs, N.J.
6. Optimization for Engineering Design: Algorithms and Examples by Kalyanmoy Deb, PHI New Delhi.
7. Numerical Optimization Techniques for Engineering Design: With Applications by Garret N. Vanderplaats, Mcgraw Hill Series in Mechanical Engineering.
8. Genetic Algorithms and Engineering Optimization by Mitsuo Gen, Runwei Cheng, John Wiley & Sons.
9. Global Optimization in Engineering Design, by Ignacio E. Grossmann, Kluwer Academic Publisher.

10. Optimization Concepts and Applications in Engineering, by Ashok D. Belegundu, Tirupathi R. Chandrupatla, Cambridge University Press, USA

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-505 ADVANCED CONCRETE TECHNOLOGY

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

STUDENTS CAN USE RELEVANT INDIAN STANDARDS PUBLISHED BY BUREAU OF INDIAN STANDARD

UNIT-I

Aggregates classification-Testing Aggregates, fibres. Cement, grade of Cement, Chemical composition, Hydration of Cement, Structure of hydrated Cement, Special Cement, Water, Chemical and Mineral Admixtures.

Principles of Concrete mix design, methods of Concrete mix design, Design of high strength and high performance concrete, Indian Standard Method, American Concrete Institute Method, British Standard Method

UNIT-II

Rheological behaviour of fresh Concrete-Properties of fresh and hardened concrete-Strength, Elastic properties, Creep and Shrinkage, Variability of concrete strength. Effects of age, aggregate content, and its shape, richness of mix, curing on Strength of Concrete, autogenous healing, tensile and flexural strength of concrete, maturity of concrete

UNIT-III

Modern trends in concrete manufacture and placement techniques, Methods of transportation, Placing and curing-extreme whether concreting, Special concreting methods, Vacuum dewatering of concrete-Under water concreting, Non destructive testing and quality control.

UNIT-IV

Durability of Concrete; Permeability of Concrete, Sulphate attack, Corrosion of rebar, Carbonation; freezing and thawing, Fire resistance of concrete

References

1. Krishnaraju, N., Advanced Concrete Technology, CBS Publishers, 1985.
2. Nevile, A.M., Concrete Technology, Prentice Hall, Newyork, 1985.
3. A.R. Santhakumar, : Concrete Technology" Oxford Univeersity Press, 2006
4. Metha P.K. & Montevio P.J.M., Concrete Microstructure, properties and Matrials", Published by Indian Concrete Institute, Chennai, 2005.
5. Krishnaraju N. "Design of Concrete Mixes" CBS Publishers

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-507 DYNAMICS OF STRUCTURES

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

UNIT-I

Introduction to Dynamic analysis-Elements of vibratory systems and simple Harmonic Motion-Mathematical models of SDOF systems-Principle of Virtual displacements-Evaluation of damping resonance.

UNIT-II

Fourier series expression for loading-(blast or earthquake) – Duhamel's integral-Numerical methods-expression for generalised system properties-vibration analysis Rayleigh;s method-Rayleigh-Ritz method.

UNIT-III

Evaluation of structural property matrices-Natural vibration-Solution of the Eigen value problem-Iteration due to Holzer and Stodola.

Idealisation of multi-storeyed frames –analysis to blast loading-Deterministic analysis of earthquake response-lumped SDOF system.

UNIT-IV

Differential equation of motion-Beam flexure including shear deformation and rotator inertia-vibration analysis using finite element method for beams and frames.

References

1. Mario Paz, and William Leigh, Structural Dynamics, CBS, Publishers, 1987.
2. Roy Craig, Jr. Structural Dynamics, John Wiley & Sons, 1981.
3. A.K. Chpora "Dynamics of Structures Theory and Application to Earthquake Engineering" Pcarson Education, 2001.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-509 COMPUTER AIDED DESIGN METHODS

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

Unit- I

Introduction to CAD and its scope simple description of computer hardware.

- Micro, mini etc.
- Memory, processor
- Peripheral devices-disks, printer. Video terminals. Graphic floater, graphic screen digitizer.

Computer Graphics: introduction, point plotting techniques, line drawing displays, two-three dimensional transformation, clipping and windowing, segmentation geometric modelling. Data base management, storing and retrieving of data.

