Master of Technology - Structural Engineering

Syllabus - First Semester

APPLIED NUMERICAL METHODS

Course Code: STE4101 **CreditUnits : 03**

Course Objective:
The primary objective of this chapter is to provide you with a concrete idea of what numerical methods are and how they relate to engineering and scientific problems.

Course Contents:

Module I:
Solution of Algebraic and Transcendental Equation:-
Newton-Raphson method including method of complex roots, Graeffe's root square method (Computer based algorithm and programme for these methods)

Module II:
Interpolation and Approximation:-
Lagrange's and Newton-divided difference formula, Newton interpolation formula for finite differences, Gauss's forward and backward interpolation formulae, Bessel's and Laplace-Everett's formulae, Cubic spline, least squares approximation using Chebyshev polynomial.
Solution of partial differential equations of linear and non-linear nature with finite difference scheme and iteration techniques

Module III:
Solution of Linear Simultaneous Equations:-
Cholesky's (Crout's) method, Gauss-Seidel iteration and relaxation methods, Solution of Eigenvalue problems; Smallest, largest and intermediate Eigen values (Computer based algorithm and programme for these methods)

Module IV:
Numerical Differentiation and Integration:-
Numerical differentiation using difference operators, Simpson's 1/3 and 3/8 rules, Boole's rule, Weddle's rule.

Module V:
Solution of Differential Equations:-
Modified Euler's method, Runge-Kutta method of 2nd, 3rd and 4th orders, Predictor- Corrector method, Stability of Ordinary differential equation, Solution of Laplace's and Poisson's equations by Liebmann's method, Relaxation method.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text and Reference Books:

- Numerical Method for Scientific and Engineering M.K. Jain, S.R.K. Iyenger and Wiley Eastern Ltd
- Numerical Methods for Engineers S.K. Gupta Wiley Eastern Ltd.
- Numerical Methods B.S. Grewal Khanna Publications
- Numerical Methods A.D. Booth Academic Press, NY
- An Introduction to Numerical Analysis K.E. Atkinson John Wiley & Sons, NY
- Introduction Methods of Numerical Analysis S.S. Sastry Prentice Hall of India
- Elementary Numerical Analysis S.D. Conte McGraw Hill

ADVANCED STRUCTURAL ANALYSIS

Course Code: STE4102 **CreditUnits : 04**

Course Objective:
The main objective is to enable the student to have a good grasp of all the fundamental issues in the advanced topics in structural analysis pertaining to the matrix method.

Course Contents:
Module I:
Introduction:Review of basic concepts. Matrix Methods of Analysis of Structures, Generalised Measurements - Degrees of freedom - Behaviour of structures - Review of analysis of indeterminate structures: Force methods and Displacement Methods. Matrix concepts and Matrix analysis of structures: matrix, vectors, displacement and force transformation matrices, Element and structure flexibility matrices; equivalent joint loads; stiffness and flexibility approaches.

Module II:
The Matrix Displacement Approach: Beams- Introduction. Stiffness Matrix of a Bar Element subjected to Axial Force. Co-ordinate Transformations. Global Stiffness Matrix. Application to Pin-Jointed Frames. Stiffness Matrix of a Beam Element. Beam element stiffness. Application to Continuous Beams.

Module III:
Matrix Analysis of Rigid Frames: Matrix displacement method vs slope deflection method, anlaysis of rigid frames with and without sidesway, analysis of rigid framed for yielding of supports.

Module IV:
Matrix Analysis of grillage or grid:Introduction, torsional stiffness of grid element and advantage of torsion release , Matrix Displacement Analysis of Grillage or Grid. Co-ordinate Transformations. Element Stiffness Matrix & its Application

Module V:
Matrix Analysis of Space Trusses & Frames:Co-ordinate Transformations. Application to Space Trusses & Space Frames, Analysis by conventional stiffness method (four dof per element) and reduced element stiffness method (single dof), Analysis by flexibility method;

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text Books & References:

- G S Pandit, S P Gupta," Structural Analysis : a matrix approach", Tata McGraw-Hill Publishing Co. New Delhi
- DevdasMenon,"AdvancedStructuralAnalysis", Narosa Publishing House, 2009.
- Kanchi, Matrix Structural Analysis, Wiley Eastern Ltd., Newdelhi 1981.
- C.K. Wang. Matrix Methods of Structural Analysis.
- Introduction to Matrix Methods of Structural Analysis: Martin,H.C.
- Advanced Structural Analysis by Ashok.K.Jain, New Channel Brothers

ADVANCED CONCRETE DESIGN

Course Code: STE4103 **CreditUnits : 04**

Course Objective:
The aim of this unit of study is to introduce engineering students to the advanced methods used for concrete structural design. With this the students will be able to design and analyze the various components/ members of the structure.

Course Contents:
Module I: Design of deep beams and corbels
Steps of Designing Deep Beams, Design by IS 456, Checking for Local Failures, Detailing of Deep Beams, Analysis of Forces in a Corbels, Design of Procedure of Corbels,

Module II: Design of Flat slabs
Flat slabs: Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns – Shear in Flat slabs-Check for one way and two way shears - Introduction to Equivalent frame method. Limitations of Direct design method, Distribution of moments in column strips and middle strip

Module III: Design of Foundations
Basic philosophy of foundation design, raft foundations, pile foundations & well foundation, combined footings.

Module IV: Design of Compression members and shear walls
Estimation of effective length of a column-Code requirements on Slenderness Limits, Design of Short Columns under Axial Compression, Design of Short Columns with Uniaxial Bending, Design of Short Columns under Biaxial Bending, Design of Slender Columns. Design of shear walls and reinforcement in walls.

Module V: Yield line theory
Introduction, assumptions, location of yield lines, method of analysis, analysis of one way and two way slabs, effect of top corner steel in a square slab, examples.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text Books & References:

- S.U. Pillai and D. Menon, Reinforced Concrete Design, Tata McGraw-Hill, 3rd Ed, 1999
- P.C. Varghese, Advanced Reinforced Concrete Design, Prentice Hall of India, 2nd Ed,200.
- Reinforced concrete structures, Vol.1, by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications, 2004.
- Reinforced concrete structures – I.C. Syal& A.K. Goel, S. Chand, 2004
- IS 456: 2000 – Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standards, 2000.
- Advanced Reinforced Concrete Design, N.Krishna Raju (CBS Publishers & Distributors),
- SP 34: 1987 – Handbook of Concrete reinforcement and Detailing, Bureau of Indian
- Standards, 1987.

