

UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN



M.TECH (STRUCTURAL ENGINEERING PROGRAMME)

M. Tech. (Civil Engineering) Specialization: Structural Engineering**Semester I**

Sr. No.	Course Type/Code	Course Name
1.	MSET-101	Advanced Structural Analysis
2.	MSET-102	Advanced Solid Mechanics
3.	MSET-103	Analytical and Numerical Methods for Structural Engineering
4.	Program Elective	Elective – I 1. MSET-111 Theory of Thin Plates and Shells 2. MSET-112 Theory and application of cement composites 3. MSET-113 Theory of Structural Stability 4. MSET-114 Structural Health monitoring
5.	MSEP101	Structural Design Lab
6.	MSEP102	Advanced Concrete Lab
7.	MLC	Research Methodology and IPR
8.	Audit 1	Audit Course

Semester II

Sr. No.	Course Type/Code	Course Name
1.	MSET-201	FEM in Structural Engineering
2.	MSET-202	Structural Dynamics
3.	Program Elective I	Elective – II 1. MSET-211 Advanced Steel Design 2. MSET-212 Design of Formwork 3. MSET-213 Design of High Rise Structures 4. MSET-214 Design of Masonry Structures
4.	Program Elective II	Elective – II 1. MSET-221 Design of Advanced Concrete Structures 2. MSET-222 Advanced Design of Foundations 3. MSET-223 Soil Structure Interaction 4. MSET-224 Design of Industrial Structure
5.	MSEP-201	Model Testing Lab
6.	MSEP-202	Numerical Analysis Lab
7.	MSEP-203	Mini Project
8.	Audit 2	Audit Course-2

Semester III

Sr. No.	Course Type/Code	Course Name
1.	Program Elective – I	Elective –I 1. MSET-311 Design of Prestressed Concrete Structures 2. MSET-312 Analysis of Laminated Composite Plates 3. MSET-313 Fracture Mechanics of Concrete Structures 4. MSET-314 Design of Plates and Shells
2.	Open Elective	1. MOET -391 Business Analytics 2. MOET -392 Industrial Safety 3. MOET -393 Operations Research 4. MOET -394 Cost Management of Engineering Projects 5. MOET -395 Composite Materials 6. MOET -396 Waste to Energy
3.	Dissertation/ MSEP-301	Dissertation Phase – I

Semester IV

Sr. No.	Course Code	Course Name
1.	Dissertation/MS EP-401	Dissertation Phase – II

Audit course 1 & 2

English for Research Paper Writing

Disaster Management

Sanskrit for Technical Knowledge

Value Addition

Constitution of India

Pedagogy Studies

Stress Management by Yoga

Personality Development through Life Enlightenment Skills.

M. Tech (Civil Engineering)

Model Curriculum Structure

Specialization: Structural Engineering

Program Outcomes (POs):

After completion of the program graduates will be able to

A. Apply the knowledge of science, mathematics, and engineering principles for developing problem solving attitude

Identify, formulate and solve engineering problems in the domain of structural engineering field.

Use different software tools for Analysis and Design structural engineering domain.

Design and conduct experiments, analyse and interpret data, for development of simulation experiments.

Function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility.

Model curriculum for ME (Civil) - specialization in Structural Engineering						
Semester I						
Sr. No.	Course Type/Code	Course Name	Teaching Scheme			Credits
			Th	Tuto	Lab	
1.	MSET-101	Advanced Structural Analysis	3	0	0	3
2.	MSET-102	Advanced Solid Mechanics	3	0	0	3
3.	MSET-103	Analytical and Numerical Methods for Structural Engineering	3	0	0	3
4.	Program Elective	Elective – I 1. MSET-111 Theory of Thin plates and Shells 2. MSET-112 Theory and application of Cement Composites 3. MSET-113 Theory of Structural Stability 4. MSET-114 Structural Health Monitoring	3	0	0	3
5.	MSEP-101	Structural Design Lab	0	0	2	2
6.	MSEP-102	Advanced Concrete Lab	0	0	2	2
7.	MLC	Research Methodology and IPR	2	0	0	2
8.	Audit 1	Audit Course	2	0	0	0
Total			16	0	4	18

