COURSE STRUCTURE & EVALUATION SCHEME
M.TECH. (Structural Engineering- Part Time)
Effective from Session 2017-18 (for New Entrants)

I SEMESTER

Sr. No.	Subject Code	Course Title	Credits (L-T-P)	Sessional Marks				ESM	Total Marks
				CT	TA	Lab	Total		
1.	BMA 509	Numerical Methods and Computer Programming	4(3-1-0)	30	20	-	50	50	100
2.	ECE 523	Limit State Analysis and Design of Structures	4(3-1-0)	30	20	-	50	50	100
3.	ECE 525	Advanced Theory of Structures	4(3-1-0)	30	20	-	50	50	100

II SEMESTER

Sr. No.	Subject Code	Course Title	Credits (L-T-P)	Sessional Marks				ESM	Total Marks
				CT	TA	Lab	Total		
1.	ECE 522	Concrete Technology and Pre-stressed Concrete	4(3-1-0)	30	20	-	50	50	100
2.	ECE 524	Earthquake analysis and Design of Structures	4(3-1-0)	30	20	-	50	50	100
3.	BMA 502	Advanced Mathematics	4(3-1-0)	30	20	-	50	50	100

III SEMESTER

Sr. No.	Subject Code	Course Title	Credits (L-T-P)	Sessional Marks				ESM	Total Marks
				CT	TA	Lab	Total		
1.	ECE 621	Advanced foundation Engineering	4(3-1-0)	30	20	-	50	50	100
2.	ECE 623 to 633	Elective I	4(3-1-0)	30	20	-	50	50	100
3.	ECE 615	Seminar	2(0-0-4)						

IV SEMESTER

Sr. No.	Subject Code	Course Title	Credits (L-T-P)	Sessional Marks				ESM	Total Marks
				CT	TA	Lab	Total		
1.	ECE 622 to 632	Elective II	4(3-1-0)	30	20	-	50	50	100
2.	ECE 634 to 644	Elective III	4(3-1-0)	30	20	-	50	50	100
3.	ECE 650	Minor Project	2(0-0-4)						

V SEMESTER

Sr. No.	Subject Code	Course Title	Credits (L-T-P)	Sessional Marks				ESM	Total Marks
				CT	TA	Lab	Total		
1.	ECE 701	Dissertation	8(0-0-16)						

VI SEMESTER

Sr. No.	Subject Code	Course Title	Credits (L-T-P)	Sessional Marks				ESM	Total Marks
				CT	TA	Lab	Total		
1.	ECE 702	Dissertation	8(0-0-16)						

LIMIT STATE ANALYSIS AND DESIGN OF STRUCTURES (ECE 523)

L T P C 3 1 0 4

UNIT I

Design philosophy, Limit state codal provisions - beams, slabs and columns according to IS Codes. Codal Provisions for deflection and crack width. Interaction curve generation for axial force and bending.

UNIT II

Design of special RC elements, Design of slender columns - Design of RC walls. Strut and tie method of analysis for corbels and deep beams, Design of corbels, Deep-beams.

UNIT III

Flat slabs and yield line based design, Design of flat slabs and flat plates according to IS method – Check for shear.

UNIT IV

Design of over-head tanks: Design of RC domes and beams curved in plan, design of Cylindrical and rectangular tanks with different end conditions using IS: 3370 tables, Intze tank design based on membrane analysis with mention of continuity effects. Design of staging: Braces, Columns and Raft Foundation.

UNIT V

Concept of Ductility – Detailing for ductility – Design of beams, columns for ductility.

Books and References

1. Gambhir M. L., “Design of Reinforced Concrete Structures”, Prentice Hall of India, 2012. 2. Purushothaman, P, “Reinforced Concrete Structural Elements: Behaviour Analysis and Design”, Tata McGraw Hill, 1986
3. Unnikrishna Pillai and Devdas Menon “Reinforced Concrete Design’, Third Edition, Tata McGraw Hill Publishers Company Ltd., New Delhi, 2007.
4. Varghese, P.C, “Advanced Reinforced Concrete Design”, Prentice Hall of India, 2005.
5. Varghese, P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, 2007.

ADVANCED THEORY OF STRUCTURES (ECE 525)

L T P C 3 1 0 4

Unit I

Iterative methods of structural analysis: Moment Distribution Method and Kani’s Method of analysis of statically indeterminate structures and applications to continuous beams and plane frames.

Unit II

Force Method of Structural Analysis: Review of energy principles, Static Indeterminacy, Force method- concept of flexibility, Matrix approach: application to beam, plane truss and plane frame.

Unit III

Matrix Algebra – methods for matrix inversion and solution of simultaneous equations – band and sparse matrix techniques, stiffness and flexibility matrices of structural elements – various co-ordinate system and their transformation and synthesis matrix formulation of force and displacement methods – member approach.

Unit IV

Linear analysis of different 2D and 3D structures, Techniques for enhancing computing power: solution algorithm, sub-structuring, Non linear analysis: types and different techniques, convergence criteria.

Unit V

Building Frames: Introduction, Equivalent 2D idealization of building frames for simplified 2D Analysis,Design Loadings for Building Frames, Analysis of framed building by approximate methods for vertical and horizontal loads

Books and References

1. William Weaver Jr & James M Gere, "Matrix Analysis of Framed Structures", 2nd Ed., CBS Publishers, New Delhi, 1986.
2. Madhu B Kanchi, "Matrix Methods of Structural Analysis", 2nd Ed., Wiley Eastern Ltd., 1993.
3. Majeed K I, "Non Linear Structure Analysis", Butterworth Ltd. London.