FINITE ELEMENT METHOD

Course Code: STE4104 **CreditUnits : 04**

Course Objective:
The Finite Element Method (FEM) is widely used in industry for analysing and modelling structures and continua, whose physical behaviour is described by ordinary and partial differential equations. The FEM is particularly useful for engineering problems that are too complicated to be solved by classical analytical methods. The main objective of this course is to introduce the mathematical concepts of the Finite Element Method for obtaining an approximate solution of ordinary and partial differential equations.

Course Contents:
Module I:
Introduction to FEM. Basic idea of FEM. Applications and importance of FEM. Differential equilibrium equations - strain displacement relation - linear constitutive relation - special cases- Principle of stationary potential energy - application to finite element methods. Some numerical techniques in finite element Analysis

Module II:
Displacement models - convergence requirements. Natural coordinate systems – Shape function. Interpolation function- Linear and quadratic elements - Lagrange & Serendipity elements- Strain displacement matrix - element stiffness matrix and nodal load vector

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

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

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

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text Books & References:

- Concepts and Applications of Finite Element Analysis by Robert D.Cook, David S. Malkus and Michael E. Plesha, John Wiley & Sons.
- Finite element Methods by OC Zienkiewicz
- C.S.Krishnamoorthy, " Finite element analysis, theory and programming", Tata McGraw Hill
- Finite element analysis, theory and progarmming by GS Krishna Murthy.
- Introduction to Finite element Method by Tirupathi Chandra Patila and Belugunudu.
- Introduction to Finite element Method by JN Reddy.

OFFSHORE STRUCTURES

Course Code: STE4108 **CreditUnits : 04**

Course Objective:
The Recent development and technological Advancement are moving into Offshore Structure. Unlike Ground Conditions, the Offshore Construction is Extreme. The Program will give the Introduction to the Offshore Structure and its components with major Loads acting on the Platform. How the Installation Process is carried out. The Introduction to Floating Structures gives the Idea about the construction in offshore industry .

Course Contents:
Module-I:
Jacket concepts, redundant framing arrangement; Launch and Lift jackets; Simple Deck configurations for Lift and float-over installations; In-service and Pre-service Loads and analysis Jackup Rigs: Configuration and operation of jackups; Simplified analysis; Spud can penetration and extraction; Spud can – pile interaction

Module-II:
Fixed and floating structures; Spars and TLP's; Modular topsides and integrated topsides; deck levels and jacket configurations; Spar and TLP hull arrangements;
Load out: Fabrication yard, grillage and foundation conditions; Fabrication sequence of Launch jacket, lift jackets, topsides and modules; Weighing and weight control; Skidded, Trailer and lifted Load out methods Lifting and launch schemes for jackets, upending and setting, on bottom stability; Float-over installations; Dynamics of barge – cargo system;

Module-III:
Loads on offshore Structure, Environmental Loads, Marine Growth, Force On Large Dia members. Accidental Loads

Module-IV:
Semi-submersible, TLPs, FPSOs, Spars and others-General concepts on estimation of loads and Hydrostatic Stability-Elastic plate theory; plated structures; stiffened plates-Buckling of plates; Semi-submersible; column

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

References

- Floating Structures: A Guide for the Design and Analysis by Ltd Oilfield Publications and CMPT (Jun 1998)
- Dynamics of Offshore Structures by James F. Wilson (Oct 9, 2002)
- Floating Ports: Design and Construction Practices by Gregory P. Tsinker (Mar 1986)
- Very Large Floating Structures (Spon Research) by C.M. Wang, E. Watanabe and T. Utsunomiya (Oct 30, 2007)

STRUCTIURAL ENGINEERING LAB

Course Code: STE4106 **CreditUnits : 02**

List of experiments

- Basic tests for materials: cement, aggregates, etc.
- Mix design for high strength concrete, use of admixture
- Non destructive evaluation of strength of concrete/steel specimens
- Testing of beams for compressive strength
- Testing of beams for flexural strength

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

Text Books & References:

- P.C. Aitcin, High-Performance Concrete, E & FN SPON, 1998.
- E. Bray and R. K. Stanley, Non Destructive Evaluation, CRC Press, 2002.

Syllabus - Second Semester

STRUCTURAL DYNAMICS

Course Code: STE4201 **CreditUnits : 04**

Course Objective:
The main aim is to analysis of structural members and systems subject to dynamic loads. It will introduce the students with the deeper understanding of the dynamics of structures taking into consideration the single and multi degree freedoms. Also the analysis will be on the basis of earthquake forces, wind forces and blast loading.

Course Contents:
Module I:
Single degree of freedom systems: Differential equation of motion - D'Alembert's principle - Free vibration and forced vibration response - damped and undamped - evaluation of damping constants - vibration of machine foundation - vibration isolation- vibration measuring instruments. Response to general loading - pulse excitation - Duhamel Integral - Numerical methods - Newmark method.

Module II:
Multi-degree of freedom and continuous Systems: Two and three degree systems - solution of eigen value problem – Stodola method - orthogonality conditions - Modal superposition method. Vibration analysis of continuous systems - simply supported beams - Effect of shear and rotary inertia - Timoshenko beam - Effect of axial loads.

Module III:
Analysis for seismic forces: Concept of response spectrum - estimation of design forces of multistory buildings using Bureau of Indian Standards (BIS) codes - earthquake analysis of base isolated buildings.

Module IV:
Analysis for wind forces: Wind effects on structures - static and dynamic - analysis for wind loads using BIS codes - quasi static method and gust factor method.

Module V:
Blast loading - over ground and underground structures - design parameters - relevant BIS codes.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text Books & References:

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

ADVANCED STEEL DESIGN

Course Code: STE4202 **CreditUnits : 04**

Course Objective:
To impart knowledge and to develop understanding of ultimate behavior of steel structural members. It creates awareness about design provisions as per current codes leading to wider use in the future along with a complete understanding of the design criterion and aspects.

