COURSE STRUCTURE
AND
DETAILED SYLLABUS

FOR

M.TECH

(COMPUTER AIDED STRUCTURAL ENGINEERING)

REGULAR

2015 – Regulations

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY

COLLEGE OF ENGINEERING (AUTONOMOUS)

ANANTAPUR – 515 002 (A.P.)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
COLLEGE OF ENGINEERING :: (AUTONOMOUS) - ANANTAPUR
CIVIL ENGINEERING DEPARTMENT
Curriculum & Course Structure for M.Tech Course
(Computer Aided Structural Engineering) 2015
For the batches admitted from 2015

I SEMESTER:

Code	SUBJECT	L	P	C
15D10102	Computational Numerical Methods	4	0	4
15D11101	Matrix Methods of Structural Analysis	4	0	4
15D11102	Theory of Elasticity	4	0	4
15D12101	C++ and Data Structures	4	0	4
	Elective – I	4	0	4
15D11104	1. Experimental Stress Analysis			
15D12102	2. Optimization in Structural Design			
	Elective – II	4	4	2
15D12103	1. Modelling, Simulation & Computer Applications			
15D11107	2. Prestressed Concrete			
15D12104	CAD Laboratory – I	0	4	26

II SEMESTER:

Code	SUBJECT	L	P	C
15D11201	Structural Dynamics	4	0	4
15D11202	Finite Element Analysis	4	0	4
15D12201	Artificial Neural Networks	4	0	4
15D12202	CAD & Computer applications in Structural Engineering	4	0	4
	Elective – III	4	0	4
15D11204	1. Analysis of Shells and Folded Plates			
15D12203	2. Reliability Based Engineering Design			
15D11207	3. Earthquake Resistant Structures			
	Elective – IV	4	4	2
15D12204	1. Management Information Systems			
15D11210	2. Fracture Mechanics			
15D11206	3. Advanced Concrete Technology			
15D54201	Research Methodology (Audit Course)			
15D12205	CAD Laboratory – II	2	4	26

III & IV SEMESTERS:

Code	Subject	T	P	C
15D12301	**III Semester** **Seminar – I**	**0**	**4**	**2**
15D12401	**IV Semester** **Seminar – II**	**0**	**4**	**2**
15D12302	**III & IV Semester** **Project work**	**--**	**--**	**44**
		0	**8**	**48**

Note :All End Examinations (Theory and Practical)are of three hours duration.

T-Tutorial L-Theory P-Practical/Drawing C-Credits

L	P	C
4	0	4

Subject Code:15D10102

M.Tech (COMPUTER AIDED STRUCTURAL ENGINEERING)

First Semester

COMPUTATIONAL NUMERICAL METHODS

UNIT-I

Solution of Non-linear Equations: Newton-Raphson method, Von-mises formula, Chord's method, bisection method- Comparative study-solution of cubic equation and quartic equation.
Numerical integration: Newton-Cotes integration formulas- Trapezoidal rule-Romberg Integration – Simpson's rule – Gaussian quadrature – Errors in integration formulas – Multiple integration with variable limits.

UNIT-II

Solution of system of equations: Gauss elimination method- gauss-Jordan method- L-U decomposition – Errors in the solution- iterative methods – solution of sets of non linear equations.
Boundary Value Problems and Characteristics – Value problems: Shooting method- solution through a set of equations – Derivative boundary conditions – characteristic value problems – Eigen values of matrix by iteration.

UNIT-III

Numerical Solution of Elliptical partial differential Equations: Equilibrium temperatures in a heated slab-Equation of steady state heat flow – Laplace equation on rectangular region – Poisson equation –Derivative boundary conditions.

UNIT-IV

Numerical Solution of parabolic partial Differential equations: Explicit Method- simple implicit method Crank- Nicolson method- Derivative boundary conditions – stability and convergence criteria - Equations in two dimensions.

UNIT-V

Finite Element method: General approach – Finite Element application in one dimension and 2-D problems.