CONCRETE TECHNOLOGY & PRE-STRESSED CONCRETE (ECE 522)

L T P C 3 1 0 4

UNIT I

Concrete Materials and Admixtures: Aggregates classification, IS specifications, properties, Grading, specified grading, Testing of aggregates, Fibers, testing of concrete, structure of hydrated cement, Mechanical Properties of Concrete, Mineral Admixtures: Pulverized Fly Ash, Ground Granulated Blast Furnace Slag and Silica Fume; Chemical Composition, Physical Characteristics, Chemical and Physical Processes of Hydration and Interaction, Effects on Properties of Concretes, Chemical Admixtures

UNIT II

Concrete Mix Design: The process of Mix Selection, Factors governing the selection of Mix Proportions, Different Methods of Mix Design, Concepts of Statistical Quality Control of Concrete, Methods of Design mix concrete by using IS code method

UNIT III

Special Concretes: Lightweight Concrete, No-Fines Concrete, High Performance Concrete,High Density and Radiation-Shielding Concrete, Polymer Concrete, Fibre Reinforced Concrete, Self Compacting Concrete, Roller Compacted Concrete, High Volume Fly Ash Concrete, Ready Mixed Concrete

UNIT IV

Pre- stressed concrete, basic concept; pre-stressing material and pre-stressing systems; losses of pre-stress, End anchorage and cable layouts, Deflections of Prestressed Concrete Beams: Short term deflections of uncracked members, Prediction of long-term deflections, load–deflection curve for a PSC beam, IS code requirements for maximum deflections.

UNIT V

Analysis and design of pre-stressed concrete flexure members, compression and tension members, Analysis and design for shear, bond and bearing, partial prestressing, composite construction with pre-stressed concrete and reinforced concrete; two-way prestressing, circular prestressing, indeterminate structures

Books and References

1. Concrete Technology, Tata Mc-Graw Hill-Education, New Delhi.
2. Shetty.M.S.,(2017), Concrete Technology, S. Chand and Company Ltd, New Delhi.
3. IS : 12269, Specification for 53 grade ordinary Portland Cement, BIS, New Delhi
4. IS : 383, Specification for Coarse and fine natural sources for Concrete, BIS, New Delhi
5. IS:10262, Concrete Mix Proportioning -Guidelines
6. Krishna Raju, "Prestressed concrete", Tata Mc Graw Hill Book
7. Ramamrutham, "Prestressed concrete", Dhanpat Rai & Sons, Delhi.

EARTHQUAKE ANALYSIS AND DESIGN OF STRUCTURES (ECE 524)

L T P C 3 1 0 4

Unit-I

Basic Concepts: Seismic performance of structures and structural components during earthquakes; Ground motion parameters; Response spectrum, design spectrum.

Unit-II

Seismic Design Philosophy: Concept of strength, over strength and ductility, Concept of equal displacement and equal energy principles, capacity design; seismic design consideration in buildings with irregularities.

Unit-III

Seismic Analysis of Buildings: Equivalent static analysis, response spectrum analysis, mode superposition method; Time history analysis; Modelling concept of reinforced concrete building.

Unit-IV

Seismic Design of Building Components: Seismic resistant properties of reinforced concrete; Seismic behaviour and design of linear reinforced concrete elements; Seismic behaviour of planar reinforced concrete elements, codal provisions.

Unit-V

Seismic Provisions for Structural Steel Buildings: Materials, connections, joints and fasters; Columns, ordinary, intermediate and special moment resisting frame; Concentrically and eccentrically braced frames.

Books and References

1.Pauley, T. and Priestley, M.J.N "Seismic Design of Reinforced Concrete and Masonry Buildings", John-Wiley & Sons.1992.
2. Drysdale, R.G. Hamid, A. H. and Baker, L.R "Masonry Structure: Behaviour and Design", Prentice Hall, Englewood Cliffs, 1994.
3. Schneider, R.R. and Dickey, W.L. "Reinforced Masonry Design", 3nd Ed., Prentice Hall, 1994.
4.Edmund Booth, "Concrete Structure in Earthquake Regions – Design & Analysis" Longman Scientific & Technical, 1994.
5. "Seismic Evaluation and Retrofit of Concrete Building – Vol. I & II", Applied Technology Council, California, ATC 40, 1996.
6. Penelis, George G., and Kappos, Andreas J., "Earthquake Resistant Concrete Structures", E & F. N., Spon, 1997.
7. "Building Seismic Safety Council", Federal Emergency Management Agency, Washington, D.C, FEMA 356, 2000, FEMA 440 / ATC 55,2005, FEMA 310.1998
8. Amrhein, J. E. "Reinforced Masonry Engineering Handbook", Masonry Institute of America, CRC Press, 1998.
9. Allan Willians, "Seismic Design of Building & Bridges", Oxford University Press.2003
10. Robert E. Englekirk "Seismic Design of Reinforced and Precast Concrete Buildings", John Wiley & Sons.2003.

ADVANCED MATHEMATICS (BMA-502)

L T P C 3 1 0 4

Unit I

Set Theory: Definition of set, Subsets and supersets. Set operations, finite and infinite set, Cardinality, Venn diagram, Cartesian product, Fuzzy sets– basic properties, Simple problems. Recurrence Relation and Generating Functions: Formation of recurrence relation, Solution of linear and nonlinear recurrence relation, Properties of generating function and solve the recurrence relation using the generating function and related problems.

Unit II

Numerical analysis: Introduction to interpolation, Newton's Forward and Backward interpolation (Statement only), Lagrange and Divided interpolation (Statement only), Simple problems. Numerical differentiation for equal and unequal interval. Matrix Eigen value and Eigen vactor by power methods, simple problems. Curve fitting and problems.

Unit III

Statistics: Analysis of Bivariate data. Correlation Analysis – Meaning of correlation;

Unit IV

Scatter Diagram; Karl Pearson's coefficient of linear correlation. , Linear regression, Properties of regression and related problem.

Unit V

Optimisation Technique: Linear programming problem (LPP) Formation of LPP, Graphical Method and related problems. Transportation Problems,

Text Books

1. Mott, Kandel& Baker, Discrete Mathematics for Comp. Scientists & Mathematicians, PHI
2. C.L.Liu, Discrete Mathematical Structure, TMH
3. Dutta & Jana, Introductory Numerical Analysis.

