ACADEMIC REGULATIONS & COURSE STRUCTURE

For

COMPUTER AIDED STRUCTURAL ENGINEERING

(Applicable for batches admitted from 2016-2017)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

I Semester

S. No.	Subject	L	P	Credits
1	Advanced Mathematics	4	-	3
2	Matrix Analysis of Structures	4	-	3
3	Theory of Elasticity	4	-	3
4	C++ and Data Structures	4	-	3
5	**Elective – I** I. Experimental Stress Analysis II. Optimization in Structural Design III. Structural Health Monitoring	4	-	3
6	**Elective – II** I. Modeling, Simulation & Computer Applications II. Prestressed Concrete Structure III. Stability of Structures	4	-	3
7	CAD Laboratory – I	-	3	2
Total Credits				**20**

II Semester

S. No.	Subject	L	P	Credits
1	Structural Dynamics	4	-	3
2	Finite Element Analysis	4	-	3
3	Artificial Neural Networks	4	-	3
4	CAD & Computer Applications in Structural Engineering	4	-	3
5	**Elective – III** I. Analysis of Shells and Folded Plates II. Reliability Based Engineering Design III. Earthquake Resistant Structures	4	-	3
6	**Elective – IV** 1. Management Information Systems 2. Fracture Mechanics 3. Advanced Concrete Technology	4	-	3
7	CAD Laboratory – II	-	3	2
Total Credits				**20**

III Semester

S. No.	Subject	L	P	Credits
1	Comprehensive Viva-Voce	**--**	**--**	2
2	Seminar – I	--	--	2
3	Project Work Part – I	--	--	16
Total Credits				**20**

IV Semester

S. No.	Subject	L	P	Credits
1	Seminar – II	--	--	2
2	Project Work Part - II	--	--	18
Total Credits				**20**

I Year I Semester	ADVANCED MATHEMATICS	L	P	C
		4	0	3

UNIT-I

Applied partial Differential Equations: One-dimensional Heat equation Cartesian, cylindrical and spherical coordinates (problems having axi-symmetry). Two-dimensional Laplace Equation in Cartesian, cylindrical and spherical coordinates (problems having axi-symmetry) – Analytical solution by separation of variables technique.

UNIT-II

Numerical solutions to Heat and Laplace Equations in Cartesian coordinates using finite – differences. Implicit methods, Crank Nicholsen Method, Jacobi Method, Guass Seidal method.

UNIT-III

Applied Statistics: Regression and correlation analysis – Method of Least squares – Curve fitting – Curvilinear Regression – Non-linear curves – correlation coefficient – Correlation of grouped bi-variate data – coefficient of determination Multiple Regression – partial Regression coefficients.

UNIT-IV

Tests of significance – Analysis of variance for regression – Multiple correlation coefficients – Multiple linear regression with two independent variables.

UNIT-V

Linear Programming Problem Formation, Graphical Method, Simplex method, artificial variable method-Big-M method-Two Phase Method. Non Linear Programming problem Gradient Method, Steepest Descent Method

TEXT BOOKS:

1. Solutions of Partial Differential Equations" – Duffy, D.G. CBS Publishers, 1988
2. Introductory Methods of Numerical Analysis – Sastry, S.S. Prentice-Hall, 2nd Edition, 1992
3. Basic Statistics – Agarval, B.L., Wiley 1991, 2nd edition.
4. Operations Research – Hamdy A, Taha.Optimization Techniques.-S.S.Rao:.

I Year I Semester	MATRIX ANALYSIS OF STRUCTURES	L	P	C
		4	0	3

UNIT-I

Introduction of matrix methods of analysis – Static and kinematic indeterminacy – Degree of freedom – Structure idealization-stiffness and flexibility methods – Suitability: Element stiffness matrix for truss element, beam element and Torsional element- Element force - displacement equations

UNIT-II

Stiffness method – Element and global stiffness equation – coordinate transformation and global assembly – structure stiffness matrix equation – analysis of simple pin jointed trusses – continuous beams
– rigid jointed plane frames

UNIT-III

Stiffness method for Grid elements – development of stiffness matrix – coordinate transformation. Examples of grid problems – tapered and curved beams

UNIT-IV

Additional topics in stiffness methods – discussion of band width – semi band width – static condensation – sub structuring –Loads between joints-Support displacements-inertial and thermal stresses-Beams on elastic foundation by stiffness method.

UNIT-V

Space trusses and frames - Member stiffness for space truss and space frame– Transformation matrix from Local to Global – Analysis of simple trusses, beams and frames

REFERENCES:

1. Matrix analysis of structures- Robert E Sennet- Prentice Hall-Englewood cliffs-New Jercy
2. Advanced structural analysis-Dr. P. Dayaratnam- Tata McGraw hill publishing company limited.
3. Indeterminate Structural analysis- C K Wang
4. Analysis of tall buildings by force – displacement – Method M. Smolira – Mc. Graw Hill.
5. Foundation Analysis and design – J.E. Bowls.