TEXT / REFERENCE BOOKS:

1. Numerical Methods for Engineers by Steven c.chapra and Raymond P.canal –Mc Graw Hill book company.

2. Applied Numerical Analysis by Curtis .F.Gerald-Addition-wesley Publishing company.

3. C. Language and Numerical Methods by C.Xavier-New age international Publishers

L	P	C
4	0	4

Subject Code:15D11101

M.Tech (COMPUTER AIDED STRUCTURAL ENGINEERING)

First Semester

MATRIX METHODS OF STRUCTURAL ANALYSIS

1. **INTRODUCTION:-**Indeterminacy-Determination of static and kinematic indeterminacies of two-dimensional and three-dimensional portal frames, pin jointed trusses and hybrid frames-coordinate systems –structural idealization. Introduction to Matrix Methods of Analysis-Flexibility and stiffness matrices-Force displacement relationships for axial force, couple, torsional moments – stiffness method of analysis and flexibility method of analysis.

2. **ANALYSIS OF CONTINUOUS BEAMS**- stiffness method and flexibility method of analysis –continuous beams of two and three spans with different end conditions-internal hinges.

3. **ANALYSIS OF TWO DIMENSIONAL PORTAL FRAMES & PINJOINTED TRUSSES** – stiffness and flexibility method of analysis of 2D portal frames with different end conditions-plotting of bending moment diagrams. Computation of joint displacement and member forces for pinjointed trusses.

4. **TRANSFORMATION OF CO-ORDINATES** - Local and Global co-ordinate systems-transformation of matrices from local to global coordinates of element stiffness matrix-direct stiffness method of analysis-assembly of global stiffness matrix from element stiffness matrices –static condensation-sub-structuring.

5. **EQUATION SOLVERS**-solution of system of linear algebraic equations-direct inversion method-gauss elimination method-Cholesky method-banded equation solvers-frontal solution technique.

TEXT/REFERENCE BOOKS :

1. Structural Analysis by Pundit & Gupta, Tata MC Graw Hill Book company.
2. Structural Analysis by C.S.Reddy, Tata MC Graw Hill Book company
3. Cotes, R.C., Couties, M.G., and Kong, F.K., Structural Analysis, ELBS.
4. MC.Guire, W.,and Gallagher, R.H., Matrix Structural analysis, John Wiley and sons.
5. John L.Meek., Matrix Structural Analysis, MC Graw Hill Book company.
6. Structural Analysis – R.C.Hibbeler, Pearson Education

L	P	C
4	0	4

Subject Code:15D11101

L	P	C
4	0	4

Subject Code:15D11102

M.Tech (Computer Aided Structural Engineering)
First Semester
THEORY OF ELASTICITY

1. **INTRODUCTION TO PLANE STRESS AND PLANE STRAIN ANALYSIS:**
   Elasticity –Notation for forces and stresses-Components of stresses –components of strain –Hooke's law. Plane stress-plane strain-Differential equations of equilibrium-Boundary conditions- Compatibility equations-stress function-Boundary conditions.
2. **TWO DIMENSIONAL PROBLEMS IN RECTANGULAR COORDINATES:**
   Solution by polynomials-Saint Venant's principle-Determination of displacements-bending of simple beams-application of Fourier series for two dimensional problems - gravity loading.

3. **TWO DIMENSIONAL PROBLEMS IN POLAR COORDINATES :**
   General Equation in polar co-ordinates - stress distribution symmetrical about an axis – Pure bending of curved bars- strain components in polar coordinates-Displacements for symmetrical stress distributions-simple symmetric and asymmetric problems-General solution of two dimensional problem in polar coordinates-Application of the general solution of two dimensional problem in polar coordinates-Application of the general solution in polar coordinates.

4. **ANALYSIS OF STRESS AND STRAIN IN THREE DIMENSIONS:** Principle stress - ellipsoid and stress-director surface-Determination of principle stresses- Maximum shear stresses-Homogeneous deformation-principle axis of strain rotation.**GENERAL THEOREMS:**
   Balance laws - Differential equations of equilibrium- conditions of compatibility - Determination of displacement-Equations of equilibrium in terms of displacements-principle of superposition-Uniqueness of solution –the Reciprocal theorem.