4. J.B.Scarborough, Numerical Mathematical Analysis.
5. Jain, Iyengar& Jain, Numerical Methods (Problems and Solution).
6. V.K. Kapoor, Operation Research.
7. PaneerSelvam, Operation Research, PHI
8. Hillier & Lieberman, Operations Research, TMH
9. Kalavati, Operations Research, VIKAS
10. R.I.Levin& D.S. Rubin, Statistics for Management, Pearson Education
11. Amir D. Aczel&JayavelSounderpandian, Complete Business Statistics, Tata McGraw Hill
12. R.S Bhardwaj, Business Statistics, Excel Books.
13. Balagurusamy: Numerical Methods,
14. Scitech.OperationResearch,HumdyTaha,PHI
15. Statistics,Random Process & Queuing Theory, Prabha, Scitech
16. S P Gupta & M.P. Gupta, Business Statistics, Sultan Chand & Sons
17. G. C. Beri, Statistics for Management, Tata McGraw- Hill

ADVANCED FOUNDATION ENGINEERING (ECE-621)

L T P C 3 1 0 4

UNIT I

Modern methods of soil investigations, Geophysical methods; soil resistivity methods seismic refraction method, stress below ground due to loads

UNIT II

Bearing capacity and settlement analysis of shallow foundations: Meyerhof and Hansen's bearing capacity equations, BIS bearing capacity equation, immediate and consolidation settlements in cohesive soil, De-Beer and schmmertman's methods of settlement prediction in non cohesive soil.

UNIT III

Classification of piles, load carrying capacity of single piles in clay, silt and sand by dynamic and static methods, Pile load test, Pile group, Negative skin friction, Settlement of pile group.

UNIT IV

Foundation on expansive soil, Construction on expansive soil, Alteration of soil condition, under-reamed piles. Elements of well foundation, Shape, Depth of scour, Well sinking, Tilt, shift and their prevention.

UNIT V

Stability of slopes, Limit equilibrium method, Method of slices, Simplified Bishop method, Stability Charts. Soil behavior under dynamic loads ,Machine foundation classification, definitions, design principle in brief, Barken's method.

Books and References

1. Alam Singh – Modern Geotechnical Engineering.
2. B. M. Das – Foundation Engineering, CENGAGE Learning
3. Gopal Ranjan and A. S. R. Rao – Basic and Applied Soil Mechanics
4. J. E. bowles – Analysis and Design of Foundation.
5. K. R. Arora – Soil Mechanics & Foundation Engineering.
6. V. N. S. Murthy – Soil Mechanics and Foundation Engineerin

ELECTIVE-I (ECE 623-633)

List of Elective I

ECE 623	Theory of Plates and Shells
ECE 625	Reliability analysis and design of structures
ECE 627	Structural Dynamics
ECE 629	Theory of elasticity and plasticity
ECE 631	Plastic design of steel structures
ECE 633	Earthquake and foundation safety

THEORY OF PLATES AND SHELLS (ECE 623)

L T P C 3 1 0 4

Unit I

Introduction to plate theory, Small deflection of laterally loaded thin rectangular plates for pure bending. Navier's and Levy's solution for various lateral loading and boundary conditions, Numerical examples.

Unit II

Energy methods for rectangular and circular plates with clamped edges subjected to symmetric loadings.

Unit III

Introduction to curved surfaces and classification of shells, Membrane theory of spherical shells, cylindrical shells, hyperbolic paraboloids, elliptic paraboloid and conoids.

Unit IV

Axially symmetric bending of shells of revolution, Closed cylindrical shells, water tanks, spherical shells and Geckler's approximation. Bending theory of doubly curved shallow shells.

Unit V

Design and detailing of folded plates with numerical examples Design and Detailing of simple shell problems – spherical domes, water tanks, barrel vaults and hyperbolic paraboloid roofs.

Books and References

1. Timosheko, S. and Woinowsky-Krieger, W., "Theory of Plates and Shells" 2nd Edition, McGraw-Hill Co., New York,1959
2. Ramaswamy G.S. – "Design and Constructions of Concrete Shell Roofs" – CBS Publishers and Distributors – New Delhi – 1986.
3. Ugural, A. C. "Stresses in Plates and Shells", 2nd edition, McGraw-Hill, 1999.
4. R. Szilard, "Theory and analysis of plates - classical and numerical methods", Prentice Hall,1994
5. Chatterjee.B.K. – "Theory and Design of Concrete Shell", – Chapman & Hall, Newyork-third edition, 1988

RELIABILITY ANALYSIS AND DESIGN OF STRUCTURES (ECE 625)

L T P C 3 1 0 4

Unit-I

Nature of Structural Design and Safety: Evolution of design codes; Hazards, risks and economy of structural design.

Uncertainty Modelling: Probability theory, random variables, probability distributions, moments, extreme value statistics, utility and descriptive statistics;

Fuzzy set theory.

Unit-II
Bayesian Decision Theory: A priori and posterior probability; Bayes strategy and computation.
Statistical Inference: Model estimation, hypothesis testing, confidence intervals and significance testing.

Unit-III
Stochastic Models for Material Strengths: Classic strength models – ideal brittle material, idea plastic material, fibre bundle; Fatigue – damage accumulation laws, cycle counting, damage statistics; Bogdanoff's cumulative damage model.
Stochastic Models for Loads: Gust wind loads, wave loads, earthquake loads, traffic load and live load modeling; Stochastic theory of load combinations.

Unit-IV
Reliability Methods: Multiple safety factor formats; Characteristic values; Reliability index and system reliability; code calibrations.

Unit-V
Time Varying Reliability Analysis, Reliability Based Optimization Introduction to Stochastic FEM.