Unit-II

Three dimensional graphics, curves and surfaces, hidden surface elimination, shading.
Graphic input devices. Graphic input technique, input functions. Raster graphic fundamentals, interactive raster graphics, raster graphic systems.

Unit-III

Computer aided linkage displays and systhesis, interactive acceleration analysis.
Appreciation of graphic packages. Matrix methods of structural analysis and associated computer programme assembly of matrices. Solution of equilibrium equations. Flow charts. Typical charts. Typical listing as illustrations.

Unit-IV

Introduction to interactive computer programme for the design detailing of simple structural elements: RCC slab, beams, columns, isolated footings etc.
Steel typical members and connections.

References:

1. Principles of interactive computer graphics by William M. Newman & Robert F.Sproul.
2. Programming in Finite Element by Hunton and owan.
3. Principles of Computer Aided design by Joe Rooney & Philips Steadman.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-511 ADVANCED CONCRETE TECHNOLOGY LAB

L	P	Credits			
	03	1.5	Class Work	:	20 Marks
			Examination	:	30 Marks

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1. **Mix proportioning of concrete as per IS;ACI and BS methods**
2. **Aggregate testing**
3. **Cement Testing**
4. **Effects of admixtures**
5. **Admixture side effects**
6. **Non-destructive testing**
7. **Determination of tensile, compressive and flexural strengths of concrete**

Note:-The students will be required to carry out the ----- experiments / exercises from the above list and any other two experiments either from the above list or designed by the department based on the theory course (**Course Code Course Name)**

CES-513 NUMERICAL & OPTIMIZATION LAB

L	P	Credits			
	03	1.5	Class Work	:	20 Marks
			Examination	:	30Marks

The students will be required to carry out the following exercise, that are based on the theory course CED-501, Numerical & Optimization Methods, with the help of MatLab/C/C++software, on personal computer.

List of exercises:

1. Write a programme that finds the solution of an equation in single variable using the method of successive bisdection.
2. Write a programme that finds the solution of non-linear equation in single variable using the Newton Raphson/Secant.
3. Write a programme that finds the solution of a system of simultaneous algebraic equations using the Gaussian elimination procedure.
4. Write a programme that finds the solution of a system of simultaneous algebraic equations using the Gauss-Seidel iterative method.
5. Write a programme that finds the numerical solution of an ordinary differential equation using the Euler's method.
6. Write a programme that finds the numerical solution of an ordinary differential equation using the Predictor-corrector method.
7. Write a programme that finds the numerical solution of an ordinary differential equation using the Predictor-corrector method.
8. Write a programme that finds the numerical solutions of Elliptic, Parabolic and Hyperbolic partial differential equations using the method of Finite Differences.
9. Write a programme that finds the minimum point of a single variable function in a specified interval using golden section search algorithm.
10. Write a programme that finds the minimum point of a multi variable function using Cauchy's steepest descent algorithm.
11. Write a programme that finds the minimum point of a constrained optimization problem using penalty function method.
12. Write a programme that finds the optimum point of a constrained optimization problem using genetic algorithm.

Note:-The students will be required to carry out the ----- experiments / exercises from the above list and any other two experiments either from the above list or designed by the department based on the theory course (**Course Code Course Name)**

CES-502 THEORY OF PLATES & SHELLS

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

UNIT-1

Simple bending of plates-Assumption in thin plate theory-Different relationships-Different Boundary Conditions for plates-Plates subjected to lateral loads-Navier's method for simple supported plates-levy's method for general plates-Example problems with different types of loading.

UNIT-II

Circular plates subjected to Axi-symmetrical loads-concerned load, uniformly distributed load and varying load-Annular plate with end moments.

Rayleigh –Ritz method – Application to different problems-Finite difference method-Finite element methodology for plates-Orthotropic Plates

UNIT-II

Bending of anisotropic plates with emphasis on orthotropic plates-Material Orthotropy-Structural Orthotropy-Plates on elastic foundation.

UNIT-IV

Shells-Classification of shells-Membrane and bending theory for singly curved and doubly curved shells-Various approximations-Analysis of folded plates.