5. **TORSION OF PRISMATICAL BARS:**
   Torsion of prismatic bars- Elliptical cross section-other elementary solutions-membrane anology-Torsion of rectangular bars-solution of torsional problems by energy method-use of soap films in solving torsionol problems-hydra dyanmical analogies-Torsion of shafts, tubes, bars etc.

TEXT/REFERENCE BOOKS :

1. Theory of Elasticity and Plasticity by Timoshenko, S., MC Graw Hill Book company.
2. Advnced Strength of materials by Papoov, MC Graw Hill Book company.
3. Theory of Elasticity and Plasticity by Sadhu Singh. Khanna Publishers.
4. Chen, W.F. and Han, D.J.Plasticity for structural Engineers, Springer – Verlag, New York.
5. Lubliner, J., Plasticity theory, Mac Millan Publishing Co., New York.
6. Foundations of Solid Mechanics by Y.C.Fung, PHI Publications.
7. Advanced Mechanics of Solids by L.S. Srinath, Tata MC Graw Hill Book company.

L	P	C
4	0	4

8. Subject Code:15D12101

M.Tech (Computer Aided Structural Engineering)
First Semester

C++ AND DATA STRUCTURES

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.

Concepts of C++:- Constructors, parameterized constructiors, copy constructor, destructors, Inheritance – single, multilevel, multiple, Hierarchical, Hybrid, parameter passing methods.

Unit II :

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.

REFERENCES :

1. Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and Mount, Wiley student edition, John Wiley and Sons.
2. Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition.
3. Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson
4. Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
5. Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education.
6. Data Structures using C++, D.S. Malik, Cengage Learning, India Edition.

L	P	C
4	0	4

Subject Code:15D11104

M.Tech (COMPUTER AIDED STRUCTURAL ENGINEERING)

EXPERIMENTAL STRESS ANALYSIS

(Elective-I)

First Semester

1. **PRINCIPLES OF EXPERIMENTAL APPROACH :-**
   Merits of Experimental Analysis Introduction, uses of experimental stress analysis advantages of experimental stress analysis, Different methods –Simplification of problems.

2. **STRAIN MEASUREMENT USING STRAIN GAUGES :-**
   Definition of strain and its relation of experimental Determinations Properties of Strain-Gauge Systems-Types of Strain Gauges –Mechanical, Acoustic and Optical Strain Gauges. Introduction to Electrical strain gauges - Inductance strain gauges – LVDT – Resistance strain gauges – various types –Gauge factor – Materials of adhesion base.

3. **STRAIN ROSSETTES AND NON – DESTRUCTIVE TESTING OF CONCRETE:-**

   Introduction – the three elements Rectangular Rosette – The Delta Rosette Corrections for Transverse Strain Gauge.

   Ultrasonic Pulse Velocity method –Application to Concrete. Hammer Test – Application to Concrete.

4. **THEORY OF PHOTOELASTICITY** :-

   Introduction –Temporary Double refraction – The stress Optic Law –Effects of stressed model in a polariscope for various arrangements – Fringe Sharpening. Brewster's Stress Optic law.

5. **TWO DIMENSIONAL PHOTOELASTICITY :-**

   Introduction – Isochramic Fringe patterns- Isoclinic Fringe patterns passage of light through plane Polariscope and Circular polariscope Isoclinic Fringe patterns – Compensation techniques – Calibration methods – Separation methods – Scaling Model to prototype Stresses – Materials for photo – Elasticity Properties of Photoelastic Materials.

Reference Books:-

1. Experimental stress analysis by J.W.Dally and W.F.Riley, College House Enterprises
2. Experimental stress analysis by Dr.Sadhu Singh.khanna Publishers
3. Experimental Stress analysis by U.C.Jindal, Pearson Pubilications.
4. Experimental Stress Analysis by L.S.Srinath, MC.Graw Hill Company Publishers.

L	P	C
4	0	4

Subject Code:15D12102

M.TECH (COMPUTER AIDED STRUCTURAL ENGINEERING)

I – SEMESTER

OPTIMIZATION IN STRUCTURAL DESIGN

(Elective-I)

1. System approach – Techniques of operation research – Decision making – Research models.Basic concepts of minimum weight, minimum cost design, variables, constrains, model and model building, objective function, classical methods.