Course Contents:
Module I:
Riveted connections-Bolted Connections- Load Transfer Mechanism – Failure of Bolted Joints – Specifications for Bolted Joints – Bearing – Type Connections – Tensile Strength of Plate – Strength and Efficiency of the Joint – Combined Shear and Tension – Slip – Critical Connections – Praying Action – Combined Shear and Tension for Slip- Critical Connections. Design of Groove welds- Design of Fillet Welds- Design of Intermittent fillet welds- Failure of Welds.

Module II:
Introduction – Beams – Column Connections- Connections Subjected to Eccentric Shear – Bolted Framed Connections- Bolted Seat Connections – Bolted Brackete Connections. Bolted Moment Connections – Welded Framed Connections – Welded Brackete Connections - Moment Resistant Connections.

Module III:
Dead loads, live loads and wind loads on roofs. Design wind speed and pressure, wind pressure on roofs; wind effect on cladding and louvers; Design of angular roof truss, tubular truss, truss for a railway platform. Design of purlins for roofs, design of built up purlins, Design of bracings.

Module IV:
Types of truss bridges, component parts of a truss bridge, economic proportions of trusses, self weight of truss girders, design of bridge compression members, tension members; wind load on truss girder bridges; wind effect on top lateral bracing; bottom lateral bracing; portal Bracing; sway bracing.

Module V:
Design of Steel Bunkers and Soils: Introduction – Janseen's Theory – Airy's Theory – Design of Parameters – Design Criteria – Analysis of Bins – Hopper Bottom –Design of Bins.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text Books & References:

- Design of Steel Structures. P. Dayaratnam, Publisher : S. Chand, Edition 2011 – 12.
- Design Steel Structures Volume – II, Dr. Ramachandra &VivendraGehlotScientitic Publishes Journals Department.
- Limit State Design of Steel Structures S.K. Duggal Mc Graw Hill Education Private Ltd. New Delhi.
- Design of Steel Structures Galyord& Gaylord, Publisher ; Tata Mc Graw Hill, Education. Edition 2012.
- Indian Standard Code – IS – 800-2007.

RESEARCH METHODOLOGY AND TECHNICAL REPORT WRITING

Course Code: STE4210 **CreditUnits : 02**

Course Objectives:
The course will enhance scientific, technical and research writing skills and impart knowledge about various stages of research process, statistical analysis, statistical tests and their applications in statistical decision making.

Course Contents:
Module I: Introduction to research: Definition, motivation, need, objectives, significance and characteristics of research; types of research; steps in research process; planning a research proposal; literature review, web searching.

Module II: Population and sample, parameter and statistic, sampling and data collection, sampling design: steps, types, sample size, sampling methods, large and small samples, primary and secondary data, data processing and analysis. Sample surveys and questionnaire designing, scaling techniques.

Module III: Dependent and independent variables, univariate, bivariate and multivariate analysis, means-arithmetic, geometric and harmonic; measure of dispersion of data, standard deviation, variance, coefficient of variation and degree of freedom. Hypothesis testing: null hypothesis and alternate hypothesis, errors in hypothesis testing, significance and confidence levels, parametric tests and non-parametric tests, one-tailed and two-tailed tests, analysis of variance. Regression analysis and curve fitting, method of least-squares, explained and unexplained variations, coefficient of correlation, coefficient of determination**.**

Module IV: Technical/scientific/research report writing: structure and components of scientific reports, formats of dissertations, research report, report writing skills, report preparation, referencing , bibliography and footnotes. Making presentation-use of visual aids and PPTs. Publication of research papers, citations,. Intellectual property rights and copy rights, plagiarism, patents and patent laws, commercialization and ethical issues.

Examination Scheme:

Attendance	Assignment/Library consultation / Thesis writing	Class test	Final Exam	Total
5	15	10	70	100

Text Books:
- Blake, G. and Bly, R.W. 1993, The Elements of Technical Writing. MacMillan, New York
- Booth, V. 1981. Writing a Scientific Paper and Speaking at Scientific Meetings. The Biochemical Society, London
- Chawla,D and Sondhi, N. 2016, Research Methodology- Concepts and Cases. Vikas Publishing House Pvt Ltd. New Delhi
- Kothari, C.R.2008. Research Methodology- Methods and Techniques, 2nd.ed. New Age International Publishers, New Delhi.

Reference Books:
- Geode, Millian J.& Paul K. Hatl, Methods in Research, McGraw Hills, New Delhi.
- Montomery, Douglas C.(2007), 5th Ed. Design and Analysis of Experiments, Wiley India.
- Panneerselvam, R.2009. Research Methodology, PHI Learning Pvt.Ltd., New Delhi-110001
- Ranjit Kumar 2009. Research Methodology- A step –by- step Guide for beginners; 2nd ed. Dorling Kindersley (India) Pvt. Ltd. Patpargang, Delhi- 110092

THEORY OF PLATES

Course Code: STE4203 **CreditUnits : 04**

Course Objective:
To impart knowledge and introduce students to the classical structural mechanics approximations of plates discussing the various theories involved in the same. This has an effect on the elastic foundations, which is seen in this course.

Course Contents:
Module I:
Cylindrical Bending: Different kind of plates – Assumptions - Derivation of differential equation for cylindrical bending of long rectangular plates - Analysis of uniformly loaded rectangular plates with edges simply supported and fixed subjected to uniform load.
Pure Bending of Plates: Slope and curvature of slightly bent plates – Relations between moments and curvature - Particular cases of pure bending - Strain energy in pure bending –Energy methods like Ritz and Galerkin Methods to rectangular plates subjected to simple loadings.

Module II:
Small Deflection Theory of Thin Rectangular Plates: Assumptions – Derivation of governing differential equation for thin plates – Boundary conditions – simply supported plate under sinusoidal load – Navier's solution – Application to different cases – Levy's solution for various boundary conditions subjected to different loadings like uniform and hydrostatic pressure.

Module III:
Circular Plates: Symmetrical loading – Relations between slope, deflection, moments and curvature– Governing differential equation – Uniformly loaded plates with clamped and simply supported edges– Central hole – bending by moments and shearing forces uniformly distributed.
Orthotropic Plates: Introduction – Bending of anisotropic plates - Derivation of governing differential equation – Determination of Rigidities in various cases like R.C. slabs, corrugated sheet

Module IV:
Plates on Elastic Foundations: Governing differential equation – deflection of uniformly loaded simply supported rectangular plate – Navier and Levy type solutions - Large plate loaded at equidistant points by concentrated forces P.