I Year I Semester	THEORY OF ELASTICITY	L	P	C
		4	0	3

UNIT-I

Elasticity – Notation for forces and stresses – components of stresses and strains – Hooke's Law - Plane Stress – Plane strain – Differential Equations of equilibrium – Boundary conditions – Compatibility equations - Stress function – Boundary Conditions.

UNIT -II

Two dimensional problems in rectangular co-ordinates – Solution by polynomials – Saint Venant's principle – Determination of displacements – Bending of simple beams – Application of Fourier series for two dimensional problems for gravity loading

UNIT-III

Two dimensional problems in polar co-ordinates - General equations in polar co-ordinates – Stress distribution for problems having symmetrical about an axis - Strain components in polar co-ordinates – Displacements for symmetrical stress distributions - Stresses for plates with circular holes subjected to far field tension – stress concentration factor.

UNIT-IV

Analysis of stress and strain in three dimension - Principal stresses – Stress ellipsoid and stress director surface – Determination of principal stresses - Maximum shear stress – Homogeneous Deformation – General Theorems - Differential equations of equilibrium – Conditions of compatibility – Equations of equilibrium in terms of displacements – Principle of superposition – Uniqueness of solution –Reciprocal theorem.

UNIT-V

Torsion of prismatical bars – Bars with elliptical cross section – Other elementary solution – Membrane analogy – Torsion of rectangular bars – Solution of torsional problems by energy method.

REFERENCES

1. Theory of Elasticity- Timoshenko & Goodier
2. Elasticity: Theory, Applications and Numeric- Martin H. Sadd

I Year I Semester	C++ AND DATA STRUCTURES	L	P	C
		4	0	3

UNIT-I

Object oriented programming :- Procedure – oriented programming, object oriented programming paradigm, basic concepts of oop, benefits of opp. Basics of C++, key words, data types, operators, functions in C++, classes and objects.

UNIT-II

Concepts of C++:- Constructors, parameterized constructiors, copy constructor, destructors, Inheritance – single, multilevel, multiple, Hierarchical, Hybrid, parameter passing methods. Sorting: Bubble sort, selection sort, Insertion sort, Quick sort, Merge sort, Heap sort , Radix sort.Searching: Binary Search, Linear Search.

UNIT- III

Linked Lists: - Single Linked List, Circular Linked List, Double Linked List, Circular Double Linked, insertion in to and deletion from linked list.

UNIT-IV

Stacks:- Introduction, Implementation using arrays and linked lists, applications: Arithmetic Expression, Implementation of Recursion, Towers of Hanoi,.Queues: Introduction, Implementation using arrays and linked lists, Types of queues, Applications

UNIT- V

Trees :- binary trees, representing binary trees in memory, Operations on Binary Trees, Types of trees.

TEXT BOOKS :

1. Object oriented programming with C++, “Balaguru Swamy”, Tata McGraw Hill.
2. Classic Data Structures, “D. Samantha”, PHI Learning Pvt. Ltd..
3. Data structures, Algorithms and Applications in C++, S. Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press.

I Year I Semester		L	P	C
		4	0	3

EXPERIMENTAL STRESS ANALYSIS
(Elective-I)

UNIT-I

Introduction and Strain measurement methods – Model & Prototype – Dimensional analysis-Factors influencing model design – Scale factors and Model material properties – Methods of model design. Definition of strain and its relation to experimental determinations - properties of strain gauge systems – Mechanical, Optical, Acoustic and Pneumatic types.

UNIT-II

Electrical resistance strain gages: Introduction – gauge construction – strain gauge adhesives - mounting methods – gauge sensitivities and gage factor – performance characteristics of wire and foil strain gauges – environmental effects. Analysis of strain gauge data – the three element rectangular rosette – the delta rosette – correction for transverse sensitivity.

UNIT-III

Non – destructive testing: Introduction – objectives of non destructive testing. Ultrasonic pulse velocity method – Rebound Hammer method (Concrete hammer) – Acoustic Emission- application to assessment of concrete quality.

UNIT-IV

Theory of photo elasticity: Introduction – temporary double refraction – Index ellipsoid and stress ellipsoid – the stress optic law – effects of stressed model in a polariscope for various arrangements - fringe sharpening.