Books and References

1. Ang , A.H., S. and Tang, W.H.. "Probability Concepts in Engineering Planning and Design", Vol. I & II., John Wiley & Sons.
2. Blockley , D.I.. "The Nature of Structural Design and Safety", Ellis Horwood.
3. Augusti, G., Baratta, A. and Casciati, F., "Probabilistic Methods in Structural Engineering", Chapman & Hall.
4. Chernoff, H. and Moses, L.E., "Elementary Decision Theory", Dover Publications.
5. Elishakoff, I.., "Probabilistic Theory of Structures", 2nd edition, Dover Publications.
6. Ditlevson, O. and Madsen, H.O., "Structural Reliability Methods, Department of Mechanical Engineering".
7. Madsen, H.O., Krenk, S. and N.C. "Lind. Methods of Structural Safety", Dover Publications.

STRUCTURAL DYNAMICS (ECE 627)

L T P C 3 1 0 4

Unit-I
Introduction: Introduction to Dynamic problems in Civil Engineering, Concept of degrees of freedom, D'Alembert's principle, principle of virtual displacement and energy principles.

Unit-II
Dynamics of Single-degree-of-freedom systems: Mathematical models of Single-degree-of-freedom systems system, Free vibration response of damped and undamped systems. Methods of evaluation of damping.

Unit-III
Response of Single-degree-of-freedom systems to harmonic loading (rotation unbalance, reciprocating unbalance) including support motion, vibration isolation, transmissibility, Numerical methods applied to Single-degree-of-freedom systems -
Duhamel integral, principle of vibration-measuring instruments – seismometer and accelerometer.

Unit-IV
Dynamics of Multi-degree freedom systems: Mathematical models of multi-degree-of-freedom systems, Shear building concept, free vibration of undamped multi-degree-of-freedom systems - Natural frequencies and mode shapes – orthogonality. property of modes.

Unit-V

Approximate methods: Rayleigh's method Dunkarley's method, Stodola's method. Dynamics of Continuous systems: flexural vibration of beams with different end conditions,. Stiffness matrix, mass matrix (lumped and consistent); equations of motion for the discretised beam in matrix form.

Books and References

1. Dynamics of Structures – Theory and Application to Earthquake Engineering"- 2nd ed., Anil K. Chopra, PearsonEducation.
2. Earthquake Resistant Design of Building Structures, Vinod Hosur, WILEY (india)
3. Vibrations, structural dynamics- M. Mukhopadhaya : Oxford IBH
4. Structural Dynamics- Mario Paz : CBS publishers.
5. Structural Dynamics- Clough & Penzien : TMH
6. Vibration Problems in Engineering Timoshenko, S, Van-Nostrand Co.

THEORY OF ELASTICITY AND PLASTICITY (ECE 629)

L T P C 3 1 0 4

Unit-I

Theory of Elasticity: Introduction: Definition of stress and strain and strain at a point, components of stress and strain at a point of Cartesian and polar coordinates. Constitutive relations, equilibrium equations, compatibility equations and boundary conditions in 2-D
and 3-D cases.

Unit-II

Formulation of boundary value problems in elasticity Equilibrium, compatibility, formulation in Cartesian and Polar coordinates , Solution of boundary value problems in elasticity- Plane stress and plane strain problems Flexure and Torsion Problems.

Unit-III

Torsion of various shapes of bars - Stress function method of solution applied to circular and elliptical bars - Torsion of rectangular bars - Solution of torsional problems by energy method-Use of soap films in solving torsion problems – Prandtl's membrane analogy - Solution of torsion of rectangular bars by (i) Raleigh Ritz method and (ii) Finite difference method.

Unit-IV

Theory of Plasticity: General concept, yield criteria, shape factor, Collapse Mechanisms, flow rules for perfectly plastic and strain hardening materials - simple applications, Theories of failure. Plasticity models for concrete.

Unit-V

Stress – strain diagram in simple tension, perfectly plastic, Rigid – Perfectly plastic, Elastic Perfectly plastic, Elastic Linear work hardening materials, stress – space representation of yield criteria through Westergard stress space, Tresca and Von-Mises criteria of yielding.
Plastic analysis – Yield criteria – St. Venant's theory.

Books and References

1. Mendelson, A., (2002), Plasticity: Theory and Applications, Mac Millanand Co., New York.
2. Sadhu Singh., (2004), Theory of Plasticity, DhanpatRai sons Private Limited, New Delhi.
3. Ansel.C.Ugural and Saul.K.Fenster, (2003), Advanced Strength and Applied Elasticity, Fourth Edition, Prentice Hall Professional technical Reference, New Jersey
4. Chakrabarty.J, (2006), Theory of Plasticity, Third Edition, Elsevier Butterworth – Heinmann.

PLASTIC DESIGN OF STEEL STRUCTURES (ECE 631)

L T P C 3 1 0 4

Unit I

Introduction, Historical review, plastic failure, plastic moment, moment distribution, capacity of a cross-section, shape factor, concept of load factor.

Unit II

Plastic hinge and collapse Mechanisms. Analysis of beams and frames. Plastic analysis of fixed and continuous beams, propped cantilevers.

Unit III

Plastic moment distribution for multi-storey and multi-bay frames.

Unit IV

Plastic design of continuous beams, Rigid jointed portal frames, Semi Graphical method and Mechanism method.

Unit V

Analysis for deflections at collapse. Effect of axial force and shear.

References

1. Design of Steel Structures – N. Subrhamanyan, Oxford.
2. Plastic Design of Low -rise frames, Horne, M.R., and Morris, L.J., Granada Publishing
3. Steel Structure -Design and Behaviour, Salmon, C.G., and Johnson, J.E. Harper and Row,
4. Design of Steel Structure - Duggal, Tata Mc Graw Hill.

EARTHQUAKE AND FOUNDATION SAFETY (ECE 633)

L T P C 3 1 0 4

Unit-I

Theory of Vibration Isolation: Principle of base isolation; Theory of vibration isolation; Components of base isolation; Advantages and limitations; General Design Criteria; Linear and Nonlinear procedures of isolation design; Application of theory to multiple degree of freedom system.

Unit-II

Isolation Devices: Laminated rubber bearing, lead rubber bearing, high damping rubber bearing, PTFE sliding bearing, friction pendulum system and sleeved pile system; Modelling of isolation bearings; Design process for multilayered elastomeric bearings and buckling behaviour of elastomeric bearings; Isolation system testing.