Module V:
Buckling of Plates: Governing equation for Bending of plate under the combined action of in-plane loading and lateral loads – Buckling of rectangular plates by compressive forces acting in one and two directions in the middle plane of plate

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text Books & References:
- Theory of Plates and Shells by Timoshenko, McGraw Hill Book Co., New York.
- Theory and Analysis of Plates by P. Szilard, Prentice Hall.
- Theory of Plates by Chandrasekhar, University Press.
- Plate Analysis by N. K. Bairagi, Khanna Publishers. New Delhi.

DESIGN OF INDUSTRIAL STRUCTURES

Course Code: STE4204 **CreditUnits : 04**

Course Objective:
To impart knowledge and understand the design criterion involved and the methodical investigation of the stability, strength and design aspects of the industrial structures such as silos, bunkers, cooling towers, large span roofs, etc.

Module-I:
Planning of industrial structures. Design of single and multibay industrial structures in steel and concrete.

Module-II:
Bunkers and silos. Pressure vessels and chimneys.

Module-III:
Cooling towers. Large span roof structures.

Module-IV:
Suspended roof structures. Structural aspects of machine foundations.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text Books & References:

- Advanced Reinforced Concrete Design, By N. Krishna Raju (CBS Publishers & Distributors).
- Design of Steel Structures, By Ram Chandra.
- Design of Steel Structures, By Duggal

STRUCTURAL OPTIMIZATION

Course Code: STE4205 **CreditUnits : 04**

Course Objective:
Design, construction and maintenance of engineering systems involve decision making both at the managerial and at the technological level. With the increasing availability of computational power, optimization is becoming an important concept in the structures as well. This course gives the overview of the optimization techniques that can be applied in structures.

Course Contents:
Module I:
Definition - Objective Function; Constraints - Equality and inequality - Linear and non-linear, Side, Non-negativity, Behaviour and other constraints -Formulation of different types of structural optimization problems; Optimality criteria based structural optimizations;

Module II:
Computation of derivatives of response quantities w.r.t. design variables; Classical optimization

Module III:
Lagrange multiplier technique and Kuhn-Tucker conditions

Module IV:
Solution of NLP by direct methods and by series of unconstrained optimization problems and by series of linear programming problems.

Module V:
Structural Application- Methods for optimal design of structural elements, continuous beams and single storied frames using plastic theory - Minimum weight design for trussmembers - Fully stressed design - Optimization principles to design of R.C. structures such as multistorey buildings, water tanks and bridges

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text Books & References:

- S.S. Rao, Optimization, Theory and Applications, 2nd Edition, Wiley Eastern Ltd., New Delhi, 1991.
- J.S. Arora, Introduction to Optimum Design, McGraw-Hill Book Company, New York, 1989.
- A.J. Morris (Editor), Foundations of Structural Optimization - A Unified Approach; John Wiley and Sons, Chichester, 1982.
- Uri Krish, "Optimum Structural Design", McGraw Hill Book Co. 1981
- Spunt, "Optimization in Structural Design", Civil Engineering and Engineering Mechanics Services, Prentice-Hall, New Jersey 1971.
- Iyengar.N.G.R and Gupta.S.K, "Structural Design Optimisation", Affiliated East West Press Ltd, New Delhi, 1997

CONSTRUCTION PLANNING AND MANAGEMENT

Course Code: STE4206 **CreditUnits : 04**

Course Objective:
Construction today is an all embracing term, covering all the activates from conception to physical realization of a project. For the project to be completed on time and with correct measures, it is important to use various planning and management techniques in construction industry. This course will help the students understand the CPM/PERT, construction methods and other estimations required in a construction project. Apart from this the students will also will also learn about the contracts.

Course Contents:
Module I:
Construction as industry and its challenges, Role of construction management, Methods of construction managements, Basic requirements of construction management: Learning structures

Module II:
Construction planning-Construction facilities, Schedules, Layout of Plant utilities, Examples of real projects and its learning requirements

Module III:
CPM/PERT: Introduction to network based project management techniques: Defining activities and their interdependence, drawing of network, time and resource estimations, use of network as scheduling techniques, use of network as control techniques i.e. project monitoring.

Module IV:
Construction methods: Excavation and handling of Earth and Rock; Production and handling of Aggregates and Concrete, cooling of concrete in dams, Drainage treatment of aquifers/sub-terrainean reservoirs; Tunneling, Tunneling in soft rocks, Grouting, chimney formation, etc

Module V:
Stages of awarding contract, types of contract, contract documents, arbitration and settlement of disputes, contract laws and handling of contracts, commissioning of project. Principles of estimation and analysis of rate.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text Books & References:

- Peurifoy, R.L. and Ledbetter, W.B.; Construction Planning ,Equipment and Methods, McGraw Hill Singapore, 1986.2. Robertwade Brown; Practical FoundationEngineering Handbook, McGraw Hill Publications , 1995.
- Joy, P.K.; Total Project Management- The Indian Context, New Delhi, MacMillan India Ltd., 1992.
- Uliman, John.E, et al; Handbook of Engineering Management, Wiley, New York , 1986.
- Neville, A.M.; Properties of Concerte, Pitman Publishing Ltd.,London, 1978.

PRESTRESSED CONCRETE DESIGN

Course Code: STE4207 **CreditUnits : 04**

Course Objective:
To impart knowledge about the analysis and design of prestressed concrete structures.

Course Contents:
Module I:
Materials for prestressed concrete and prestressing systems: High strength concrete and high tensile steel – tensioning devices – pretensioning systems – post tensioning systems.

Module II:
Analysis of prestress and bending stresses**:** Analysis of prestress – resultant stresses at a sector – pressure line or thrust line and internal resisting couple – concept of load balancing – losses of prestress – deflection of beams.

Module III:
Strength of prestressed concrete sections in flexure, shear and torsion:Types of flexural failure – strain compatibility method – IS code procedure – design for limit state of shear and torsion.