2. Concept of liner programming, Integer programming, Quadratic programming, Dynamic programming and geometric programming methods for optimal design of structural elements. Linear programming: Standard form of linear programming problem, geometry of linear programming problem. Solution of system of linear simultaneous equations. Application of linear programming methods for plastic design of frames Computer search methods of univarite and multivariate minimsation.

3. Simplex method. – Revised simplex method, duality of linear programming sensitivity or post optimality analysis.

4. Optimization by structural theorems. Maxwell Mitchell and Heymans theorem for structures and frames.

5. Optimization Techniques applied to fully stressed design with deflection constraints, optimality criterion methods.

TEXT / REFERENCE BOOKS:

1. Spunt, Optimum Structural Design, Civil Engineering and Engineering mechanics Services, Prentice Hall New Jersey, 1971.
2. S.S.Rao, Optimization theory and applications, Wiley Eastern Limited, New Delhi, 1977.
3. Uri Krisch, Optimum Structural Design Mc Graw hill Book co., 1981.
4. Richard Bronson, Operations Research, Schaums, outline series, Mc Graw Hill book company, Singapore 1983.
5. J.S.Arora, introduction to optimum Design, Mc Graw Hill Book company, new your, 1989.
6. A.J. Morris (Editor) Foundations of Structural Optimization – a unified Approach, John Wiley and Sons, Chichester, 1982.

L	P	C
4	0	4

Subject Code:15D12103

M.TECH (COMPUTER AIDED STRUCTURAL ENGINEERING)

I – SEMESTER

MODELLING, SIMULATIONS AND COMPUTER APPLICATIONS

(Elective-II)

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.

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

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

4. **Queuing Theory:** Arrival pattern distributions, servicing times, queuing disciplines, measure of queues, mathematical solutions to queuing problems.**Discrete System Simulation**: Events, generation of arrival patterns, simulation programming tasks, analysis of simulation output.
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.

L	P	C
4	0	4

Subject Code:15D11107

M.TECH (COMPUTER AIDED STRUCTURAL ENGINEERING)
I – SEMESTER
PRESTRESSED CONCRETE STRUCTURES
ELECTIVE – II

1. **INTRODUCTION:**Development of prestressed concrete –Advantages and Disadvantages of PSC over RCC –General principles of pre-stressing-pre tensioning and post tensioning –Materials used in PSC-high strength concrete –High tension steel-Different types /methods/systems of prestressing.

2. **Losses of prestress**: Estimation of the loss of prestress due to various causes like elastic shortening of concrete ,creep of concrete, shrinkage of concrete, relaxation of steel, slip in anchorage, friction etc.

3. **Flexure & Deflections:** Analysis of sections for flexure in accordance with elastic theory-Allowable stresses-Design criteria as per I.S code of practice –Elastic design of Beams (rectangular, I and T sections) for Flexure –Introduction to partial prestressing. Introduction-Factors influencing deflections-short term and long term deflections of uncracked and cracked members.

4. **Shear, bond, Bearing and Anchorage:** shear in PSC beams –Principal stresses –Conventional elastic design for shear-transfer of prestress in pretensioned members-transmission length –Bond stresses-bearing at anchorage –Anchorage zone stresses in post-tensioned members-Analysis and design of end blocks by Guyon, Magnel and approximate methods –Anchorage zone reinforcements.

5. **Statistically indeterminate structures**: Introduction –advantages and disadvantages of continuity –Layouts for continuous beams-primary and secondary moments –Elastic analysis of continuous beams-Linear transformation-Concordant cable profile-Design of continuous beams.**Circular prestressing**: Introduction –Circumferential prestressing Design of Prestressed concrete tanks –vertical prestressing in tanks-Dome prestressing.