UNIT-V

Two dimensional photo elasticity: Introduction – iso-chromatic fringe patterns – isoclinic fringe patterns – compensation techniques calibration methods – separation methods – materials for photo elasticity – properties of photo-elastic materials

REFERENCES:

1. Experimental Stress Analysis- Riley and Dally
2. Experimental Stress Analysis - L.S. Srinath
3. Experimental Stress Analysis – Lee
4. Experimental Stress Analysis- Sadhu Singh

STRUCTURAL OPTIMIZATION
(Elective-I)

UNIT-I

Introduction: Need and scope for optimization – statements of optimization problems- Objective function and its surface design variables- constraints and constraint surface- Classification of optimization problems (various functions continuous, discontinuous and discrete) and function behavior (monotonic and unimodal)

UNIT-II

Classical optimization techniques: Differential calculus method, multi variable optimization by method of constrained variation and Lagrange multipliers (generalized problem) Khun-Tucker conditions of optimality -Fully stressed design and optimality criterion based algorithms-introduction, characteristics of fully stressed design theoretical basis-examples

UNIT-III

Non-Liner programming: Unconstrained minimization- Fibonacci, golden search, Quadratic and cubic interpolation methods for a one dimensional minimization and univariate method, Powel's method, Newton's method and Davidon Fletcher Powell's method for multivariable optimization- Constrained minimization- Cutting plane method- Zoutendjik's method- penalty function methods

UNIT-IV

Linear programming: Definitions and theorems- Simplex method-Duality in Linear programming- Plastic analysis and Minimum weight design and rigid frame

UNIT-V

Introduction to quadratic programming: Geometric programming- and dynamic programming- Design of beams and frames using dynamic programming technique

REFERENCES

1. Optimization Theory and Applications – S.S. Rao, Wiley Eastern Limited, New Delhi

2. Optimization Concepts and Application in Engineering- Belegundu A.D. and Chandrupatla T.R

STRUCTURAL HEALTH MONITERING
(Elective-I)

UNIT-I

Introduction to Structural Health Monitoring (SHM) :

Definition & motivation for SHM, SHM - a way for smart materials and structures, SHM and bio mimetic - analog between the nervous system of a man and a structure with SHM- SHM as a part of system management, Passive and Active SHM, NDE, SHM and NDECS, basic components of SHM, materials for sensor design.

UNIT-II

Application of SHM in Civil Engineering: Introduction to capacitive methods, capacitive probe for cover concrete, SHM of a bridge, applications for external post tensioned cables, monitoring historical buildings.

UNIT-III

Non Destructive Testing of Concrete Structures: Introduction to NDT - Situations and contexts, where NDT is needed, classification of NDT procedures, visual Inspection, half-Cell electrical potential methods, Schmidt Rebound Hammer Test, resistivity measurement, electromagnetic methods, radiographic Testing, ultrasonic testing, Infra Red thermography, ground penetrating radar, radio isotope gauges, other methods.

UNIT-IV

Condition Survey & NDE of Concrete Structure: Definition and objective of Condition survey, stages of condition survey (Preliminary, Planning, Inspection and Testing stages) Possible defects in concrete structures, quality control of concrete structures - Definition and need, Quality control applications in concrete structures, NDT as an option for Non-Destructive Evaluation (NDE) of Concrete structures, case studies of a few NDT procedures on concrete structures.

UNIT-V

Rehabilitation and Retrofitting of Concrete Structure :

Repair rehabilitation & retrofitting of structures, damage assessment of concrete structures, Materials and methods for repairs and rehabilitation. Modeling of repaired composite structure, structural analysis and design - Importance ofre-analysis, execution of rehabilitation strategy, Case studies

REFERENCE BOOKS:

1. Daniel Balageas, Claus - Peter FritzenamI Alfredo Guemes, Structural Health Monitoring, Published by ISTE Ltd., U.K. 2006.
2. Guide Book on Non-destructive Testing of Concrete Structures,Training course series No.17,International Atomic Energy Agency,Vienna, 2002.
3. Hand book on "Repair and Rehabilitation of RCC Buildings", Published by Director General, CPWD, Govt. of India, 2002.
4. Hand Book on Seismic Retrofitting of Buildings, Published by CPWD & Indian Building Congress in Association with IIT, Madras, Narosa Publishing House, 2008

I Year I Semester		L	P	C
		4	0	3

MODELLING, SIMULATIONS AND COMPUTER APPLICATIONS
(Elective-II)

UNIT-1

System models: Concepts, continues and discrete systems, system modeling, types of models, subsystems, corporate model, and system study.

System simulation: Techniques, comparison of simulation and analytical methods, types of simulation, Distributed log models, cobweb models.

UNIT-2

Continuous System Simulation: Nemeric solution of differential equations, Analog computers, Hybrid computers, continuous system simulation languages CSMP, system dynamic growth models, logistic curves.

UNIT-3

Probability concepts in simulation: Monte Carlo techniques, stochastic variables, probability functions, Random Number generation algorithms.