Semester II						
Sr. No.	Course Type/Code	Course Name	Teaching Scheme			Credits
			Th	Tuto	Lab	
1.	MSET-201	FEM in Structural Engineering	3	0	0	3
2.	MSET-202	Structural Dynamics	3	0	0	3
3.	Program Elective I	Elective – I 1. MSET-211 Advanced Steel Design 2. MSET-212 Design of Formwork 3. MSET-213 Design of High Rise Structures 4. MSET-214 Design of Masonry Structures	3	0	0	3
4.	Program Elective II	Elective – II 1. MSET-221 Design of Advanced Concrete Structures 2. MSET-222 Advanced Design of Foundations 3. MSET-223 Soil Structure Interaction 4. MSET-224 Design of Industrial Structure	3	0	0	3
5.	MSEP-201	Model Testing Lab	0	0	2	2
6.	MSEP-202	Numerical Analysis Lab	0	0	2	2
7.	MSEP-203	Mini Project	0	0	4	2
8.	Audit 2	Audit Course-2	2	0	0	0
Total			14	0	8	18

Semester III						
Sr. No.	Course Type/Code	Course Name	Teaching Scheme			Credits
			Th	Tuto	Lab	
1.	Program Elective-I	Elective – IV 1. MSET-311 Design of Prestressed Concrete Structures 2. MSET-312 Analysis of Laminated Composite Plates 3. MSET-313 Fracture Mechanics of Concrete Structures 4. MSET-314 Design of Plates and Shells	3	0	0	3
2.	Open Elective	1. MOET-391 Business Analytics 2. MOET-392 Industrial Safety 3. MOET-393 Operations Research 4. MOET-394 Cost Management of Engineering Projects 5. MOET-395 Composite Materials 6. MOET-396 Waste to Energy	3	0	0	3
3.	Dissertation MSEP-301	Dissertation Phase – I	0	0	20	10
Total			6	0	0	16

Semester-IV

Sr. No.	Course Code	Course Name	Teaching Scheme			Credits
1.	Dissertation MSEP-401	Dissertation Phase – II	0	0	32	16
Total			--	--	--	16

Total Credits for the programme = 18 + 18 +16 +16 =68

Audit course 1 & 2

English for Research Paper Writing

Disaster Management

Sanskrit for Technical Knowledge

Value Addition

Constitution of India

Pedagogy Studies

Stress Management by Yoga

Personality Development through Life Enlightenment Skills.

Semester I

Advanced Structural Analysis (Credits - 3:0:0 = 3)

Subject code: MSET-101

Teaching Scheme

Lectures: 3 hrs/week

Course outcomes: At the end of the course, students will be able to
Analyze the skeleton structures using stiffness analysis code.
Use direct stiffness method understanding its limitations

Syllabus Contents:

Influence Coefficients: Physical Significance, Effects of Settlements, Temperature Change and Lack of Fit, Member Approach and Structure Approach.

Stiffness Method applied to Large Frames: Local Coordinates and Global Coordinates.

Stiffness Matrix Assembly of Structures: Stiffness Matrix in Global Coordinates, Boundary Conditions, Solution of Stiffness Matrix Equations, Calculation of Reactions and Member Forces.

Applications to Simple Problems: Beams, Plane Trusses, Plane Rigid Jointed Frames and Grids by Structure Approach and Member Approach.

Boundary Value Problems (BVP): Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional BVP, Matrix Formulation of the Modified Galerkin Method.

Linear Element: Shape Functions, Solution for Poisson's Equation, General One Dimensional Equilibrium Problem.

References:

Matrix Analysis of Framed Structures, Weaver and Gere.

The Finite Element Method, Lewis P. E. and Ward J. P., Addison-Wesley Publication Co.