Unit-III

Linear and Non-linear modelling; Modelling of soil and foundations. Seismic Safety of Equipments and Accessories: Retrofitting solutions against sliding and overturning of equipments and accessories.

Unit-IV

Seismological considerations for safety of pipelines, tunnels, cavities, archaeological monuments, etc.

Unit-V

Safety of infills in in-plane action – shear, compression and buckling;

Books and References

1. Building Seismic Safety Council", Federal Emergency Management Agency, Washington, D.C, FEMA 356, 2000, FEMA 440 / ATC 55, 2005, FEMA 310.
2. Skinner, R., Robinson , W.H., Mc Verry, G. H., "An Introduction to Seismic Isolation", John Wiley and Sons.1996
3. 2. Pristley, M.J.N., Seible, F., Calvi, G.M. "Seismic Design and Retrofit of Bridges", John Wiley and Sons.1996
4. 3. James, M., Kelly, "Earthquake - Resistant Design with Rubber", Springer Verlag

SEMINAR (ECE-615)

L T P C 0 0 4 2

Individuals have to select topic of current interest, Review and Evaluate available Literature & present the content in own Language and style

ELECTIVE-II (ECE 622-632)

List of Elective II

ECE 622	Srtuctural Fire Engineering
ECE 624	Computer Aided Design
ECE 626	Design of tank and reservoirs
ECE 628	Rehabilitation of structures
ECE 630	Bridge engineering
ECE 632	Design of retaining structures

STRUCTURAL FIRE ENGINEERING (ECE 622)

L T P C 3 1 0 4

Unit I
Introduction to Structural Fire Engineering: Fire loads, ventilation effects, compartment geometry

Unit II
Fire safety and fire resistant tests

Unit III
Elements of construction for fire safety, protection for openings, selection of materials, site planning

Unit IV
Fire protection of tall buildings

Unit – V
Architectural fire safety measures. Repair and rehabilitation of fire damaged structures

Books and References

1. Structural Fire Engineering by Tom Lennon
2. Structural Fire Engineering Edited by Kevin J. LaMalva, P.E. ASCE.

COMPUTER AIDED DESIGN (ECE 624)

L T P C 3 1 0 4

UNIT I

Introduction to computer aided design-An over view-computer as a design medium hardware components of a computer -programming languages. C - Programming language-Introduction-An over view of programming in C-variables and data types-Declaration of variables-Initialization of variables-operators-arithmetic operators- precedence and associability-Input and output-Character I/O-Formatted output. Print f ()-Formatted input scan f ()-Examples.

UNIT II

C Programming Language-Control structures-If statement-Switch statement-loops-nested loops-while and for ,Do-While-continue statement-Go to statement-Examples. C Programming Language-Arrays-One dimensional Arrays-Two Dimensional Arrays pointer operators-pointer arithmetic-pointers and arrays-Matrix manipulations using arrays and pointers-pointers to functions-data files-basic operations-reading and writing and file accessing files-examples.

UNIT III

Computer Graphics-introduction-applications graphic devices-display devices-output and input devices-two dimensional geometric transformations-homogeneous co-ordinates world co-ordinates-device co-ordinates-window to view port-transformations-clipping operations.

UNIT IV

Data base management system-introduction-data base systems-hardware-software users-operational data independence-architecture of data base system-distributed databases.

UNIT V

Knowledge based expert system-introduction-artificial intelligence-components of an expert system-stages in expert system development-knowledge representation inference mechanisms-applications.

Books and References

1. Computer Aided Design by C.S.Krishnamoorthy and S.Rajeev.
2. Computational Structures by S.Rajasekharan.
3.David.F. Rogers. Mathematical elements for computer graphics, McGraw Hill 1990.
4. David F. Rogers Elements of computer graphics, Mc Graw Hill International

DESIGN OF TANKS AND RESERVOIRS (ECE 626)

L T P C 3 1 0 4

RCC WATER TANKS

Unit I

Design of over-head tanks: Design of RC domes and beams curved in plan, design of Cylindrical and rectangular tanks with different end conditions using IS: 3370 tables

Unit II

Intze tank design based on membrane analysis with mention of continuity effects. Design of staging: Braces, Columns and Raft Foundation.

Unit III:

Design Of Rectangular and circular Tanks – Approximate Methods And IS Methods – Design Of Under Ground Tanks – Design Of Base Slab And Side Wall – Check For Uplift.

UNIT IV

STEEL WATER TANKS

Design Of Rectangular Riveted Steel Water Tank – Tee Covers – Plates – Stays –Longitudinal And Transverse Beams – Design Of Staging – Base Plates – Foundation And Anchor Bolts – Design Of Pressed Steel Water Tank – Design Of Stays – Joints – Design Of Hemispherical Bottom Water Tank – Side Plates – Bottom Plates – Joints – Ring Girder – Design Of Staging And Foundation.

UNIT V

PRESTRESSED CONCRETE WATER TANKS

Principles of Circular Prestressing – Design Of Prestressed Concrete Circular Water Tanks.

Books and References

1. Rajagopalan K., “Storage Structures”, Tata McGraw Hill, New Delhi, 1998.
2. Krishna Raju N., “Advanced Reinforced Concrete Design”, CBS Publishers And Distributors, New Delhi, 1998.
3. Punmia B.C, Ashok Kumar Jain, Arun K.Jain, “R.C.C. Designs Reinforced Concrete Structures”, Laxmi Publications Pvt. Ltd., New Delhi, 2006.
4. Gambhir.M.L., “Design Of Reinforced Concrete Structures”, Prentice Hall Of India Private Limited, 2012.

REHABILITATION OF STRUCTURES (ECE 628)

L T P C 3 1 0 4

UNIT I

Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking. Influence on serviceability and durability:–Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection

UNIT II

Maintenance and repair strategies:– Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance, Preventive measures on various aspects Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration, testing techniques;

UNIT III

Materials:-Materials for Repair – Special Mortar and Concretes, Concrete Chemicals, Special Cements and High Grade Concrete, Expansive Cement, Polymer Concrete, Sulphur Infiltrated Concrete, Ferro Cement, Fibre Reinforced Concrete, and Admixtures of latest origin.