Queuing Theory: Arrival pattern distributions, servicing times, queuing disciplines, measure of queues, mathematical solutions to queuing problems.

UNIT-4

Discrete System Simulation: Events, generation of arrival patterns, simulation programming tasks, analysis of simulation output.

UNIT-5

GPSS & SIMSCRIPT, programming in GPSS: simulation programming Techniques: Data Structures, Implementation of activities, events and queues, Event scanning, simulation algorithms in GPSS and SIMSCRIPT.

TEXT/ REFERENCE BOOKS:

1. Geoffery Gordon: System Simulation, PHI.
2. Naylor, Thomas, H.Computer Simulation experiments with models of economic systems, John Wiley and sons, 1971.
3. Naylor Thomas, H and ET. AI. Computer simulation techniques, John wiley and Sons, 1966.
4. Louis Wdward Alfeld and Alan K.Graham, Introduction to Urban Dynamics, wright – Allen Press Inc., Massachusetts, 1976.
5. Richard J.Chorley and Peter haggett, Models in Geography, Methuen & Co.Ltd., 1977.
6. Hamdy A.Taha, Operations Research – An Introduction, Macmillan Company, New York, 1987.
7. Thirumurthy.A.M. Environmental Facilities and Urban development in India-A System Dynamic Model for developing countries, Academic foundations, India.

PRESTRESSED CONCRETE STRUCTURES
(Elective-II)

UNIT 1

General principles of Pre-stressing- Pre-tensioning and Post tensioning - Pre tensioning and Post tensioning methods- Different systems of Pre-stressing- Analysis of prestress and Bending stresses– Resultant – stress at a section – pressure line – concept of load balancing – stresses in tendons.

UNIT 2

Losses of Pre-stressing- Loss of Pre-stress in pre-tensioned and post tensioned members due to various causes -Elastic shortening of concrete, shrinkage of concrete, creep of concrete, Relaxation of steel, slip in anchorage, differential shrinkage- bending of members and frictional losses- Long term losses

UNIT 3

Flexural, shear; torsional resistance and design of Prestressed concrete section. Types of flexural failure – code procedures-shear and principal stresses – Prestressed concrete members in torsion – Design of sections for flexure, Axial Tension, Compression and bending, shear, Bond

UNIT 4

Analysis of continuous beams –Elastic theory- Linear transformation and Concordant tendons-Deflections of pre-stressed concrete beams: Importance of control of deflections- factors influencing deflections-short term deflections of un-cracked member – prediction of long term deflections

UNIT 5

Analysis of end blocks: By Guyon's method and Magnel's method, Anchorage zone stresses-Approximate method of design- anchorage zone reinforcement- transfer of pre stresses- pre tensioned members-Composite sections: Introduction-Analysis for stresses- differential shrinkage- general design considerations

REFERENCES:

1. Prestressed Concrete- N. Krishna Raju
2. Prestressed Concrete- S. Ramamrutham
3. Prestressed Concrete- P. Dayaratnam

STABILITY OF STRUCTURES
(Elective-II)

UNIT 1

Beam columns: Differential equation for beam columns – Beams column with concentrated loads – continuous lateral load – couples – Beam column with built in ends – continuous beams with axial load – application of Trigonometric series – Determination of allowable stresses.

UNIT 2

Elastic buckling of bars : Elastic buckling of straight columns – Effect of shear stress on buckling – Eccentrically and laterally loaded columns –Sway & Non Sway mode - Energy methods – Buckling of a bar on elastic foundation – Buckling of bar with intermediate compressive forces and distributed axial loads – Buckling of bars with change in cross section – Effect of shear force on critical load – Built up columns – Effect of Initial curvature on bars – Buckling of frames – Sway & Non Sway mode.

UNIT 3

In-elastic buckling: Buckling of straight bars – Double modulus theory Tangent modulus theory. Experiments and design formulae: Experiments on columns – Critical stress diagram – Empirical formulae of design – various end conditions – Design of columns based on buckling. Mathematical Treatment of stability problems: Buckling problem orthogonality relation – Ritz method –Stiffness method and formulation of Geometric stiffness matrix- Applications to simple frames

UNIT 4

Torsional Buckling: Pure torsion of thin walled bars of open cross section – Non uniform torsion of thin walled bars of open cross section - Torsional buckling – Buckling of Torsion and Flexure.

UNIT 5

Lateral Buckling of simply supported Beams: Beams of rectangular cross section subjected for pure bending, Buckling of I Section subjected to pure bending.

REFERENCES:

1. Theory of Elastic stability by Timshenko & Gere-Mc Graw Hill
2. Theory of Stability of Structures by Alexander ChaJes.