Computer Methods in Structural Analysis, Meek J. L., E and FN, Span Publication.

The Finite Element Method, Desai and Able, CBS Publication.

Advanced Solid Mechanics (Credits - 3:0:0 = 3)

Subject Code:MSET-102

Teaching Scheme

Lectures: 3 hrs/week

Course outcomes: At the end of the course, students will be able to

Solve simple problems of elasticity and plasticity understanding the basic concepts.

Apply numerical methods to solve continuum problems.

Syllabus Contents:

Introduction to Elasticity: Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity.

Strain and Stress Field: Elementary Concept of Strain, Strain at a Point, Principal Strains and Principal Axes, Compatibility Conditions, Stress at a Point, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Hydrostatic and Deviatoric Components.

Equations of Elasticity: Equations of Equilibrium, Stress- Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems, Co-axiality of the Principal Directions.

Two-Dimensional Problems of Elasticity: Plane Stress and Plane Strain Problems, Airy's stress Function, Two-Dimensional Problems in Polar Coordinates.

Torsion of Prismatic Bars: Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, Torsion of Thin Tubes.

Plastic Deformation: Strain Hardening, Idealized Stress- Strain curve, Yield Criteria, von Mises Yield Criterion, Tresca Yield Criterion, Plastic Stress-Strain Relations, Principle of Normality and Plastic Potential, Isotropic Hardening.

References:

Theory of Elasticity, Timoshenko S. and Goodier J. N., McGraw Hill, 1961.

Elasticity, Sadd M. H., Elsevier, 2005.

Engineering Solid Mechanics, Ragab A. R., Bayoumi S. E., CRC Press, 1999.

Computational Elasticity, Ameen M., Narosa, 2005.

Solid Mechanics, Kazimi S. M. A., Tata McGraw Hill, 1994.

Advanced Mechanics of Solids, Srinath L. S., Tata McGraw Hill, 2000.

Theory of Thin Plates and Shells (Credits - 3:0:0 = 3)

Subject Code: MSET-111

Teaching Scheme

Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to

Use analytical methods for the solution of thin plates and shells.

Use analytical methods for the solution of shells.

Apply the numerical techniques and tools for the complex problems in thin plates.

Apply the numerical techniques and tools for the complex problems in shells.

Syllabus Contents:

Introduction: Space Curves, Surfaces, Shell Co-ordinates, Strain Displacement Relations, Assumptions in Shell Theory, Displacement Field Approximations, Stress Resultants, Equation of Equilibrium using Principle of Virtual Work, Boundary Conditions.

Static Analysis of Plates: Governing Equation for a Rectangular Plate, Navier Solution for Simply-Supported Rectangular Plate under Various Loadings, Levy solution for Rectangular Plate with other Boundary Conditions.

Circular Plates: Analysis under Axi-Symmetric Loading, Governing Differential Equation in Polar Co-ordinates. Approximate Methods of Analysis- Rayleigh-Ritz approach for Simple Cases in Rectangular Plates.

Static Analysis of Shells: Membrane Theory of Shells - Cylindrical, Conical and Spherical Shells,

Shells of Revolution: with Bending Resistance - Cylindrical and Conical Shells, Application to Pipes and Pressure Vessels.

Thermal Stresses in Plate/ Shell

References:

Theory of Plates and Shells, Timoshenko S. and Krieger W., McGraw Hill.

Stresses in Plates and Shells, Ugural Ansel C., McGraw Hill.

Thin Elastic Shells, Kraus H., John Wiley and Sons.

Theory of Plates, Chandrashekhar K., Universities Press.

Design and Construction of Concrete Shells, Ramaswamy G.S.

Theory and Applications of Cement Composites

(Credits- 3:0:0=3)

Subject Code:MSET-112

Teaching Scheme

Course Outcomes:At the end of the course, students will be able to

Formulate constitutive behaviour of composite materials – Ferrocement, SIFCON and Fibre Reinforced Concrete - by understanding their strain- stress behaviour.