References

1. Rudolph Szilard, Theory and Analysis of Plates, Prentice Hall, New Jercy 1986.
2. Stephen P. Timoshenko & Woinowsky Krieger, Theory of Plates and Shells, Mc Graw Hill, 1984.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-504 PRESTRESSED CONCRETE STRUCTURES

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

STUDENTS CAN USE RELEVANT INDIAN STANDARDS PUBLISHED BY BUREAU OF INDIAN STANDARD

UNIT-I

Principles of prestressing-Materials of prestressing-Systems of prestressing-Loss of prestress-Deflection of Prestressed Concrete members.

UNIT-II

Slabs-Pre-tensioned and Post-tensioned beams-Design for flexure, bond and shear –IS code provisions-Ultimate flexural and shear strength of prestressed concrete sections-Design of end anchorate zones using IS code method.

UNIT-III

Composite beams-Analysis and design. Partial prestressing-non –prestressed reinforcements. Analysis of Continuous beams-cable layout-Linear transformation-Concordant cables.

UNIT-IV

Design of compression members and tension members. Circular prestressing-Water tanks-Pipes –Analysis and design-IS Codal privisions.

References

1. Lin.T.Y., Burns, N.H., Design of Prestressed Concrete Structures, John Wiley & Sons, 1982.
2. Raja Gopalan N. Prestressed Concrete, Narosa Publishing House, New Delhi, 2002.
3. Krishnaraju N. Prestressed Concrete Tata McGraw Hill

4. Note:

5. 1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.

6. 2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-506 STRUCTURAL STABILITY

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

UNIT-1

Buckling of columns-introduction-concepts of stability-methods of Neutral Equilibrium-Euler column-Eigen value problem-Axially loaded column-Eccentrically loaded column.

UNIT-II

Energy principle –Raleigh Ritz method-Galerkin method –Munerical methods (New mark's difference and matrix methods)

Beams and Beam columns-introduction-lateral buckling of beams-beam column with concentrated and distributed loads-effect of axial load on bending stiffnes

UNIT-III

Buckling of frames-introduction –modes of buckling-critical load using various methods. Neutral equilibrium-slope deflection equations, matrix method.

UNIT-IV

Buckling plates-Differential equation of plate buckling –critical loan on plates for various boundary conditions-Energy method-Finite difference method.

References

1. Timoshenko and Gere. Theory of elastic stability, McGraw Hill Book Company, 1981
2. Alexandar Chajes, Principles of Structural Stability Theory, Prentice Hall, New Jersey, 1980
3. Iyender, N.G.R. Structural Stability of columns and plates, Affiliated East west press Pvt Ltd., 1990.
4. Bleich F.Buckling Strength of metal structures, McGraw Hill 1991.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-508 CAD IN STRUCTURAL ENGINEERING

L	P	Credits			
	03	1.5	Class Work	:	20 Marks
			Examination	:	30Marks

Computer Aided Drafting –Basic 2D objects-line, polyline, circle, ellipse-Dimensioning-Preparation of plan, elevation and section drawings of simple structural objects-Introduction to 3D-DBMS concepts-Civil Engg. Databases-Data entry & Reports. Spreadsheet concepts-Worksheet calculations in Civil Engineering-Regression & Matric Inversion.

Development of C programs to solve problems using numerical techniques

1. Roots of an equation using Newton-Raphson method.
2. Solution of linear simultaneous equations using Gauss elimination.
3. Matrix inversion using GJ method
4. Linear regression line of given points.
5. Curve fitting using Polynomial Regression.
6. Eigen value extraction power method.

Matrix methods of structural analysis and associated computer programme assembly of matricesComputer methods of structural analyzsis-Finite Element programming

Analysis and Design through application packages. Design of steel and RC Structural elements.