I Year I Semester	CAD LABORATORY – I	L	P	C
		0	3	2

1. Simple Programs: Prime number, Factorial of a number, conversion of integers into words, swapping of two integers, addition and multiplication of matrices.

2. Functions : Inline functions, functions with parameters

3. Objects : Objects with arrays, counting of votes

4. Analysis of cantilever, simply supported beam, fixed beams, continuous beams for different loading conditions.

5. Design of R.C.C. beams, slabs, foundations.

6. Design of steel tension Members.

I Year II Semester	STRUCTURAL DYNAMICS	L	P	C
		4	0	3

UNIT-1

Introduction to Structural Dynamics: Fundamental objective of Dynamic analysis – Types of prescribed loadings – methods of Discretization – Formulation of the Equations of Motion.

UNIT-2

Theory of Vibrations: Introduction – Elements of a Vibratory system – Degrees of Freedom of continuous systems - Oscillatory motion – Simple Harmonic Motion – Free Vibrations of Single Degree of Freedom (SDOF) systems – Undamped and Damped – Critical damping – Logarithmic decrement – Forced vibrations of SDOF systems – Harmonic excitation – Dynamic magnification factor – Band width.

UNIT-3

Single Degree of Freedom System: Formulation and Solution of the equation of Motion – Free vibration response – Response to Harmonic, Periodic, Impulsive and general dynamic loadings – Duhamel integral.

UNIT-4

Multi Degree of Freedom System: Selection of the Degrees of Freedom

– Evaluation of Structural Property Matrices – Formulation of the MDOF equations of motion - Undamped free vibrations – Solution of Eigen value problem for natural frequencies and mode shapes – Analysis of dynamic response - Normal coordinates.

UNIT-5

Continuous Systems: Introduction – Flexural vibrations of beams – Elementary case – Equation of motion – Analysis of undamped free vibration of beams in flexure – Natural frequencies and mode shapes of simple beams with different end conditions.

REFERENCES:

1. Dynamics of Structures by Clough & Penzien.
2. Structural Dynamics A K Chopra

I Year II Semester	FINITE ELEMENT ANALYSIS	L	P	C
		4	0	3

UNIT 1

Introduction: Review of stiffness method- Principle of Stationary potential energy-Potential energy of an elastic body- Rayleigh-Ritz method of functional approximation - variational approaches -weighted residual methods

UNIT 2

Finite Element formulation of truss element: Stiffness matrix- properties of stiffness matrix –Selection of approximate displacement functions-solution of a plane truss- transformation matrix and stiffness matrix for a 3-D truss- Inclined and skewed supports- Galerkin's method for 1-D truss – Computation of stress in a truss element.

UNIT 3

Finite element formulation of Beam elements: Beam stiffness-assemblage of beam stiffness matrix- Examples of beam analysis for concentrated and distributed loading- Galerkin's method - 2-D Arbitrarily oriented beam element – inclined and skewed supports – rigid plane frame examples

UNIT 4

Finite element formulation for plane stress, plane strain and axisymmetric problems-Derivation of CST and LST stiffness matrix and equations-treatment of body and surface forces-Finite Element solution for plane stress and axisymmetric problems- comparison of CST and LST elements –convergence of solution- interpretation of stresses

UNIT 5

Iso-parametric Formulation: An isoparametric bar element- plane bilinear isoparametric element – quadratic plane element - shape functions, evaluation of stiffness matrix, consistent nodal load vector - Gauss quadrature- appropriate order of quadrature – element and mesh instabilities – spurious zero energy modes, stress computation- patch test.

REFERENCES:

1. Concepts and applications of Finite Element Analysis – Robert D. Cook, Michael E Plesha, John Wiley & sons Publications
2. A first course in the Finite Element Method – Daryl L. Logan, Thomson Publications.
3. Introduction to Finite Elements in Engineering- Tirupati R. Chandrupatla, Ashok D. Belgundu, PHI publications.

I Year II Semester	ARTIFICIAL NEURAL NETWORKS	L	P	C
		4	0	3

UNIT 1

Introduction: History Of Neural Networks, Structure And Functions Of Biological And Artificial Neuron, Neural Network Architectures, And Characteristics of ANN. Applications, And Basic Learning Rules: Hibbing Learning, Competitive Learning, And Boltzmann Learning.

UNIT-2

Supervised Learning-1: Single Layer Neural Network and architecture, McCulloch-Pitts Neuron Model, Perception Model, Perception Convergence Theorem, ADALINE, Delta Learning Rule.

Supervised Learning-2: Multi Layer Neural Network and architecture, MADALINE, Back Propagation learning, Back Propagation Algorithm.

UNIT 3

Unsupervised Learning-1: Kohenen Self Organization Networks, Hamming Network and MAXNET, Learning Vector Quantization, Mexican hat.