Classify the materials as per orthotropic and anisotropic behaviour.

Estimate strain constants using theories applicable to composite materials.

Analyse and design structural elements made of cement composites.

Syllabus Content:

Introduction: Classification and Characteristics of Composite Materials- Basic Terminology, Advantages. Stress-Strain Relations- Orthotropic and Anisotropic Materials, Engineering Constants for Orthotropic Materials, Restrictions on Elastic Constants, Plane Stress Problem, Biaxial Strength, Theories for an Orthotropic Lamina.

Mechanical Behaviour: Mechanics of Materials Approach to Stiffness- Determination of Relations between Elastic Constants, Elasticity Approach to Stiffness- Bounding Techniques of Elasticity, Exact Solutions - Elasticity Solutions with Continuity, Halpin, Tsai Equations, Comparison of approaches to Stiffness.

Cement Composites: Types of Cement Composites, Terminology, Constituent Materials and their Properties, Construction Techniques for Fibre Reinforced Concrete - Ferrocement, SIFCON, Polymer Concretes, Preparation of Reinforcement, Casting and Curing.

Mechanical Properties of Cement Composites: Behavior of Ferrocement, Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion.

Application of Cement Composites: FRC and Ferrocement- Housing, Water Storage, Boats and Miscellaneous Structures. Composite Materials- Orthotropic and Anisotropic behaviour, Constitutive relationship, Elastic Constants.

Analysis and Design of Cement Composite Structural Elements - Ferrocement, SIFCON and Fibre Reinforced Concrete.

Reference Books:

Mechanics of Composite Materials, Jones R. M., 2nd Ed., Taylor and Francis, BSP Books, 1998. Ferrocement – Theory and Applications, Pama R. P., IFIC, 1980.

New Concrete Materials, Swamy R.N., 1st Ed., Blackie, Academic and Professional, Chapman & Hall, 1983.

Theory of Structural Stability (Credits- 3:0:0 = 3)

Subject Code:MSET-113

Teaching Scheme

Lectures: 3 hrs/week

Course Outcomes:At the end of the course, students will be able to

Determine stability of columns and frames

Determine stability of beams and plates

Use stability criteria and concepts for analysing discrete and continuous systems,

Syllabus Contents:

Criteria for Design of Structures: Stability, Strength, and Stiffness, Classical Concept of Stability of Discrete and Continuous Systems, Linear and nonlinear behaviour.

Stability of Columns:Axial and Flexural Buckling, Lateral Bracing ofColumns, Combined Axial, Flexural and Torsion Buckling.

Stability of Frames: Member Buckling versus Global Buckling, Slenderness Ratio ofFrame Members.

Stability of Beams: lateraltorsion buckling.

Stability of Plates: axialflexural buckling, shearflexural buckling, buckling under combined loads.

Introduction to Inelastic Buckling and Dynamic Stability.

Reference Books:

Theory of elastic stability, Timoshenko and Gere, Tata Mc Graw Hill,1981

Principles of Structural Stability Theory, Alexander Chajes, Prentice Hall, New Jersey.

Structural Stability of columns and plates, Iyengar, N. G. R., Eastern west press Pvt.

Ltd. Strength of Metal Structures,Bleich F. Bucking, Tata McGraw Hill, New York.

Analytical and Numerical Methods for Structural Engineering
(Credits - 3:0:0 = 3)

Subject Code: MSET-103

Teaching Scheme

Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to
Solve ordinary and partial differential equations in structural mechanics using numerical methods.
Write a program to solve a mathematical problem.

Syllabus Contents:

Fundamentals of Numerical Methods: Error Analysis, Polynomial Approximations and Interpolations, **Curve Fitting;** Interpolation and extrapolation.

Solution of Nonlinear Algebraic and Transcendental Equations

Elements of Matrix Algebra: Solution of Systems of Linear Equations, Eigen Value Problems.