Module IV:
Design of prestressed concrete Structures/Sections: Transfer of prestress in pre tensioned and post tensioned members – design of anchorage zone reinforcement – design of simple beams – cable profiles – design of slabs. Design of prestressed concrete pipes and tanks – prestressed concrete trusses.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**EE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- N. Krishna Raju, Prestressed concrete, Tata McGraw Hill, 2000
- T.Y. Lin, Ned H. Burns, Design of Prestressed Concrete Structures, John Wiley & Sons, 2004.
- P. Dayaratnam, Prestressed Concrete, Oxford & IBH,1982
- R. Rajagopalan, Prestressed Concrete, Narosa publishers, 2004.
- BIS codes (IS 1343)

ADVANCED BRIDGE DESIGN

Course Code: STE4208 **CreditUnits : 04**

Course Objective:
To impart knowledge about the purpose and design of the various kinds of bridges which are used in day-to-day life.

Course Contents:
Module I:
Concrete Bridges: Introduction-Types of Bridges-Economic span length-Types of loading-Dead load live load-Impact Effect-Centrifugal force-wind loads-Lateral loads-Longitudinal forces-Sesmic loads-Frictioal resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of raodway and footway-General Design Requirements.

Module II:
Load distribution theories, analysis and design of slab culverts, tee beam and slab bridges.

Module III:
Design principles of continuous bridges, box girder bridges, balanced cantilever bridges.

Module IV:
Design of prestressed bridges: Flexural and torsional parameters – Courbon's theory – Distribution co-efficient by exact analysis – Design of girder section – maximum and minimum prestressing forces – Eccentricity – Live load and dead load shear forces – Cable Zone in girder – check for stresses at various sections – check for diagonal tension – Diaphragms – End block – short term and long term deflections.

Module V:
Design of riveted and welded plate girder bridges for highway and railway loading – wind effects – main section, splicing, curtailment, stiffeners – Different types of bearings – Design of bearings – Design of masonry and concrete piers and abutments – Types of bridge foundations – Design of foundations.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Ponnuswamy, S., "Bridge Engineering", Tata McGraw Hill, 2008.
- Johnson Victor, D. "Essentials of Bridge Engineering", Oxford and IBH Publishing Co. New Delhi, 1990
- Jagadeesh.T.R. and Jayaram.M.A., "Design of Bridge Structures", Prentice Hall of India Pvt. Ltd. 2004.
- Raina V.K." Concrete Bridge Practice" Tata McGraw Hill Publishing Company, New Delhi, 1991.
- Bakht, B. and Jaegar, L.G., "Bridge Analysis Simplified", McGraw Hill, 1985.
- Derrick Beckett, "An introduction to Structural Design of Concrete Bridges", Surrey University Press, Henley Thomes, Oxford Shire, 1973.
- Taylor, F.W., Thomson, S.E., and Smulski E., "Reinforced Concrete Bridges", John Wiley and Sons, New York, 1955.

Syllabus - Third Semester

EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

Course Code: STE4301 **CreditUnits : 04**

Course Objective:
The primary objective of earthquake resistant design is to prevent building collapse, so keeping in mind this point , the students will know and understand about the various considerations in the design of earthquake resistant structures in accordance with the codal provisions.

Course Contents:
Module I:
Engineering Seismology: Earthquake phenomenon cause of earthquakes-Faults- Plate tectonics-Seismic waves- Terms associated with earthquakes-Magnitude/Intensity of an earthquake-scales-Energy released-Earthquake measuring instruments-Seismoscope, Seismograph, accelerograph-Characteristics of strong ground motions- Seismic zones of India.

Module II:
Conceptual design: Introduction-Functional planning-Continuous load path-Overall form-simplicity and symmetry-elongated shapes-stiffness and strength-Horizontal and Vertical members-Twisting of buildings-Ductility-definition-ductility relationships-flexible buildings-framing systems-choice of construction materials-unconfined concrete-confined concrete-masonry-reinforcing steel. Introduction to earthquake resistant design: Seismic design requirements-regular and irregular configurations-basic assumptions-design earthquake loads-basic load combinations-permissible stresses-seismic methods of analysis-factors in seismic analysis-equivalent lateral force method-dynamic analysis-response spectrum method.

Module III:
Reinforced Concrete Buildings: Principles of earthquake resistant deign of RC members- Structural models for frame buildings- Seismic methods of analysis- Seismic deign methods- IS code based methods for seismic design- Seismic evaluation and retrofitting- Vertical irregularities- Plan configuration problems- Lateral load resisting systems- Determination of design lateral forces-Equivalent lateral force procedure- Lateral distribution of base shear. Masonry Buildings: Introduction- Elastic properties of masonry assemblage- Categories of masonry buildings- Behaviour of unreinforced and reinforced masonry walls- Behaviour of walls- Box action and bands- Behaviour of infill walls- Improving seismic behaviour of masonry buildings- Load combinations and permissible stresses- Seismic design requirements- Lateral load analysis of masonry buildings.

Module IV:
Structural Walls and Non-Structural Elements: Strategies in the location of structural walls- sectional shapes- variations in elevation- cantilever walls without openings – Failure mechanism of non-structures- Effects of non-structural elements on structural system- Analysis of non-structural elements- Prevention of non-structural damage- Isolation of non-structures.

Module V:
Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction- Impact of Ductility- Requirements for Ductility- Assessment of Ductility- Factors affecting Ductility- Ductile detailing considerations as per IS 13920. Behaviour of beams, columns and joints in RC buildings during earthquakes-Vulnerability of open ground storey and short columns during earthquakes.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Earthquake Resistant Design of structures – S. K. Duggal, Oxford University Press
- Earthquake Resistant Design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.
- Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons
- Masory and Timber structures including earthquake Resistant Design –AnandS.Arya, Nemchand& Bros
- Earthquake –Resistant Design of Masonry Building –MihaTomazevic, Imperial college Press.
- Earthquake Tips – Learning Earthquake Design and Construction C.V.R. Murty
- IS: 1893 (Part-1) -2002. "Criteria for Earthquake Resistant – Design of structures." B.I.S., New Delhi.
- IS:4326-1993, " Earthquake Resistant Design and Construction of Building", Code of Practice B.I.S., New Delhi.
- IS:13920-1993, " Ductile detailing of concrete structures subjected to seismic force" – Guidelines, B.I.S., New Delhi.

ADVANCED CONCRETE TECHNOLOGY

Course Code: STE4302 **CreditUnits : 04**

Course Objective:
The objective for this course are for the students to learn and characterize the engineering properties of cement-based materials and understanding the mixture design and engineering properties of special concretes such as high-performance concrete, self-consolidating concrete, fibre reinforced concrete, sprayed concrete, etc.