Unsupervised Learning-2: Counter Propagation Network, Forward Only Counter Propagation Network, Adaptive Resonance Theory (ART) -Architecture, Algorithms.

UNIT 4

Associative Memory Networks : Introduction, Auto Associative Memory ,Hetero Associative Memory, Bidirectional Associative Memory(BAM) -Theory And Architecture, BAM Training Algorithm-Storage.

UNIT 5

Hopfield Network: Introduction, Architecture Of Hopfield Network, Discrete And Continuous Hopfield Network, Iterative Auto Associative Memory Network (Linear Auto Associative Memory, Brain-In-The-Box Network), Temporal Associative Memory Architecture .

REFERENCE BOOKS:

1. Jacek M. Zurada , " Introduction to Artificial Neural Systems " – Jaico Publishing, 2006.

2. S.N.Sivanandam , S.N.Deepa, " Introduction to Neural Networks using MATLAB 6.0 " Tata McGraw- Hill Publications, 2006.

3. B.Yegnanarayana " Artificial Neural Networks " PHI, NewDelhi, 2005.

4. S.Rajasekaran and G.A.Vijayalakshmi Pai " Neural Networks. Fuzzy Logic and Genetic Algorithms ", 2007.

5. James A Freeman and Davis Skapura" Neural Networks Algorithm, Applications and Programming Techniques ", Pearson Education, 2002.

I Year II Semester	CAD & COMPUTER APPLICATIONS IN STRUCTURAL ENGINEERING	L	P	C
		4	0	3

UNIT-1

Introduction to computer aided design – Reasons for implementing CAD – Design process – Applications of computers to design – Benefits of computer Aided design.

Principles of computer graphics – Introduction, Graphic primitives, point plotting, drawing of lines, Bresenhams Algorithm, C program to draw a line, circle, ellipse using breasenhams algorithm.

UNIT-2

Transformation in Graphics – Coordinate system used lin graphics & windowing, view port, 2 – D transformations, clipping, 3-D transformation; C-graphics.

UNIT-3

Stiffness Method : Microsoft Excel procedure for stiffness method of analysis step – by step procedure using Excel, examples using Excel.

UNIT-4

Analysis of beams using stiffness method : Long hand solution of single span beams, continuous beams solution of single span beams, continuous beams using Excel.

UNIT-5

Database : Introduction, concept of a database, objectives of databases, Design of data base, design consideration of data base.

REFERENCE BOOKS :

1. C. S. Krishna Murthy & Rajiv S. – Computer Aided Design, Software & Analytical tools – Narasha publishing house India.
2. Computer Aided design in reinforced concrete – Dr L.Shah-Structures Publishers Pune.
3. IS – 456 -2000
4. Limit State Design – A.K. Jain.
5. Computer application – Boyd C. Panbou Mc Graw Hill 1997.
6. Raker D., and Rice H. Inside Aut CAD, BPD Publication, Delhi, 1986.
7. Nancy Andrews – Windows the Official guide to Microsoft Operation Environment, Micro Soft, 1986.
8. Moshi, f., Rubinstein, Matrix computer analysis of Structures, Prentice Hall 1986.

I Year II Semester		L	P	C
		4	0	3

ANALYSIS OF SHELLS AND FOLDED PLATES
(Elective-III)

UNIT-1

Equations of equilibrium: Introduction, classification, derivation of stress Resultants, Principles of membrane theory and bending theory.

UNIT-2

Cylindrical shells: Derivation of governing DKJ equation for bending theory, details of Schorers theory, Applications to the analysis and design of short shells and long shells. Introduction of ASCE manual coefficients for design.

UNIT-3

Introduction to shells of double curvature: (other than shells of revolution:) Geometry and analysis of elliptic paraboloid, rotational paraboloid and hyperbolic paraboloid shapes by membrane theory.

UNIT-4

Folded Plates: Folded plate theory, plate and slab action, Whitneys theory, Simpsons theory for the analysis of different types of folded plates (Design is not included)

UNIT-5

Shells of double Curvature-Surfaces of revolution .Derivation of equilibrium equations by membrane theory, Applications to spherical shell and rotational Hyperboloid

REFERENCE BOOKS:

1. Design and construction of concrete shell roofs by G.S. Rama Swamy – CBS Publishers & Distributors, 485, Jain Bhawan Bhola Nath Nagar, shahotra, Delhi.
2. Fundamentals of the analysis and design of shell structures by Vasant S. Kelkar Robert T.S well – Prentice hall, Inc., Englewood cliffs, new Jersy -02632.
3. N. K. Bairagi, Shell analysis, Khanna Publishers, Delhi, 1990.
4. Billington, Ithin shell concrete structures, Mc Graw Hill Book company, New York, St. Louis, Sand Francisco, Toronto, London.
5. ASCE Manual of Engineering practice No.31, design of cylindrical concrete shell roofs ASC, Newyork.