UNIT IV

Techniques for Repair- Surface Repair – Material Selection – Surface Preparation - Rust Eliminators and Polymers Coating For Rebar During Repair – Repair Of Cracks In Concrete and Masonry-Methods of Repair - Epoxy Injection, Mortar Repair For Cracks - Guniting and Shotcreting - Waterproofing Of Concrete Roofs;

UNIT V

Strengthening Measures - Flexural Strengthening, Beam Shear Capacity Strengthening, Column Strengthening, Shoring, Under Pinning and Jacketing. Demolition of Buildings – Introduction, Planning, Precautions and protective measures in demolition work, Sequence of operations, demolition of structural elements.

Books and References

1. Dayaratnam, P. and Rao, R., Maintenance and Durability of Concrete Structures, University Press, India
2. CPWD, Handbook on Repairs and Rehabilitation of RCC Buildings.

BRIDGE ENGINEERING (ECE 630)

L T P C 3 1 0 4

UNIT I

Introduction, historical review, Engineering and aesthetic requirements in bridge design, Introduction to bridge codes. Economic evaluation of a bridge project. Site investigation and planning;. Factors affecting scour and its evaluation, Site selection, various types of bridges and their suitability, loads, forces and IRC bridge loading and permissible stresses.

UNIT II

Bridge foundations - open, pile, well and caisson. Piers, abutments and approach structures; Superstructure - analysis and design of right, skew and curved slabs.

UNIT III

Design of RC bridges under concentrated loads using effective width and Pigeauds Method, Courbon's method of load distribution.

UNIT IV

Girder bridges - types, load distribution, design. Introduction to long span bridges - cantilever, arch, cable stayed and suspension bridges.

UNIT V

Detail design of slab culvert, T-beam bridge, box culverts

Books and References

1) Principle & Practice of Bridge Engineering by S.P. Bindra- Dhanpat Rai
2) Bridge Engineering by Demetrios E. Tonias, Jim J. Zhao
3) Design of Bridge Structures – Jagadish & Jayaram – Prentice Hall
4) Bridge Engineering by S. Ponnuswamy (Manohar Publishers & Distributor)
5)Ponnuswamy, S., Bridge Engineering, Tata Mcgraw Hill

DESIGN OF RETAINING STRUCTURES (ECE 632)

L T P C 3 1 0 4

Unit I

Active and passive earth pressures; Terzaghi's passive wedge theory, numerical methods, earth pressure measurements

Unit II

Types of earth pressures, numerical methods, pseudo static methods; Retaining walls: types, failure modes, static pressure, acquisition of soil parameters, Backfilled walls Stability check, Compaction pressure, Lateral pressure due to external loads.

Unit III

Design of reinforced earth retaining walls, reinforced earth embankments structures, wall with reinforced backfill.

Unit IV

Design of retaining walls with surcharge loads. Retaining walls resting on piles, Design of bridge abutments, Design of basement walls.

Unit V

Dynamic earth pressure, analytical and graphical methods, displacement analysis of retaining walls, Seismic design of retaining walls: types, modes of failures, seismic response (including M-O Method, seismic displacement, design considerations.

Books and References

1. Swami Saran, Analysis and Design of Sub structures, Oxford and IBH Publishing Co. PVT. Ltd, New Delhi.
2. Tomlinson, Foundation Design and Construction, Prentice Hall Publication.
2. Clayton, C.R.I., Milititsky, J., and Woods, R.I. (1993) "Earth Pressure and Earth Retaining Structures," 2nd ed., Blackie Academic & Professional.
3. Bowles.J.E. (1997) "Foundation Analysis and Design," 5th Edition, McGraw Hill.
4. Church, H.K. (1981) "Excavation Handbook," McGraw Hill.
5. Clayton, C.R.I (1992) "Retaining Structures," Proc. of the Conference on Retaining Structures, Cambridge, 20 23 July, 1992.

ELECTIVE-III (ECE 634-644)

List of Elective III

ECE 634	Finite Element Analysis
ECE 636	Hydraulic structures
ECE 638	Design of water and wastewater systems
ECE 640	Disaster management
ECE 642	Prefabricated construction techniques
ECE 644	High rise structures

FINITE ELEMENT ANALYSIS (ECE 634)

L T P C 3 1 0 4

UNIT 1-

Basic concepts of elasticity – Kinematic and Static variables for various types of structural problems – approximate method of structural analysis – Rayleigh – Ritz method – Finite difference method – Finite element method. Variation method and minimization of Energy approach of element formulation. Principles of finite element method – advantages & disadvantages – Finite element procedure. Finite elements used for one, two & three dimensional problems – Element aspect ratio – mesh refinement vs. higher order elements – Numbering of nodes to minimize band width.

UNIT-2

Nodal displacement parameters – Convergence criterion – Compatibility requirements – Geometric invariance – Shape function – Polynomial form of displacement function. Generalized and Natural coordinates – Lagrangian interpolation function – shape functions for one, two & three dimensional elements.

UNIT-3

Isoparametric elements, Internal nodes and higher order elements, Serendipity and lagrangian family of Finite Elements, Sub-parametric and superparametric elements, condensation of internal nodes, jacobian transformation Matrix. Development of strain-displacement matrix and stiffness matrix, consistent load vector, numerical integration.

UNIT-4

Application of Finite Element Method for the analysis of one & two dimensional problems - Analysis of simple beams and plane trusses – Application to plane stress / strain / axisymmetric problems using CST & Quadrilateral Elements.

UNIT-5

Application to Plates & Shells- Choice of displacement function (C^0, C^1 and C^2 type) – Techniques for Non – linear Analysis.