REFERENCE BOOKS:

1. Prestressed Concrete by S. Krishna raju, TMH Pubilishers.
2. Prestressed Concrete by S. Ramamrutham, Dhanpati Rai Pubilicartions.
3. Prestressed concrete design by Praveen Nagarajan, Pearson Pubilications.
4. T.Y.Lin, Design of Prestressed Concrete Structures, Asian Publishing house, Bombay, 1953.
5. Y.Guyon, Prestressed Concrete, Vol.I&II, Wiley and Sons, 1960.
6. F.Leohhardt, Prestressed concrete Design and construction, Wilhelm Ernst and shon, Berlin, 1964.
7. C.E.Reynolds and J.C. Steedman, Reinforced concrete designers hand bood, A view point publication, 1989.
8. Edward P.Nawy, Prentise Hall – Prestressed Concrete.
9. Prestressed Concrete – by Raj Gopal, Narsoa Pubilications.

L	P	C
0	4	2

10. Subject Code:15D12104

M.TECH (COMPUTER AIDED STRUCTURAL ENGINEERING)

I – SEMESTER

CAD LABORATORY – I

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.

L	P	C
4	0	4

Subject Code:15D11201

M.Tech (COMPUTER AIDED STRUCTURAL ENGINEERING)
II – Semester
STRUCTURAL DYNAMICS

1. **Theory of Vibrations:** Introduction –Elements of a vibratory system – degrees of freedom-continuous systems –lumped mass idealization –Oscillatory motion –Simple harmonic motion –pictorial representation of S.H.M - 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- Bandwidth.Fundamental objective of dynamic analysis-types of prescribed loading- Methods of discretization- Formulation of the equations of motion.

2. **Single degree of Freedom System**: Formulation and solutions of the equation of motion - free Vibration response –response to harmonic, periodic, Impulsive and general Dynamic loading –Duhamel integral

3. **Multi Degree of Freedom System:** selection of the degree 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 –Uncoupled equations of motion –Orthogonal properties of normal modes-mode superposition procedure

4. **Practical vibration analysis:** Stodola method- Fundamental mode analysis –analysis of second and higher modes –Holzer's method –basic procedure –transfer matrix procedure

5. **Introduction to Earthquake analysis:** Introduction –Excitation by rigid base translation –Lumped mass approach -SDOF and MDOF system- I.S code methods of analysis.**Continuous system:** Introduction –Flexural vibrations of beams- Elementary case-Equation of motion –Analysis of undamped free shapes of simple beams with different end conditions-principles of application to continuous beams.

REFERENCE BOOKS:

- A.K.Chopra, "Structural Dynamics for Earthquake Engineering",Pearson Pubilications
- Dynamics of structures by Clough & Penziem
- Structural dynamics by Mario Paz
- I.S:1893(latest)" code of practice for earthquakes resistant design of stuctures"
- Anderson R.A fundamentals of vibration, Amerind Pulblishing Co., 1972.

L	P	C
4	0	4

Subject Code:15D11202

M.Tech (COMPUTER AIDED STRUCTURAL ENGINEERING)

II – Semester
FINITE ELEMENT ANALYSIS

1. **Introduction-**Concepts of FEM –steps involved –merits &demerits –energy principles – Discretization –Rayleigh –Ritz method of functional approximation.**Elastic formulations:** Stress equations-strain displacement relationships in matrix form-plane stress, plane strain and Axi-symmetric bodies of revolution with axi symmetric loading

2. **One Dimensional FEM-**Stiffness Matrix for Beam and bar elements shape functions for ID elements –static condensation of global stiffness matrix-solution –Initial strain and temperature effects.

3. **Two Dimensional FEM-**Different types of elements for plane stress and plane strain analysis –Displacement models –generalized coordinates-shape functions-convergent and compatibility requirements –Geometric Invariance –Natural coordinate system-area and volume coordinates-Generation of element stiffness and nodal load matrices –static condensation.

4. **Isoparametric formulation**-Concept, Different isoparametric elements for 2d analysis-Formulation of 4-noded and 8-noded isoparametric quadrilateral elements –Lagrangian elements-serendipity elements.**Axi symmetric analysis** –bodies of revolution-axi symmetric modelling –strain displacement relationship-formulation of axi symmetric elements.
5. **Three Dimensional FEM-**Different 3-D elements, 3D strain –displacement relationship-formulation of hexahedral and isoparametric solid element.