RELIABILITY BASED ENGINEERING DESIGN
(Elective-III)

UNIT-1

Basic statistics and probability – Concepts of structural safety.
Resistance parameters and distributions. Probabilistic analysis of loads live load & wind load.

UNIT-2

Determination of reliability, Monte Carlo study of structural safety. Levels of reliability methods and their suitable adoption in structural engineering elements.

UNIT-3

Level 2 reliability methods including advanced level 2 method.

UNIT-4

Reliability analysis of structural components – Reliability based design determination of partial safety factors, code calibration.

UNIT-5

Reliability of structural systems application to steel & concrete structures, off shore structures.

REFERENCE BOOKS :

1. Palle Thoft Christensen and M. J. Baker – Structural Reliability Theory and its application springer – verlag, Berlon Haiderberg, newyork 1982.
2. R.E. Melchers, structural Reliability Analysis and prediction, Elles Harwood, Chisester, England, 1987.
3. A.H.S. Ang and W.H.Tang, Prbability concepts in Engineering planning and design volume II Jhon Wiley, Newyork 1984.
4. Palle Thoft Cristensen and Y.Murotsu applicantion of Structural systems, Reliability theory Springer – Verlog, Berlin 1986.

EARTHQUAKE RESISTANT STRUCTURES
(Elective-III)

UNIT 1

Engineering seismology – rebound theory – plate tectonics – seismic waves - earthquake size and various scales – local site effects – Indian seismicity – seismic zones of India – theory of vibrations – near ground and far ground rotation and their effects.

UNIT 2

Seismic design concepts – EQ load on simple building – load path – floor and roof diaphragms – seismic resistant building architecture – plan configuration – vertical configuration – pounding effects – mass and stiffness irregularities – torsion in structural system- Provision of seismic code (IS 1893 & 13920) – Building system – frames – shear wall – braced frames – layout design of Moment Resisting Frames(MRF) – ductility of MRF – Infill wall – Non- structural elements.

UNIT 3

Calculation of EQ load – 3D modeling of building systems and analysis (theory only) Design and ductile detailing of Beams and columns of frames Concept of strong column weak beams, Design and ductile detailing of shear walls

UNIT 4

Cyclic loading behavior of RC, steel and pre- stressed concrete elements - modern concepts- Base isolation – Adaptive systems – case studies.

UNIT 5

Retrofitting and restoration of buildings subjected to damage due to earthquakes- effects of earthquakes – factors related to building damages due to earthquake- methods of seismic retrofitting- restoration of buildings

REFERENCES

1. Pankaj Agarwal and Manish ShriKhande, Earthquake Resistant Design of Structures, Prentice – Hall of India, 2007, New Delhi.

2. Bullen K.E., Introduction to the Theory of Seismology, Great Britain at the University Printing houses, Cambridge University Press 1996.

3. Relevant code of practices.

I Year II Semester		L	P	C
		4	0	3

MANAGEMENT INFORMATION SYSTEMS
(Elective-IV)

UNIT-1

Introduction to MIS – Importance of information for management decisions – systems approach and information – System Development – Information System Architecture – Quantitative Techniques and Management Information Systems interfacing.

UNIT-2

Physical design of computer sub-systems, database design, file design, input-output and procedure design and system security. MIS development – process – system development – system life cycle method. Structured development method, and prototype method – Software development.

UNIT-3

Information systems – Computers in Management – MIS office automations decision support system – Expert system.

UNIT-4

Implementation, Evaluation and maintenance of MIS – pitfalls in MIS development.

UNIT-5

System modeling for MIS system engineering methodology for MIS problem solving.

REFERENCE BOOKS :

1. Suresh K. Basandra – Computers To day, Glagotia Publishers.
2. R. G. Murdicks – Information systems for management.
3. Elias M. Award – System Analysis and Design
4. A. Senn – Analysis and design information systems.
5. Jerome Kanter – Managing with information, Prentice & Hall.
6. C. S. V. Murthy – Management information systems Text & application Himalaya Publishing house – Mumbai.

FRACTURE MECHANICS
(Elective-IV)

UNIT 1

Introduction: Fundamentals of elastic and plastic behaviour of materials- stresses in a plate with a hole – Stress Concentration factor-modes of failure- Brittle fracture and ductile fracture- history of fracture mechanics-Griffiths criteria for crack propagation cracks- Energy release rate, G_I G_{II} and G_{III} - Critical energy release rate G_{Ic} , G_{IIc} and G_{IIIc} – surface energy - R curves – compliance.