Numerical Differentiation & Integration: Solution of Ordinary and Partial Differential Equations.

Finite Difference scheme: Implicit & Explicit scheme.

Computer Algorithms: Numerical Solutions for Different Structural Problems, Fuzzy Logic and Neural Network.

Reference Books:

An Introduction to Numerical Analysis, Atkinson K.E., J. Wiley and Sons, 1989.

Theory and Problems of Numerical Analysis, Scheid F, McGraw Hill Book Company, (Sham Series), 1988.

Introductory Methods of Numerical Analysis, Sastry S. S, Prentice Hall of India, 1998.

Structural Health Monitoring (Credits - 3:0:0 = 3)

Subject Code:MSET-114

Teaching Scheme

Lectures: 3 hrs/week

Course Outcomes:At the end of the course, students will be able to Diagnosis the distress in the structure understanding the causes and factors. Assess the health of structure using static field methods. Assessthe health of structure using dynamic field tests. Suggest repairs and rehabilitation measures of the structure

Syllabus Contents:

Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance.

Structural Health Monitoring: Concepts, Various Measures, Structural Safety in Alteration.

Structural Audit:Assessment of Health of Structure, Collapse andInvestigation, Investigation Management, SHM Procedures.

Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.

Dynamic Field Testing: Types ofDynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

Introduction to Repairs andRehabilitations ofStructures: Case Studies (Site Visits), piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

Reference Books:

Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006.

Health Monitoring of Structural Materials and Components Methods with Applications, Douglas E Adams, John Wiley and Sons, 2007.

Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006. Structural Health Monitoring with Wafer Active Sensors, Victor Giurgutiu, Academic Press Inc, 2007.

Structural Design Lab (Credits - 0:0:4= 2)

Subject Code :MSEP-101

Teaching Scheme

Lab: 2 hrs/week

Course Outcomes:At the end of the course, students will be able to
Design and Detail all the Structural Components of Frame Buildings.
Design and Detail complete Multi-Storey Frame Buildings.

Syllabus Content:

Design and detailed drawing of complete G+ 3 structures by individual student using latest relevant IS codes.

Advanced Concrete Lab (Credits - 0:0:4 = 2)

Subject Code:MSEP-102

Teaching Scheme

Lab: 2 hrs/week

Course Outcomes:At the end of the course, students will be able to

Design high grade concrete and study the parameters affecting its performance.
Conduct Non Destructive Tests on existing concrete structures.
Apply engineering principles to understand behavior of structural/ elements.

List of Experiments/Assignments:

Study of stress-strain curve of high strength concrete, Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture.
Effect of cyclic loading on steel.
Non-Destructive testing of existing concrete members.
Behavior of Beams under flexure, Shear and Torsion.

Reference Books:

Properties of Concrete, Neville A. M., 5th Edition, Prentice Hall, 2012.
Concrete Technology, Shetty M. S., S. Chand and Co., 2006.

Research Methodology and IPR

Teaching Scheme

Lectures: 1hrs/week

Course Outcomes:

At the end of this course, students will be able to

Understand research problem formulation.

Analyze research related information

Follow research ethics

Understand that today’s world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Syllabus Contents:

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2: Effective literature studies approaches, analysis

Plagiarism, Research ethics,

Unit 3: Effective technical writing, how to write report, Paper

Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students”

Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”

Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"

Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd

,2007. Mayall , "Industrial Design", McGraw Hill, 1992.

Niebel , "Product Design", McGraw Hill, 1974.

Asimov , "Introduction to Design", Prentice Hall, 1962.

Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Semester II

Finite Element Method in Structural Engineering(Credits- 3:0:0 = 3)

Subject Code:MSET-201

Teaching Scheme

Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to

Use Finite Element Method for structural analysis.

Execute the Finite Element Program/ Software.

Solve continuum problems using finite element analysis.

Syllabus Contents:

Introduction: History and Applications. Spring and Bar Elements, Minimum Potential Energy Principle, Direct Stiffness Method, Nodal Equilibrium equations, Assembly of Global Stiffness Matrix, Element Strain and Stress.