REFERENCE BOOKS:

- Finite Elements Methods in Engineering by Tirupati. R. Chandrnpatla and Ashok D. Belegundu – Pearson Education Publications.
- Finite Element analysis – Theory & Programming by C.S.Krishna Murthy- Tata Mc.Graw Hill Publishers Finite Elements Methods in Engineering by Tirupati. R. Chandrnpatla, Universities Press India Ltd. Hyderabad.
- Finite element method and its application by Desai, 2012, Pearson Pubilications.
- Finite element methods by Darrel W.Pepper, Vikas Pubilishers
- Finite element analysis and procedures in engineering by H.V.Lakshminaryana, 3rd edition, universities press, Hyderabad.
- Finite element analysis in Engineering Design by S.Rajasekharan, S.Chand Publications, New Delhi.
- Finite element analysis by S.S. Bhavakatti-New age international publishers

L	P	C
4	0	4

Subject Code:15D12201

M.Tech (COMPUTER AIDED STRUCTURAL ENGINEERING)
II – Semester

ARTIFICIAL NEURAL NETWORKS

UNIT I:
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-II
SUPERVISED LEARNING-1: Single Layer Neural Network and architecture, McCulloch-Pitts Neuron Model, Perception Model, Perception Convergence Theorem, ADALINE, Delta Learning Rule.

UNIT III:
SUPERVISED LEARNING-2: Multi Layer Neural Network and architecture, MADALINE, Back Propagation learning, Back Propagation Algorithm.
UNSUPERVISED LEARNING-1: Kohenen Self Organization Networks, Hamming Network and MAXNET, Learning Vector Quantization, Mexican hat.

UNIT IV:
UNSUPERVISED LEARNING-2: Counter Propagation Network, Forward Only Counter Propagation Network, Adaptive Resonance Theory (ART) -Architecture, Algorithms.
ASSOCIATIVE MEMORY NETWORKS : Introduction, Auto Associative Memory ,Hetero Associative Memory, Bidirectional Associative Memory(BAM) -Theory And Architecture, BAM Training Algorithm-Storage.

UNIT V:
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 .

TEXT 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.

REFERENCE BOOKS:

1. B.Yegnanarayana " Artificial Neural Networks " PHI, NewDelhi, 2005.
2. S.Rajasekaran and G.A.Vijayalakshmi Pai " Neural Networks. Fuzzy Logic and Genetic Algorithms ", 2007.
3. James A Freeman and Davis Skapura" Neural Networks Algorithm, Applications and Programming Techniques ", Pearson Education, 2002.

L	P	C
4	0	4

Subject Code:15D122002

M.Tech (COMPUTER AIDED STRUCTURAL ENGINEERING)

II – Semester

CAD & COMPUTER APPLICATIONS IN STRUCTURAL ENGINEERING

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, Bresenham's Algorithm, C program to draw a line, circle, ellipse using breasenham's algorithm.

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

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

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.

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

TEXT / REFERENCE BOOKS :

1. C.S.Krishna Murthy & Rajiv S. – Computer Aided Design, Software & Analytical tools – Narasha publishing house India.
2. Computer Aided design in rainforced concrete – Dr L.Shah-Structures Publishers Pune.\
3. IS – 456 -2000
4. Limit State Design – A.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.

L	P	C
4	0	4

Subject Code:15D11204

M.Tech (COMPUTER AIDED STRUCTURAL ENGINEERING) II- SEMESTER

II – **Semester**

ANALYSIS OF SHELLS AND FOLDED PLATES
(Ellective-III)

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

2. **Cylindrical shells:** Derivation of governing DKJ equation for bending theory, details of Schorer's theory, Applications to the analysis and design of short shells and long shells. Introduction of ASCE manual co-efficients for design.

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.

4. **Folded Plates:** Folded plate theory, plate and slab action, Whitney's theory, Simpson's theory for the analysis of different types of folded plates (Design is not included)

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

TEXT / 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.Swell – 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.

L	P	C
4	0	4

Subject Code:15D12203

M.Tech (COMPUTER AIDED STRUCTURAL ENGINEERING) II- SEMESTER

II – **Semester**

RELIABILITY BASED ENGINEERING DESIGN

(Elective-III)

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

2. Determination of reliability, Monte Carlo study of structural safety.

3. Levels of reliability methods and their suitable adoption in structural engineering elements.

4. Level 2 reliability methods including advanced level 2 method.

5. Reliability analysis of structural components – Reliability based design determination of partial safety factors, code calibration – Reliability of structural systems application to steel & concrete structures, off shore structures.