UNIT 2

Principles of Linear Elastic Fracture Mechanics: SOM vs Fracture Mechanics -stressed based Criteria for fracture- Stress Intensity Factors- K_I K_{II} and K_{III} – Critical stress Intensity Factors, K_{Ic} K_{IIc} and K_{IIc} – crack tip plastic zone – Erwin's plastic zone correction –Critical crack length-Load carrying capacity of a cracked component- Design of components based on fracture mechanics.

UNIT 3

Mixed mode crack propagation- Maximum tangential stress criterion – crack propagation angle -Material characterisation by Crack Tip Opening Displacements (CTOD)- Crack Mouth Opening Displacement (CMOD)- Critical crack tip opening displacement ($CTOD_c$) –critical Crack Mouth Opening Displacement ($CMOD_c$).

UNIT 4

Fatigue Crack propagation- Fatigue load parameters Fatigue crack growth curve – Threshold stress intensity factor-Paris law- Retardation effects.

UNIT 5

Applications of fracture Mechanics to concrete- reasons –strain softening behaviour – Bazant's size effect law.

REFERENCES

1. Elementary engineering fracture mechanics – David Broek – Sijthoff & Noordhoff – Netherlands.
1. Elements of Fracture Mechanics – Prasanth Kumar, wiley Eastern Publications
2. Fracture Mechanics: Fundamentals and applications – T. L. Andrason, PhD, CRC publications
3. Fracture Mechanics of Concrete: Applications of fracture mechanics to concrete, Rock, and other quasi-brittle materials, Surendra P. Shah, Stuart E. Swartz, Chengsheng Ouyang, John Wiley & Son publications.

ADVANCED CONCRETE TECHNOLOGY
(Elective-IV)

UNIT-1

Cements and Admixtures:

Portland cement – Chemical composition - Hydration, setting and finenesses of cement – structures of hydrated cement – mechanical strength of cement gel - water held in hydrate cement paste – Heat of hydration of cement –Influence of compound composition on properties of cement – tests on physical properties of cement – I.S. specifications – Different types of cements – Admixtures.

Aggregates: Properties of aggregates – Road note No.4 grading of fine and coarse aggregates gap graded aggregate – maximum aggregate size.

UNIT-3

Fresh & Hardened concrete: Workability – factors affecting workability – measurement of workability by different tests – Effect of time and temperature on workability – segregation and bleeding – mixing and vibration of concrete – quality of mixing water.

Hardened Concrete: Water/cement ratio-Abrams law – Gel space ratio – effective water in mix – Nature of strength of concrete – strength in tension and compression-Griffiths hypothesis – factors affecting strength – autogeneous healing –Relation between compression and tensile strength – curing and maturity of concrete Influence of temperature on strength – Steam curing – testing of Hardened concrete – Non destructive testing methods.

UNIT-4

Elasticity, Shrinkage and Creep: Modulus of elasticity – dynamic modulus of elasticity– poissons ratio – Early volume changes – swelling – Draying shrinkage - Mechanism of shrinkage – factors affecting shrinkage – Differential shrinkage – moisture movement carbonation shrinkage-creep of concrete – factors influencing creep – relation between creep and time – Nature of creep – Effect of creep.

UNIT-5

Mix Design: Proportioning of concrete mixes by various methods – fineness modulus, trial and error, mix density, Road Note. No. 4, ACI and ISI code methods – factors in the choice of mix proportions – Durability of concrete – quality control of concrete – Statistical methods – High strength concrete mix design.

Special concrete's: Light weight concretes –light weight aggregate concrete- Mix design – Cellular concrete - No fines concrete – High density concrete – Fiber reinforced concrete – Different types of fibers - factories affecting properties of FRC – Applications polymer concrete – types of polymer concrete properties of polymer concrete applications.

REFERENCE BOOKS:

1. Properties of Concrete by A. M. Neville – Pearson publication – 4th edition
2. Concrete Technology by M. S. Shetty. – S.Chand & Co. ; 2004
3. Design of Concrete Mix by Krishna Raju, CBS pubilishers.
4. Concrete: Micro structure, Properties and Materials – P. K. Mehta and J. M. Monteiro, Mc-Graw Hill Publishers
5. Concrete Technology by A.R. Santha Kumar, Oxford University Press, New Delhi
6. Non-Destructive Test and Evaluation of materials by J. Prasad & C.G.K. Nair, Tata Mcgraw hill Publishers, New Delhi

I Year II Semester	CAD LABORATORY – II	L	P	C
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1. To draw a line using Bresenhams line algorithm
2. To draw a circle, Ellipse using Bresenhams line algorithm,
3. Reinforcement detailing in beam using graphics.
4. Reinforcement detailing in slabs using graphics.
5. Reinforcement detailing in foundation using graphics.