Course Contents:
Module I:
Concrete Making Materials: Cement- Bogues compounds – Hydration Process– Types of cement – Aggregates – Gradation Charts – Combined aggregate-Alkali Silica Reaction -Admixtures – Chemical and Mineral admixtures..

Module II:
Fresh and Hardened Concrete: Fresh Concrete - workability tests on Concrete Setting times of Fresh Concrete - Segregation and bleeding. Hardened Concrete : Abram's law- Gel space ratios, Maturity Concept – Stress Behaviour – Creep and Shrinkage – Durability tests on concrete - Non destructive testing of concrete

Module III:
High Strength Concrete – Micro structure – Manufacturing and Properties- Design 0s HSC Using ErintroyShaklok Method- Ultra High Strength Concrete. High Performance Concrete- Requirements and properties of High Performance Concrete- Design Considerations.

Module IV:
Special Concrete: Self Compacting concrete – Polymer concrete – Fiber reinforced concrete – Reactive Powder concrete – Requirements and Guidelines – Advantages and Applications. Light weight concrete. Concrete mix design : Quality Control - Quality assurance - Quality audit- Mix Design method – BIS method, ACI method, DOE method.

Module V:
Form work – materials – structural requirements – form work systems – connections – specifications – design of form work – shores – removal for forms – reshoring – failure of form work.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
- Properties of Concrete by A.M.Neville, ELBS publications.
- Concrete Technology by A.K. Santhakumar, Oxford Press.
- Concrete Technology by M.S.Shetty, S.Chand& Co.
- Special Structural concretes by Rajat Siddique, Galgotia Publications.
- Design of Concrete Mixes by N.Krishna Raju, CBS Publications.
- Concrete: Micro Structure by P.K.Mehta, ICI, Chennai.

ADVANCED CONCRETE TECHNOLOGY LAB

Course Code: STE4303 **CreditUnits : 01**

List of Experiments:

- Tests on cement - Consistency, Setting times, Soundness, Compressive Strength.
- Gradation Charts of Aggregates.
- Bulking of fine Aggregate.
- Aggregate Crushing and Impact value
- Workability Tests on Fresh self compacting concrete
- Permeability of Concrete.
- Non Destructive Testing of Concrete.
- Influence of W/C ratio on strength and Aggregate / Cement ratio on workability and Strength

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

ADVANCED CONSTRUCTION MATERIALS

Course Code: STE4304 **CreditUnits : 04**

Course Objective:
To impart knowledge about the various construction materials that can be used in construction work ranging from the cement, aggregates, admixtures and other waste materials that can be put to use in construction.

Course Contents:
Module I:
Fresh concrete and its rheology. Mechanical, deformational behavior and microstructure of hardened concrete. Creep and shrinkage. Testing of concrete. mix design and properties of concrete; High strength concrete; High density and lightweight concretes; admixtures.

Module II:
Industrial waste materials in concrete, their influence on physical and mechanical properties and durability of concrete, Concreting under extreme weather conditions, High strength concrete. Changes in concrete with time, Corrosion of concrete in various environments. Corrosion of reinforcing steel. Ferro-cement, material and properties.

Module III:
Foams and light weight materials, fibre reinforced concrete. Types of fibres, workability, mechanical and physical properties of fibre reinforced concrete. Polymers in Civil Engineering, Polymers, fibres and composites

Module IV:
Fibre reinforced plastic in sandwich panels, modeling. Architectural use and aesthetics of composties. Adhesives and sealants. Structural elastomeric bearings and resilient seating. Moisture barriers, Polymer foams and polymers in Building, Polymer concrete composites.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Neville A.M., 'Properties of concrete', 3rd ed., 1985, ELBS Lea F.M.,
- 'Chemistry of cement and concrete', 3rd ed., 1970, Edward Arnold Proceedings of recent seminars etc. and journals.

ADVANCED CONSTRUCTION MATERIALSLAB

Course Code: STE4305 **CreditUnits : 01**

List of Experiments:

- Tests on cement - Consistency, Setting times, Soundness, Compressive Strength.
- Tests on aggregates: Gradation Charts of Aggregates, Bulking of fine Aggregate, Aggregate Crushing and Impact value
- Workability Tests on Fresh self compacting concrete
- Test the compressive strength of concrete cubes by adding the industrial waste products in replacement of cement/ aggregates.
- Non Destructive Testing of Concrete.
- Use of light weight materials in concrete.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

DISASTER MITIGATION AND MANAGEMENT

Course Code: STE4306 **CreditUnits : 04**

Course Objective:
To impart knowledge about the disasters, the measure to eliminate or reduce the effects of such manmade or natural disasters and finding the correct measures for the same. This will help students to understand the need for the disaster preparedness and the considerations in designing of the structures as well.

Course Contents:
Module I:
Understanding Disasters: Meaning, nature, characteristics and types of Disasters, Causes and effects, Disaster: A Global View

Module II:
Introduction to disaster Preparedness, Disaster Management: Prevention, Preparedness and Mitigation, Disaster Preparedness: Concept & Nature, Disaster Preparedness Plan, Disaster Preparedness for People and Infrastructure, Community based Disaster Preparedness Plan.

Module III:
Disaster Mitigation, Disaster Mitigation: meaning and concept, Disaster Mitigation Strategies, Emerging Trends in Disaster Mitigation, Mitigation management, Role of Team and Coordination.

Module IV:
Technologies for Disaster Management, Role of IT in Disaster Preparedness, Remote Sensing, GIS and GPS, Use and Application of Emerging Technologies, Application of Modern Technologies for the Emergency communication, Application and use of ICST for different disasters. Develop an understanding of why and how the modern disaster manager is involved with predisaster and post-disaster activities.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**EE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Sharma, R.K. & Sharma, G. (2005) (ed) Natural Disaster, APH Publishing Corporation, New Delhi.
- Carter, W. Nick, 1991: Disaster Management, Asian Development Bank, Manila
- Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.
- Roy, P.S. (2000): Space Technology for Disaster management: A Remote Sensing & GIS Perspective, Indian Institute of Remote Sensing (NRSA) Dehradun.

SOIL STRUCTURE INTERACTION

Course Code: STE4307 **CreditUnits : 04**

Course Objective:
To impart knowledge about the critical study of the foundation design , its nature in accordance with the soil structure interaction and applying the techniques to analyze it.