References

1. Rajaraman, V., Computer Oriented Numerical Methods, Prentice-Hall of India, 2004.

Note: The students will be required to carry out the ----- experiments / exercises from the above list and any other two experiments either from the above list or designed by the department based on the theory course (**Course Code Course Name)**

CES-510 ADVANCED CONCRETE STRUCTURES

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

STUDENTS CAN USE RELEVANT INDIAN STANDARDS PUBLISHED BY BUREAU OF INDIAN STANDARD

UNIT-1

Design of water Tanks; circular; rectangular; underground, surface and OHSR, using working stress and Limit State Method

UNIT-II

Bunkers & Silos; Janssen's theory; Airy's Theory; Bunkers with sloping bottom, high side wall, Battery of Bunkers with low and high side walls

UNIT-III

Reinforced Concrete chimneys, Reinforced Concrete Cooling Towers

UNIT-IV

Introduction of Design of machine foundation in concrete

References:

1. Structural Engineers Handbook.
2. Jaikrishna & Jain OP, "Plain and Reinforced Concrete, Nem Chand & Brothers, Roorkee
3. Varghese P C "Advanced Reinforced Concrete Design" Prentice Hall India
4. Dayaratnam P "Reinforced Concrete Structures", Oxford and IBH Publisher

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-512 ADVANCED SOLID MECHANICS

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

Unit I

Linear elasticity; Stress; Principal Stress and Principal Planes; Stress Tensor; Spherical and Deviational Stress tensor; Equation of Equilibrium; Transformation of Stresses; Transformation Equations; Mohrôs Circle

Unit II

Types of strains, strain displacement relation; Properties of Strain Tensor; Small Strains and Elasticity; Rotations of Axes, Transformation Equations for Strains; Strain Rosettes; Compatibility concept and significance Stress strain relations; Generalized Hookeôs Law; Relation among Elastic Constants; theories of failures; Tresca condition; Von-Mises Condition; Displacement Equations of Equilibrium

Unit – III

Beams and bending; stresses under bending; straight beams and asymmetrical bending; Bernouli hypothesis; centre of flexure; bending of curved beams; deflection of thick curved bars

Unit – IV

Boundary conditions; Description of an elastic problem as a boundary value problem; Plain stress, strain, axi-symmetric problems, large displacements and large strains

Cartesian, cylindrical and spherical coordinates; Introduction to curvilinear coordinates, thermal strains Introduction to plasticity; yield condition; ideal elasto-plastic material; complete formulation for an elasto-plastic problem

References:

1. Timoshenka S.P. and J N Goodier, ñTheory of Elasticityò, McGraw Hill
2. Calladine CR, ñPlasticity for Engineersò, Ellis Herwood
3. Srinath LS ñAdvanced Mechanics of Solidsò, Tata McGraw Hill

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-514 DESIGN OF TALL BUILDINGS

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

UNIT-I

Design philosophy –Loading –Sequential loading, materials.

High risk behaviour, Rigid frames, braced frames, infilled frames, shear walls, coupled shear walls, wall –frames, tubular, cores, futrigger-braced and hybrid mega system.

UNIT-II

Approximate Analysis, Accurate Analysis and Reduction Techniquest-Analysis of building for member forces-drift and twist –Computerised general three dimensional analysis.

UNIT-III

Structural elements-design, deflection, cracking, prestressing, shear flow-design for differential movements, creep and shrinkage effects, temperature effects and fire.

UNIT-IV

Overall buckling analysis of frames, wall-frames-second order effects of gravity of loading-simultaneous first order and P-delta analysis Translational –torsional instability, out of plum effects.

References

1. Bryan Stafford smith and Alex coull, Tall Building Structures-Analysis and Design, John Wiley & sons, 2006.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-516 FINITE ELEMENT METHOD

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

UNIT-I

Differential equilibrium equations-strain displacement relation-linear constitutive relation-special cases-Principle of stationary potential energy-application to finite element methods. Some numerical techniques in finite element Analysis.

UNIT-II

Displacement models-convergence req uirements. Natural coordinate systems-Shape function. Interpolation function-Linear and quadratic elements-Lagrange & Serendipity elements-Strain displacement matrix-element stiffness matrix and nodal load vector.

UNIT-III

Two dimensional isoparametric elements-Four noded quadrilateral elements-triangular elements-Computation of stiffness matrix for isoparametric elements-numerical integration (Gauss quadrature)-Convergence criteria for isoparametric elements.

Assemblage of elements-Direct stiffness method-Special characteristics of stiffness matrix-Boundary condition & reaction-Gauss elimination and LDLT decomposition-Basic steps in finite element analysis.