Books and References

1. Krishnamoorthy C S, “Finite Element Analysis”- Tata McGraw Hill
2. Desai C and Abel J F, “Introduction to the Finite Element Method”- East West Press Pvt. Ltd., 1972
3. Bathe K J, “Finite Element Procedures in Engineering Analysis”- Prentice Hall
4. Rajasekaran. S, “Finite Element Analysis in Engineering Design”-Wheeler Publishing
5. Cook R D, Malkan D S & Plesta M.E, “Concepts and Application of Finite Element Analysis” - 3rd Edition, John Wiley and Sons Inc., 1989
6. Shames I H and Dym C J, “Energy and Finite Element Methods in Structural Mechanics”- McGraw Hill, New York, 1985

HYDRAULIC STRUCTURES (ECE 636)

L T P C 3 1 0 4

UNIT-1

Introduction: Hydraulic structures for water resources projects. Embankment Dams: Types, design considerations, seepage analysis and control, stability analysis, construction techniques.

UNIT-2

Gravity Dams: Forces acting on failure of a gravity dam, stress analysis, elementary profile, design of gravity dam, other functional features of a gravity dam.

UNIT-3

Terminal Structures: Hydraulic jump types, stilling basin, roller bucket, ski jump basin, baffled spillway, drop structure Hydraulic

UNIT-4

Dam Outlet Works: Types of outlet structures, ogee spillway, chute spillway, siphon spillway, side channel spillway, Labyrinth and Pianokey weir.

UNIT-5

Modeling: Basic principles, dimensional analysis, modeling free-surface flows, design of physical models.

Books and References

1. Peterka, A.J, “Hydraulic Design of Stilling Basins and Energy Dissipators”, USBR Engineering Monographs No. 25”. 1984
2. "Design of Small Dams", Third Edition, Water Resources Technical Publication – US Bureau of Reclamation. 1987
3. Singh, B., and Varshney, R.S., "Embankment Dam and Engineering", Nem Chand and Brothers. 2004
4. Chanson, H., “The Hydraulics of Open Channel Flow : An Introduction”, Elsevier Scientific Publications. 2004
5. Novak, P. and Nalluri, C., “Hydraulic Structures”, Edition 4, Taylor & Francis. 2007
6. Creager, Justin and Hinds, “Engineering for Dams”, Vol. I and II, John Wiley.

DESIGN OF WATER AND WASTE WATER SYSTEMS (ECE 638)

L T P C 3 1 0 4

UNIT-1

Water and Wastewater Quantity Estimation Population forecast; Water demand for various purposes; Estimation of wastewater quantity; Variation in quantity of water and wastewater, Water Supply/Distribution Systems Wastewater Collection Systems Water/Wastewater Quality Enhancement

UNIT-2

Philosophy of treatment; Unit operations and processes; Physical, chemical and biological methods Domestic Wastewater Treatment Wastewater characteristics; Primary, secondary and tertiary treatment; Physical Unit Processes Screening; Commutation; Grit Removal; Equilization; Sedimentation;

UNIT-3

Introduction to Microbiology Microbial ecology and Growth kinetics; Types of microorganisms; aerobic vs. anaerobic processes. Biological Unit Processes Aerobic treatment; Suspended growth

aerobic treatment processes; Activated sludge process and its modifications; Attached growth aerobic processes; Tricking filters and Rotating biological contactors; Anaerobic treatment; suspended growth, attached growth, fluidized bed and sludge blanket systems; nitrification, denitrification; Phosphorus removal Sludge Treatment Thickening; Digestion; Dewatering; Sludge drying; Composting

UNIT-4

Wastewater Treatment Plant Characteristics Sequencing of unit operations and processes; Plant layout; Hydraulic considerations, Natural Wastewater Treatment Systems Ponds and Lagoons; Wetlands and Root-zone systems. Surface and Ground Water Treatment for Potable Water Supply Water Characteristics; Sequencing of unit operations and processes;

UNIT-5

Chemical Unit Processes Coagulation- Flocculation; Filtration; Disinfections; Aeration and Gas transfer; Precipitation; Softening; Adsorption and Ion exchange; Membrane processes Water Treatment Plant Characteristics Plant layout; Hydraulic considerations Rural Water Supply; Low Cost Sanitation; Septic tanks, Soak-pits.

Books and References

1.Waste water Engineering Treatment and Reuse: Mc Graw Hill, G. Tchobanoglous, FI Biston, 2002.
2.Industrial Waste Water Management Treatment and Disposal by Waste Water Mc Graw Hill III Edition 2008.

DISASTER MANAGEMENT (ECE 640)

L T P C 3 1 0 4

UNIT-1

Concepts of Hazard, Vulnerability, Risks, Natural Disasters (earthquake, Cyclone, Floods, Volcanoes), and Man Made Disaster (Armed conflicts and civil strip, Technological disasters, Human Settlement, Slow Disasters (famine, draught, epidemics) and Rapid Onset Disasters(Air Crash, tidal waves, Tsunami) Risks, Difference between Accidents and Disasters, Simple and Complex Disasters, Refugee problems, Political, Social, Economic impacts of Disasters, Gender and Social issues during disasters, principles of psychosocial issues and recovery during emergency situations, Equity issues in disasters, Relationship between Disasters and Development and vulnerabilities, different stake holders in Disaster Relief. Refugee operations during disasters, Human Resettlement and Rehabilitation issues during and after disasters, Inter-sectoral coordination during disasters, Models in Disasters.

UNIT-2

Disaster Risk Reduction Strategies, Disaster Cycle, Phases of Disaster, Preparedness Plans, Action Plans and Procedures, Early warning Systems Models in disaster preparedness, Components of Disaster Relief (Water, food, sanitation, shelter, Health and Waste Management), Community based DRR, Structural non structural measures in DRR, Factors affecting Vulnerabilities, , Mainstreaming disaster risk reduction in development, Undertaking risk and vulnerability assessments, Policies for Disaster Preparedness Programs, Preparedness Planning, Roles and Responsibilities, Public Awareness and Warnings, Conducting a participatory capacity and vulnerability analysis, , Sustainable Management, Survey of Activities Before Disasters Strike, Survey of Activities During Disasters, DRR Master Planning for the Future, Capacity Building, Sphere Standards. Rehabilitation measures and long term reconstruction.