Course Contents:

Module I:
Introduction, Importance and Applications of Soil Structure Interaction (SSI): Introduction to SSI, Importance of SSI, Applications and examples of SSI for structural engineer, Effects of structure roughness/smoothness on soil behaviour. General soil-structure interaction problems – Shallow Foundations, Sheet piles, Mat/Raft foundations etc., Contact pressures and soil-structure interaction for shallow Foundations, Fixed/Flexible Base.

Module II:
Soil Structure Interaction – Parameters: Concept of sub grade modulus, effects/parameters influencing sub grade modulus, Flexible and Rigid Foundations – Rigidity calculations, Static and Dynamic Spring Constants – Winkler Model, Estimation of soil spring constants/stiffness for foundations design. SSI Models - Elastic Continuum, Winkler Model, Multi-Parameter Models, Hybrid Model. Structure Contact Interface.

Module III:
Soil Behaviour: Arching in soils. Elastic and plastic analysis of stress distribution on yielding bases. Analysis of conduits/pipes in soils. Beams on elastic foundation concept, introduction to the solution of beam problems. Seismic Soil-Structure Interaction - Dynamic response of soil, strain-compatibility, and damping characteristics of soil-structure. Shake-table tests.

Module IV:
SSI in Retaining Structures: Curved failure surfaces, their utility and analytical/graphical predictions from Mohr-Coulomb envelope and circle of stresses. Earth pressure computations by friction circle method. Earth pressure distribution on walls with limited/restrained deformations, Dubravo's analysis. Earth pressures on sheet piles, braced excavations. Design of supporting system for excavations. Soil-Pile Behaviour: Introduction, axial and laterally loaded piles, load-displacement behaviour, Modified Ramberg Osgood Model, pile group, interaction effect in pile group, soil-pile modelling in FEM, Elastic continuum and elasto-plasticanalysis of piles and pile
groups. Non-linear load-deflection response.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Bowels J.E., "Analytical and Computer Methods in Foundation", McGraw Hill Book Co.
- New York.
- Desai C.S. and Christian J.T., "Numerical Methods in Geotechnical Engineering" McGraw Hill Book Co. New York.
- Soil Structure Interaction, the real behaviour of structures, Institution of Structural
- Engineers, 1989.
- Structure Soil Interaction- State of Art Report, Institution of Structural Engineers, 1978.

- Elastic Analysis of Soil Foundation Interaction, Developments in Geotechnical Engg.vol-17, Elsevier Scientific Publishing Co.
- Prakash, S., and Sharma, H. D., "Pile Foundations in Engineering Practice."John Wiley & Sons, New York, 1990.
- "Foundation Engineering Handbook," H.-Y. Fang, Editor, Van Nostrand Reinhold, 2nd Ed., New York, USA.

DESIGN OF TALL BUILDINGS

Course Code: STE4308 **CreditUnits : 04**

Course Objective:
The main aim is to learn and develop design criteria and guidance for the seismic design and review of tall buildings.

Course Contents:
Module I:
Design philosophy, Loading, sequential loading, materials - high performance, concrete - Fibre reinforced Concrete - Light weight concrete - design mixes. Gravity loading Wind loading Earthquake loading

Module II:
Factors affecting growth, Height and Structural form. High rise behaviour, Rigid frames, braced frames, Infilled frames, shear walls, coupled shear walls, wall-frames, tubulars, cores, futrigger - braced and hybrid mega systems.

Module III:
Modelling 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, computerized general three dimensional analysis.

Module IV:
Sectional shapes, properties and resisting capacity, design, deflection, cracking, prestressing, shear flow, Design for differential movement, creep and shrinkage effects, temperature effects and fire resistance.

Module V:
Overall buckling analysis of frames, wall-frames, Approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first-order and PDelta analysis, Translational, Torsional instability, out of plumb effects, stiffness of member in stability, effect of foundation rotation.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Bryan Stafford Smith and Alexcoull, "Tall Building Structures - Analysis and Design", John Wiley and Sons, Inc., 1991.
- Taranath B.S., "Structural Analysis and Design of Tall Buildings", McGraw Hill, 1988.
- Gupta.Y.P.,(Editor), Proceedings of National Seminar on High Rise Structures- Design and Construction Practices for Middle Level Cities, New Age International Limited, New Delhi,1995.
- Lin T.Y and Stotes Burry D, "Structural Concepts and systems for Architects and Engineers", John Wiley, 1988.
- Beedle.L.S., "Advances in Tall Buildings", CBS Publishers and Distributors Delhi, 1986.

ADVANCED STEEL AND CONCRETE COMPOSITE STRUCTURES

Course Code: STE4309 **CreditUnits : 04**

Course Objective:
To impart knowledge and carry out the analysis and design of steel and concrete composite structural components.

Course Contents:

Module I:
Introduction: definition and characteristics, fibres, matrices, fibre reinforced composites, advantages and limitations, basic concepts and characteristics: isotropy, orthotropy, classification, limina and laminate, micromechanics and macromechanics, constituent materials and properties.

Module II:
Elastic behaviour of unidirectional lamina: specially orthotropic and transversely isotropic material, relation between mathematical and engineering constants, stress strain relations for thin lamina, transformation of stress and strain, transformation of elastic parameters, transformation of stress-strain relations in terms of engineering constants.

Module III:
Elastic behaviour of multidirectional laminates, symmetric and balanced laminates, design considerations, computational procedure for finding engineering elastic properties, stress and failure analysis of multidirectional laminates.

Module IV:
Bending of laminated composite plates, thin laminated plate theory, deflection of all edges simply supported rectangular symmetric cross-ply laminate, two opposite edges simply supported.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- I.M. Daniel & O. Ishai,"Engineering Mechanics of Composite Materials", Oxford Press
- S.W.Tsai&H.T.Hahn, "Introduction to Composite Materials:Technomic Pub. Co.INC,USA.
- P.K.Sinha,"A short term course on Composite Materials and Structures"-1996

SUMMER INTERNSHIP EVALUATION

Course Code: STE4335 **Credit Units: 06**

Guidelines:
There are certain phases of every Intern's professional development that cannot be effectively taught in the academic environment. These facets can only be learned through direct, on-the-job experience working with successful professionals and experts in the field. The internship program can best be described as an attempt to institutionalize efforts to bridge the gap between the professional world and the academic institutions. Entire effort in internship is in terms of extending the program of education and evaluation beyond the classroom of a university or institution. The educational process in the internship course seeks out and focuses attention on many latent attributes, which do not surface in the normal classroom situations. These attributes are intellectual ability, professional judgment and decision-making ability, inter-disciplinary approach, skills for data handling, ability in written and oral presentation, sense of responsibility etc.