UNIT-IV

Analysis of framed Structure-2D truss element-2D beam element. Analysis of plate bending: Basic theory of plate bending-displacement functions-plate bending Elements. Plane stress and plane strain analysis: Triangular elements-Rectangular elements

References

1. Krishnamoorthy, C.S. Finite Element Analysis Theory & Programming, McGraw-Hill, 1995.
2. Desai C.S. and Abel, J.F. Introduction to the finite element Method, Affiliated East west Press Pvt. Ltd. New Delhi 2000.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-518 DISASTER MITIGTAION & MANAGEMENT

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

UNIT-I

Disaster Reduction; Earthquake resistant design of structures, Response spectra and design earthquake parameters, Principles and philosophies, Codal provisions, Factors affecting damage to structure, Enforcement of codal provisions, Strong motion instrumentation and data processing, Effective rescue operation, General planning and design aspects, Conventional earthquake resistant design, Seismic base isolation method, retrofitting, Training and lecturing at various levels, Preparedness to meet earthquake disaster, Programmes for public awareness, demonstrations and exhibitions, information management (Safety, emergencies, management and planning, design, response, user experience problems and case studies), proper land use practices, long term disaster preparedness measures.

UNIT-II

Precautions after a major earthquake, preparedness for medical supply Emergency care (First aid, Home remedies), Disposal of dead bodies (Human and Cattle), Care for old and orphans.

Indirect Damages; Damage due to ground failures, Landslides, rockslides, liquefaction, fire, floods, tsunamis, release of hazardous material like pcisonous gas, nuclear radiation.

UNIT-III

Disaster Management; Management cell, Central crisis management core group, damage reconnaissance, Management of relief and rehabilitation (Infrasture rehabilation, Housing rehabilation, Social rehabilation), Role of volunteers, Emergency operation centres, Information system, Danger zone restrictions, Cooperation with local authority, Coordination for international relief, Role of Government, NGO's, Business and donors, Role of remote sensing in relief operations, Information management and related technologies in engineering and disaster management.

UNIT IV

The Design and management of Disaster Information Resource Network, Asian Disaster Preparedness Centre, Regional data base, Contacts and Sources, CD-ROM Library for Natural Disaster Management, Regional Disaster Documentation Centre, Non Governmental Organisations.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-520 RANDOM VIBRATIONS AND STRUCTURAL RELIABILITY

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

UNIT-I

Review of probability space, random variables, functions of random variables, sequence of random variables and limit theorems for sums, products and extremes.

UNIT-II

Review of random processes: stationarity, ergodictiy, power spectrum and auto covariance. Calculus of random processes.

UNIT-III

Input-output relations for linear systems. Stochastic steady state. Level crossing and first passage problems. Extreme value distributions.

UNIT-IV

Reliability index based analysis: FORM and SORM. Monte Carlo simulations and variance reduction. Reliability of existing structures.

References

1. NC Nigam, 1983, Introduction to random vibrations, MIT Press, Boston.
2. A Papoulis, 1993, Probability, random variables and stochastic processes, McGraw-Hill, NY.
3. RE Melchers, 1999, Structural reliability analysis and prediction, John Wiley, Chichester.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-522 EXPERT SYSTEM IN CIVIL ENGINEERING

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

Introduction; History of expert system research e.g. aquittance with researchers and their research fields. Current research activities. Conventional programs vs. Expert Systems Advantages and limitations of expert systems. Architecture of an expert system; Components of expert system; Knowledge base, Inference mechanism; User Interface

UNIT-II

Knowledge base; Knowledge Engineering; Nature of expert knowledge; Knowledge acquisition and knowledge representative e.g. rule based systems, Semature nets, frames, Validity nature base, working memory

UNIT-III

Inference Engine and user interface, techniques for inference mechanism, forward chaining and backward chaining. Interface language, terminal interface.

UNIT-IV

Development of expert systems; Problem formulation, Search spaces, Task for expert system, application to engineering analysis and design, consideration, operations representative application in Civil Engg.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-524 ADVANCED FOUNDATION ENGINEERING

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

UNIT-1

Criteria for foundation choice, bearing capacity, total and differential settlement, tolerance for various types of structures. Interpretation of soil profile for design parameters like Modulus of compressibility, modulus of sub grade reaction. Poisson ratio etc.