UNIT-3

Introduction to disaster medicine, Various definitions in disaster medicine, Disaster life cycle, Disaster planning, Disaster preparation, Disaster recovery in relation to disaster medical management, Medical surge, Surge capacity, Medical triage, 275

National Assessing the nature of hazardous material -Types of injuries caused, Self protection contaminated area and decontaminated area –Pre hospital medical management of victims–Triaging medical & psychosocial identification of hospitals and other medical facilities to offer efficient disastrous medical service –Safe patient transportation.

UNIT-4

Principles of Disaster Epidemiology , Rapid Health Assessment, Rapid Health needs assessment. Outbreak Investigation Environment health hygiene and sanitation issues during disasters, Preventive and prophylactic measures including Measles immunization, ORS, water, supply, chemoprophylaxis, food fortification, food supplements, MISP-Reproductive Health Care, International cooperation in funding on public health during disaster, To identify existing and potential public health problems before, during and after disasters. (168 countries Framework Disaster Risk Reduction), International Health Regulation, United Nation International Strategy for Disaster Risk Reduction (UNISDR)

UNIT-5

Hazard and Vulnerability Profile India,, Disaster Management Indian scenario, India's vulnerability profile, Disaster Management Act 2005 and Policy guidelines,National Institute of Disaster Management, , National Disaster Response Force (NDRF)National Disaster Management Authority, States Disaster Management Authority, District Disaster Management Authority Cases Studies : Bhopal Gas Disaster, Gujarat Earth Quake, Orissa Super-cyclone, south India Tsunami, Bihar floods, Plague-Surat, Landslide in North East, Heat waves of AP& Orissa, 278 Cold waves in UP.Bengal famine, best practices in disaster management, Local Knowledge Appropriate Technology and local Responses, Indigenous Knowledge, Development projects in India (dams, SEZ) and their impacts, Logistics management in specific emergency situation.

Books and References

1. Coppola P Damon, 2007. Introduction to International Disaster Management, Carter, Nick 1991. Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manil
2. Disaster Management Guidelines. GOI-UNDP Disaster Risk Reduction Programme(2009-2012.
3. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
4. Guerisse P. 2005 Basic Principles of Disaster Medical Management. Act Anaesth. Belg;56:395-401
5. Aim and Scope of Disaster Management. Study Guide prepared by Sharman and Hansen. UW-DMC, University of Washington.
6. Sphere Project (2011). Humanitarian Charter and Minimum Standards in Disaster Response

PREFABRICATED CONSTRUCTION TECHNIQUES (ECE 642)

L T P C 3 1 0 4

UNIT I

Types of fabrication – Modular co-ordination, components, prefabrication systems and structural schemes; Design considerations; Economy of prefabrication; prefabrication of load carrying members;

UNIT II

Disuniting of structures; Design of cross section of load carrying members; Structural behavior of precast structures. Handling and erection stresses

UNIT III

Application of pre-stressing of roof members; floor systems; Two way load bearing slabs, wall panels, hipped plate and shell structures.

UNIT IV
Dimensioning and detailing of joints for different structural connections; construction and expansion joints.

UNIT V
Production, Transportation & erection; Organization of production, storing and erection equipment; Shuttering and mould design – Dimensional tolerances; Erection of R.C. structures, Total prefabricated buildings

Books and References
1. A.S.G Bruggeling, G.F Huyghe, "Prefabrication with Concrete", CRC Press, January 1991
2. IS 8916, " Building Design & Erection Using Prefabricated Concrete" , 208
3. R.L Gilbert, N.C Mickeborough, " Design of Prestressed Concrete", Taylor & Francis
4. Architectural Precast Concrete, Prestressed Concrete Institute, third edition 2007

HIGH RISE STRUCTURES (ECE 644)

L T P C 3 1 0 4

UNIT I
DESIGN CRITERIA AND MATERIALS ; Development of High Rise Structures – General Planning Considerations – Design philosophies – Materials used for Construction – High Strength Concrete – High Performance Concrete – Self Compacting Concrete – Glass – High Strength Steel

UNIT II
LOADING ; Gravity Loading – Dead Load – Live Load – Live load reduction technique – Impact Load – Construction Load – Sequential Loading. Lateral Loading – Wind load – Earthquake Load. Combination of Loads.

UNIT III
BEHAVIOUR OF VARIOUS STRUCTURAL SYSTEMS; Factors affecting growth, Height and Structural form. High rise behaviour of Various structural systems – Rigid frames, braced frames, Infilled frames, shear walls, coupled shear walls, wallframes, tubular structures, cores, outrigger – braced and hybrid mega systems.

UNIT IV
ANALYSIS AND DESIGN; Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of buildings as total structural system considering overall integrity and major subsystem interaction, Analysis for member forces, drift and twist, computerised general three dimensional analysis.

UNIT V
STABILITY OF TALL BUILDINGS; Overall buckling analysis of frames, wall-frames, Approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first-order and P-Delta analysis, Translational, Torsional instability, out of plumb effects, stiffness of member in stability, effect of foundation rotation.

Books and References

1. Bryan Stafford Smith, Alex coull, "Tall Building Structures, Analysis and Design", John Wiley and Sons, Inc., 1991.

2. Taranath B.S., “Structural Analysis and Design of Tall Buildings”, McGraw Hill, 2011.
3. Lin.T.Y, Stotes Burry.D, “Structural Concepts and systems for Architects and Engineers”, John Wiley, 1988.
4. Lynn S.Beedle, “Advances in Tall Buildings”, CBS Publishers and Distributors, Delhi, 1986.
5. Wolfgang Schueller “High Rise Building Structures”, John Wiley and Sons, New York 1977.

MINOR PROJECT (ECE-650)

L T P C 0 0 4 2

DISSERTATION (ECE-701)

L T P C 0 0 16 8

DISSERTATION (ECE-702)

L T P C 0 0 16 8