TEXT / 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.

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Subject Code:15D11207

M.Tech (COMPUTER AIDED STRUCTURAL ENGINEERING)

II – **Semester**

EARTHQUAKE RESISTANT STRUCTURES
ELECTIVE – III

1. **Engineering seismology :**
   Earthquake – causes of earthquake – earthquakes and seismic waves – scale and intensity of earthquakes – seismic activity – Measurements of earth quakes – seismometer- strong motion accelerograph / field observation of ground motion – analysis of earthquakes waves – earth quake motion – amplification of characteristics of surface layers – earthquake motion on the ground surface;
2. **Vibration of structures under ground motion:**
   Elastic vibration of simple structures – modelling of structures and equations of motion – freevibrations of simple structures – steady state forced vibrations – Non steady state forced vibrations – response spectrum representations; Relation between the nature of the ground motion and structural damage.
3. **Design approaches:** Methods of analysis – selection of analysis – equivalent lateral force procedure seismic base shear – seismic design co-efficient - vertical distribution of seismic forces and horizontal shear – twisting moment - Over turning moment – vertical seismic load and orthogonal effects lateral deflection – P- Δ characteristics effect – soil structure Interaction
   Seismic – Graphs study, earthquake records for design – factors affecting Accelerogram characteristics - artificial Accelerogram – zoning map.
   Dynamic – analysis procedure: Model analysis – Inelastic – time history analysis Evaluation of the results.
4.. **Earthquake – Resistant design of structural Components and systems:**
   Introduction – monolithic reinforced – concrete structures – precast concrete structures – Prestressed concrete structures – steel structures – composite – structures, masonry structures – Timber structures.
5. **Fundamentals of seismic planning:** Selection of materials and types of construction form of superstructure – framing systems and seismic units – devices for reducing. Earthquake loads.

TEXT / REFERENCE BOOKS:

1. Design of earthquake resistant structures by Minoru Wakabayashi.
2. A.K.Chopra, Strucutural Dynamics for Earthquake Engineering", Pearson Pubilications.
3. R.W.Clough and 'Dynamics of structures'. Mc Graw – Hill, 2nd edition,1992.
4. N.M Newmark and E.Rosenblueth, Fundamentals of Earthquake Engineering' prentice hall,1971.
5. David Key, Earthquake design practice for buildings." Thomas telford,London,1988
6. R.L. Wegel, Earthquake Engg; Prentice Hall 12nd edition 1989.
7. J.A. Blume, N.M. Newmark, L.H. Corning., Design of Multi –storied Buildings for Earthquake ground motions', Portland Cement Association, Chicago,1961
8. I.S.Codes No. 1893,4326,13920.
9. Earthquake Resistant Design by Pankaj Agarwal.

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Subject Code:15D12204

M.Tech (COMPUTER AIDED STRUCTURAL ENGINEERING)
II – **Semester**

MANAGEMENT INFORMATION SYSTEMS
ELECTIVE – IV

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.

2. Physical design of computer sub-systems, database design, file design, input-output and procedure design and system security.

3. MIS development – process – system development – system life cycle method – Structured development method, and prototype method – Software development.

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

5. Implementation, Evaluation and maintenance of MIS – pitfalls in MIS development. System modeling for MIS system engineering methodology for MIS problem solving.

TEXT / 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
7. Himalaya Publishing house – Mumbai.
8. Gordan Davis – Management Information Systems, Mc Graw – hill Publishers.