In order to achieve these objectives:

- **Each student will be allotted a supervisor** for proper guidance.
- **Student will first submit synopsis in the format given by coordinator/supervisor.**
- Student will maintain a file (**Internship File/Project Report**). **Further, coordinator will provide NTCC project guidelines and sample to help in preparation of file.** The Internship File aims to encourage students to keep a personal record of their learning and achievement throughout the Programme. It can be used as the basis for lifelong learning and for job applications. Items can be drawn from activities completed in the course modules and from the workplace to demonstrate learning and personal development. The File will assess the student's analytical skills and ability to present supportive evidence, whilst demonstrating understanding of their organization, its needs and their own personal contribution to the organization.

The **layout guidelines** for the Project Report

1. File should be in the following specification

- A4 size paper
- **Font**

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

- **Margins**

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

- **Line Spacing**

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

- **Tables and Figures**

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures

experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

- **Drawings**

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

- **Equations**

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

2. Report Size: The maximum number of pages of the Report should be preferably between 50-80 pages.

3. Report Layout: The report should contain the following components
Front Page
Table of Content
Acknowledgement
Student Certificate
Company Profile (optional)
Introduction
Main Body
References / Bibliography

The File will include ***five sections*** in the order described below. The content and comprehensiveness of the main body and appendices of the report should include the following:

1. **The Title Page**--Title - An Internship Experience Report For (Your Name), name of internship organization, name of the Supervisor/Guide and his/her designation, date started and completed, and number of credits for which the report is submitted.
2. **Declaration by the Students-**This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.
3. Certificate-This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).
4. Acknowledgements-This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.
5. Abstract and **Keywords-**This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.
7. Contents-This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

8. **Introduction**--short, but should include how and why you obtained the internship experience position and the relationship it has to your professional and career goals.
9. **Main Body**--should include but not be limited to daily tasks performed. Major projects contributed to, dates, hours on task, observations and feelings, meetings attended and their purposes, listing of tools and materials and their suppliers, and photographs if possible of projects, buildings and co-workers.
10. **References / Bibliography** --This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE INTERNSHIP FILE

Continuous Internal Assessment	**Final Assessment**
40 Marks	60 Marks

Continuous Internal Assessment consists of topic relevance, progress report and synopsis marks. Final Assessment includes viva, presentation and report marks.

Examination Scheme:

Components	**V**	**S**	**R**	**PR**	**FP**
Weightage (%)	20	20	20	20	20

V – Viva, S – Synopsis, FP – Final Presentation, R – Report, PR-Progress Report

PROJECT-DISSERTATION-I

Course Code: STE4337 **CreditUnits: 05**

GUIDELINES FOR DISSERTATION

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

A short account of the activities that were undertaken as part of the project;

A statement about the extent to which the project has achieved its stated goals.

A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;

Any activities planned but not yet completed as part of the DISSERTION, or as a future initiative directly resulting from the project;

Any problems that have arisen that may be useful to document for future reference.

- Report Layout

The report should contain the following components:

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Future prospects**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic*Escherichia coli* O157: H7. *ClinMicrobiol Infect*, **8** (suppl 1): 116–117.

For book

Kowalski,M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

ASSESSMENT OF THE DISSERTATION FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Dissertation	50
Viva Voce	50
Total	**100**

ata, leading to production of a structured report.

Selecting the Dissertation Topic
It is usual to give you some discretion in the choice of topic for the dissertation and the approach to be adopted. You will need to ensure that your dissertation is related to your field of specialization.

Deciding this is often the most difficult part of the dissertation process, and perhaps, you have been thinking of a topic for some time.

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- Drawing up initial dissertation outlines considering the aims and objectives of the dissertation. Workout various stages of dissertation
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The Layout Guidelines for the Dissertation

- A4 size Paper
- Font: Arial (10 points) or Times New Roman (12 points)
- Line spacing: 1.5
- Top and bottom margins: 1 inch/ 2.5 cm; left and right margins: 1.25 inches/ 3 cm

Guidelines for the assessment of the Dissertation
While evaluating the dissertation, faculty guide will consider the following aspects:

1. Has the student made a clear statement of the objective or objective(s).
2. If there is more than one objective, do these constitute parts of a whole?
3. Has the student developed an appropriate analytical framework for addressing the problem at hand.
4. Is this based on up-to-date developments in the topic area?
5. Has the student collected information / data suitable to the frameworks?

6. Are the techniques employed by the student to analyse the data / information appropriate and relevant?
7. Has the student succeeded in drawing conclusion form the analysis?
8. Do the conclusions relate well to the objectives of the project?
9. Has the student been regular in his work?
10. Layout of the written report.

Assessment Scheme:

Continuous Evaluation:		40%
(Based on Abstract, Regularity, Adherence to initial plan, Records etc.)		
Final Evaluation: Based on,		60%
Contents & Layout of the Report,	20	
Conceptual Framework,	05	
Objectives & Methodology and	05	
Implications & Conclusions	10	
Viva & Presentation	20	

Syllabus - Fourth Semester

PROJECT-DISSERTATION-II

Course Code: STE4437 **CreditUnits: 15**

GUIDELINES FOR DISSERTATION

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

A short account of the activities that were undertaken as part of the project;

A statement about the extent to which the project has achieved its stated goals.

A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;

Any activities planned but not yet completed as part of the DISSERTION, or as a future initiative directly resulting from the project;

Any problems that have arisen that may be useful to document for future reference.

- Report Layout

The report should contain the following components:

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Future prospects**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic*Escherichia coli* O157: H7. *ClinMicrobiol Infect*, **8** (suppl 1): 116–117.

For book

Kowalski,M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

ASSESSMENT OF THE DISSERTATION FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Dissertation	50
Viva Voce	50
Total	**100**

ata, leading to production of a structured report.

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