UNIT-II

Raft foundations for buildings and tower structures including effects of soil structure interaction and non-linearity, different types of rafts and, methods of analysis, precautions for construction of shallow foundations

UNIT-III

Pile foundations, types, method of installation codal practices for permissible loads under vertical and lateral loads, Diaphragm walls, design and construction, foundations for heavy structures.

UNIT-IV

Well and caisson foundations, Equipment foundation subjected to dynamic loads. Underground structures, strategies for instrumentation and monitoring of foundation performance.

References

Foundation analysis and design-Bowles, J.E.

Foundation engg-Pech, Hansen and Thornburn.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-526 PROBABILISTIC METHODS IN CIVIL ENGINEERING

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

Unit ï I

Introduction: Role of Probability in Civil Engineering Problems; Examples.

Random Events: Definition of basic random events; Application of set theory in definition of composite even operations; Probability of events and definition of probability axioms; Solution of real life examples from civil engineering.

Random Variables: Definition of random variables - discrete and continuous; Probability definitions - PMF, PDF, CDF; Moments and expectations.

Unit -II

Functions of Random Variables: Definition of probability distributions of functions of single random variables ï exact methods and approximate methods; Moments and expectations of functions - direct and indirect methods.

Multiple Random Variables: Definition of joint, marginal, and conditional probability distributions; Definitions of moments and expectations, including the definition of correlation coefficient; Functions of multiple random variables.

Unit III

Common Probability Models: Discrete random variables ï binomial distribution, Poissonôs distribution; Continuous random variables ï exponential distribution, gamma distribution; Central limit theorem; Normal and lognormal distributions; External distributions.

Unit -IV

Statistics and sampling: Goodness of fit tests; regression and correlation analyses; estimation of distribution parameters from statistics; Hypothesis testing and significance; Bayesian updating of distributions.

References:

1. Papoulis, A, and S. U. Pillai (2002), Probability, Random Variables and Stochastic Processes, McGraw-Hill, New York.
2. Richard A. Jonson and C. B. Gupta (2005), Miller and Freundôs Probability and Statistics for Engineers, Pearson Education, Inc., United States.
3. L.S. Shrinath Linear Programming

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-528 CONSTRUCTION AND MAINTENANCE MANAGEMENT

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

UNIT-I

Services in Residential, Commercial and Medical buildings; Sanitation, water supply, electric wiring, rain water disposal, lighting & illumination, calculation methods for these services. Air Conditioning & Ventilation: Natural ventilation, control cooling systems, modern systems of air conditioning, ducting systems, different mechanical means of air conditioning. CCD-CS: General principles of transmission and passage of sound reverberation, absorption, reflection, acoustice materials and their co-efficiency, principles of good acoustic design. Thermal Insulation: Behavior of various building materials & thermal conductivity. Thermal insulation for air conditioned interior spaces, working out air conditioning loads for different spaces; Fire Safety Dye.

UNIT-II

Architectural controls and building beylaws: Role of building byelaws in a city, local byelaws and arthitectural controls, facade control and zoning plans.

UNIT - III

Regional planning: Understanding of physical, social and economical parameters for regional planning.

UNIT-IV

Landscaping: Forces of man and nature, their relationship and effect on shaping landscape, site analysis.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-601 BRIDGE ENGINEERING

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

UNIT-1

Introduction-definition and components of bridges. Layout and planning of bridges-classification, investigations for bridges, preliminary data collection, choice of type of the bridges, hydraulic design of bridges, traffic design of bridges.

UNIT-II

Analysis and design of superstructure of straight and curved bridge decks-loadings details, specification-reinforced concrete and steel decks. Decks of various types like slab, hollow and voided slab, beam and slam, box girder etc. Design of substructure-piers and abutments of different types. Analysis and design of foundations-shallow foundations (open Foundations), deep foundations-well foundations and caisson.

UNIT-III

Design and constructional aspects of foundations. Modern methods of construction of concrete and steel bridge-their impact on the analysis and the design. Introduction to analysis and design of long span bridges like suspension and cable stayed bridges.