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Subject Code:15D11210

M.Tech (COMPUTER AIDED STRUCTURAL ENGINEERING)

II – **Semester**

FRACTURE MECHANICS

ELECTIVE-IV

1. Summary of basic problems and concepts:

Introduction - A crack in a structure - The stress at a crack tip - The Griffith criterion The crack opening displacement criterion - Crack Propagation - Closure

2. The elastic crack – tip stress field :

The Airy stress function - Complex stress functions - Solution to crack problems - The effect of finite size - Special cases - Elliptical cracks - Some useful expressions

3. **The crack tip plastic zone:**

The Irwin plastic zone correction - The Dugdale approach - The shape of the plastic zone - Plane stress versus plane strain - Plastic constraint factor - The thickness effect

4. The energy principle:

The energy release rate - The criterion for crack growth - The crack resistance (R curve) - Compliance , The J integral (Definitions only)

Plane strain fracture toughness:

The standard test - Size requirements - Non-Linearity – Applicability

Plane stress and transitional behaviour:

Introduction - An engineering concept of plane stress - The R curve concept

5. The crack opening displacement criterion:

Fracture beyond general yield - The crack tip opening displacement - The possible use of the CTOD criterion

Determination of stress intensity factors:

Introduction - Analytical and numerical methods - Finite element methods, Experimental methods (An Ariel views only)

REFERENCES;

1. Elementary engineering fracture mechanics - David Broek, Battelle, columbus laboratories, columbus, Ohieo, USA
2. Fracture and Fatigue Control in Structures - john M.Barsom, Senior consultant United states Steel corporation & Stanley T.Rolfe, Ross H.Forney Professor of Engineering University of Kansas. &Stanley T.Rolfe, Ross H.forney Professor of Engineering, University of Kansas

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Subject Code:15D11206

M.Tech (COMPUTER AIDED STRUCTURAL ENGINEERING)
II- SEMESTER

ADVANCED CONCRETE TECHNOLOGY

ELECTIVE-IV

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.
2. **Aggregates**: Classification of aggregate – particle shape and texture – Bond strength and other mechanical properties of aggregate specific gravity, Bulk density, porosity, absorption and moisture in aggregate – soundness of aggregate – Alkali – aggregate reaction, Thermal properties – sieve analysis – Fineness modulus – grading curves – grading requirements – practical grading – Road note No.4 grading of fine and coarse aggregates gap graded aggregate – maximum aggregate size.
3. **Fresh 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-Abram's law – Gel space ratio – effective water in mix – Nature of strength of concrete – strength in tension and compression-Griffith's 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 – compression tests – tension tests – factors affecting strength – flexure tests – splitting tests – Non destructive testing methods.
4. **Elasticity, Shrinkage and Creep**: Modulus of elasticity – dynamic modulus of elasticity – poisson's 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.
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

TEXT/ 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. Concrete Technology by A.M.Neville – Pearson publication
7. Concrete Technology by M.L. Gambhir. – Tata Mc. Graw Hill Publishers, New Delhi
8. Non-Destructive Test and Evaluation of materials by J.Prasad & C.G.K. Nair , Tata Mcgraw hill Publishers, New Delhi

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Subject Code:15D54201

M.Tech (COMPUTER AIDED STRUCTURAL ENGINEERING)
II- SEMESTER

RESEARCH METHODOLOGY
(Audit Course)

(Audit Course For M.Tech. –II Semester Program from 2015 admitted batches onwards)

UNIT I

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining a Research Problem – research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

UNIT II

Sampling Design – steps in Sampling Design –Characteristics of a Good Sample Design – Random Sampling Design.
Measurement and Scaling Techniques-Errors in Measurement – Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation.
Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

UNIT III

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

UNIT IV

Statistical Inference: Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multi-variate Analysis.

UNIT V

Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research.

Text books:

1. **Research Methodology:Methods and Techniques – C.R.Kothari, 2nd Edition,New Age International Publishers.**
2. **Research Methodology: A Step by Step Guide for Beginners- Ranjit Kumar, Sage Publications (Available as pdf on internet)**
3. **Research Methodology and Statistical Tools – P.Narayana Reddy and G.V.R.K.Acharyulu, 1st Edition,Excel Books,New Delhi.**

REFERENCES:

1. Scientists must Write - Robert Barrass (Available as pdf on internet)

2. Crafting Your Research Future –Charles X. Ling and Quiang Yang (Available as pdf on internet)

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Subject Code:15D12205

M.Tech (COMPUTER AIDED STRUCTURAL ENGINEERING)

II- SEMESTER

CAD LABORATORY – II

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.