UNIT-IV

Special aspects in analysis and design, based on construction methodology. Inspection and maintenance and rehabilitation of bridges.

References :

1. Bridge Deck analysis by Pama & Gusens
2. Bridge deck behaviour by Edward V. Humbly
3. Essentials of bridge engineering by D. Johnson Vector
4. Ponnuswamy S “Bridge Engineering”, McGraw Hill

5. **Note:**
6. 1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
7. 2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-603 ADVANCED STRUCTURAL DESIGN & DETAILING

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

USE OF INDIAN STANDARDS IS ALLOWED IN EXAMINATION

UNIT-I

Introduction to limit state method of design, provisions in the Indian standard codes for loading wind loads and seismic loads, design and detailing of concrete structures.

BIS Handbook for design, Examples of design using handbook SP-16.

UNIT-II

Design of Structures as per I.S. 1893 for Earthquake Resistant Design Construction.

Design and Detailing Requirements as per 4326-1993.

UNIT-III

Design and detailing of Earthen Buildings as per 13827-1993

Design and detailing of Masonry Structures as per I.S. 13828-1993

UNIT-IV

Design and Ductile Detailing of R.C.C. Structures of R.C.C. Structures as per I.S. 13920-1993

Repair and Seismic Strengthening of Building as per I.S. 13935-1993

References:

1. **Pillai and Menon, Reinforced Concrete Design**
2. **Jain, A.K. Reinforced Concrete, Limit State Method of Design.**
3. **Punmia, B.C. reinforced Concrete Structures, Vol-II.**
4. **B.I.S. Codes 1893, 4326, 13827, 13828, 13920, 13935**

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES611 COMPOSITE MATERIALS

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

UNIT-1

FIBRE REINFORCED CONCRETE: Properties of Constituent Materials, Mix Proportions, Mixing and Casting Procedures, Properties of Freshly mixed FRC, Mechanics and properties of Fibre reinforced concrete, Composite Material approach, Application of fibre reinforced concrete.

UNIT-II

FLY ASH CONCRETE: Classification of Indian Flyashes, Properties of Flyash, Reaction Mechanism, Proportioning of Flyash concretes, Properties of Flyash concrete in fresh and hardened state, Durability of flyash concrete.

UNIT-III

POLYMER CONCRETE: Terminology used in polymer concrete, Properties of constituent materials, Ploymer impregnated concrete, Polymer modified concrete, Properties and applications of polymer concrete and polymer impregnated concrete.

FERRO CEMENT: Constituent materials and their properties, Mechanical properties of fero cement, Construction techniques and application of ferro cement.

UNIT-IV

HIGH PERFORMANCE CONCRETE: Materials for high performance concrete, Supplementary cementing materials, Properties and durability of high performance concrete, Introduction to silica fume concrete, Properties and applications of silica fume concrete.

LIGHT WEIGHT CONCRETE: Properties of light weight concretes, Pumice concrete, Aerated cement mortars, No fines concrete, Design and applications of light weight concrete.

References:

1. Concrete Technology-A.M. Nevillie
2. Concrete Technology-M.L. Gambhir.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-613 DESIGN OF OFFSHORE STRUCTURES

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

UNIT-1

Materials and their behaviour under static and dynamic loads, allowable stresses, various design methods and codes, design consideration, design loads,

UNIT-II

Design of decking of template type steel structures, design of supporting legs, design of braces.

UNIT-III

Corrosion and other allowances, consideration of stress concentration, design of concrete platforms

UNIT-IV

Ingredient materials and protective measure, design of raft foundation, design of side walls, design of decking, design of composite structures.

Texts/References

1. Defnorske Veritas, Rules for the design, construction and inspection of fixed offshore structures, 1977.
2. Energy Department, U.K. , Guidance of Design and Construction of offshore Installation, 1974.
3. American Petroleum Institute, API RP-2A, Recommended Practice for Planning, Designing and constructing fixed offshore platforms, 1974.
4. Offshore Technology Conference Volumes, O.C. Zienkiewicz, R., Wlewis and K.G. Stagg, Numerical Methods in offshore Engineering, Wiley Interscience Publication, 1978.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
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CES-615 NON DESTRUCTIVE TESTING OF MATERIALS

L	P	Credits			
4	-	4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

Types of materials, tests and the variables involved, destructive and non-destructive testing correlation of properties obtained by NDT with the basic structure of matter and other properties: NDT of different materials by various techniques such as radiographic, sonic and ultrasonic, electric, soleoroscopic, microwave, eddy current penetrant, thermal optical, holographic etc., practical applications and advances in NDT.

TEXTS/Reference

1. J.F. Hinslay, Non-Destructive Testing, MacDonald and Evants, 1959.
2. H.B. Egerton, Non-Destructive Testing, Oxford University Press, 1969.
3. Kraukramer: Ultrasonic Testing of Materials, Springer-Verlag, 1969.
4. M.A. Novgoresky, Testing of Building Materials and Structures, Mir Publishers, 1973.
5. American Society of Metals: Handbook, Vol-II, Destructive Inspection and Quality Control, 1976

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-617 FAILURE ANALYSIS OF STRUCTURES

L	P	Credits			
4		4	Class Work	:	25 Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

UNIT-I

Causes of failure-Types of failure –why, what, how-durability of materials-Landmark case-Performance and shape inadequacy-statistics and reliability-life cycle assessment.

UNIT-II

Structural failure-materials and load effects-environment effect-Non-structural and structural repairs-Biocidal treatment and use of preservatives-deterioration or wood. Macro micro level failures-component and sub-system failures-failure theories-analytical models-cases and type of problem in components-safety evaluation.

UNIT-III

Structural systems-case studies-pin-jointed steel systems-rigid jointed frames-co ncrete walls arches-reinforced concrete beams and frames-shells-repair of concrete bridge and water retaining structures.

UNIT-IV

Bridge maintenance techniques-The refurbishment of buildings, legal responsibilities-Case studies-Definition of smartness-sensors-automatic and adaptive systems-smart components.

References

1. Rasnom, W.H., Building Failures, E&F, N. SPON Ltd., 1980.
2. Moskvin V, Concrete and Reinforced Structures-Deterioration and Protection, Mir Publishers, Moscow, 1980.

Note:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

CES-605 Project

L	P	Credits			
-	03	03	Class Work	:	50 Marks
			Examination	:	50 Marks
			Duration of Examination	:	3 Hours

A student will be required to take a problem related with the courses he has gone through in M.Tech. under a faculty member. He/she will submit the work done in the form of report with the certificate from his/her guide at the end of semester. The project will also be assessed by the external examiner and the student will make a presentation before the examiner.

CES-605 Seminar

L	P	Credits			
			Class Work	:	50 Marks
-	02	02			

The objective of this course is to provide a foundation for research work to the student. The student will get a topic from his/her supervisor. He/she will concentrate on the topic and will explore different aspects. He will make a presentation before a committee which will consist of

1. Chairperson
2. Supervisor and/ Co-supervisor
3. Faculty member nominated by the Chairperson preferably in Structural Engineering

The assessment will be based on the presentation and the report submitted by the student.

CES-609 DISSERTATION

L	P	Credits			
-	20	20	**Class Work**	:	**50 Marks**
			Examination	:	**100 Marks**
			Total	:	**150 Marks**
			Duration of Examination	:	**3 Hours**

The dissertation started in III Semester will be completed in IV Semester and will be evaluated in the following manner.

Internal Assessment

Internal Assessment (class work evaluation) will be effected as per ordinance through interim report, presentation and discussion thereon by the following committee of three persons:

Chairperson of Department	: Chairperson
M Tech Coordinator/ Sr Faculty	: Member Secretary
Respective dissertation supervisor	: Member

External Assessment

Final dissertation will be assessed by a panel of examiners consisting of the following:

Chairperson of Department	: Chairperson
Respective Supervisor(s)	: Member(s)
External expert	: To be appointed by the University

Note: The External Expert must be from the respective area of specialization. The chairperson & M Tech Coordinator with mutual consultation will divide the submitted dissertations into groups depending upon the area of specialization and will recommend the list of experts for each group separately to the V C for selecting the examiners with the note that an external expert should be assigned a maximum of FIVE dissertations for evaluation.

The student will be required to submit THREE copies of his/her report to the M Tech Coordinator for record and processing.