Beam Elements: Flexure Element, Element Stiffness Matrix, Element Load Vector.

Method of Weighted Residuals: Galerkin Finite Element Method, Application to Structural Elements, Interpolation Functions, Compatibility and Completeness Requirements, Polynomial Forms, Applications.

Types: Triangular Elements, Rectangular Elements, Three-Dimensional Elements, Isoparametric Formulation, Axi-Symmetric Elements, Numerical Integration, Gaussian Quadrature.

Application to Solid Mechanics: Plane Stress, CST Element, Plane Strain Rectangular Element, Isoparametric Formulation of the Plane Quadrilateral Element, Axi-Symmetric Stress Analysis, Strain and Stress Computations.

Computer Implementation of FEM procedure, Pre-Processing, Solution, Post-Processing, Use of Commercial FEA Software.

Reference Books:

Finite Element Analysis, Seshu P., Prentice-Hall of India, 2005.

Concepts and Applications of Finite Element Analysis, Cook R. D., Wiley J., New York, 1995.

Fundamentals of Finite Element Analysis, Hutton David, Mc-Graw Hill, 2004.

Finite Element Analysis, Buchanan G.R., McGraw Hill Publications, New York, 1995.

Finite Element Method, Zienkiewicz O.C. & Taylor R.L. Vol. I, II & III, Elsevier, 2000.

Finite Element Methods in Engineering, Belegundu A.D., Chandrupatla, T.R., Prentice Hall India, 1991.

Structural Dynamics (Credits - 3:0:0 = 3)

Subject Code: MSET-202

Teaching Scheme

Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to

Analyze and study dynamics response of single degree freedom system using fundamental theory and equation of motion.

Analyze and study dynamics response of Multi degree freedom system using fundamental theory and equation of motion.

Use the available software for dynamic analysis.

Introduction: Objectives, Importance of Vibration Analysis, Nature of Exciting Forces, Mathematical Modeling of Dynamic Systems.

Single Degree of Freedom System: Free and Forced Vibration with and without Damping, Response to Harmonic Loading, Response to General Dynamic Loading using Duhamel's Integral, Fourier Analysis for Periodic Loading, State Space Solution for Response.

Numerical Solution to Response using Newmark Method and Wilson Method, Numerical Solution for State Space Response using Direct Integration.

Multiple Degree of Freedom System (Lumped parameter): Two Degree of Freedom System, Multiple Degree of Freedom System, Inverse Iteration Method for Determination of Natural Frequencies and Mode Shapes, Dynamic Response by Modal Superposition Method, Direct Integration of Equation of Motion.

Multiple Degree of Freedom System (Distributed Mass and Load): Single Span Beams, Free and Forced Vibration, Generalized Single Degree of Freedom System.

Special Topics in Structural Dynamics (Concepts only): Dynamic Effects of Wind Loading, Moving Loads, Vibrations caused by Traffic, Blasting and Pile Driving, Foundations for Industrial Machinery, Base Isolation.

Reference Books:

Dynamics of Structures, Clough R. W. and Penzien J., Mc Graw Hill.

Structural Dynamics and Introduction to Earthquake Engineering, Chopra A. K.
[20]

Vibration of Structures – Application in Civil Engineering Design, Smith J. W., Chapman and Hall.

Dynamics of Structures, Humar J. L., Prentice Hall.

Structural Dynamics – Theory and Computation, Paz Mario, CBS Publication. Dynamics of Structures, Hart and Wong.

Advanced Steel Design (Credits - 3:0:0 = 3)

Subject Code:MSET-211

Teaching Scheme

Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to
Design steel structures/ components by different design processes.
Analyze and design beams and columns for stability and strength, and drift.
Design welded and bolted connections.

Syllabus Contents:

Properties of Steel: Mechanical Properties, Hysteresis, Ductility.

Hot Rolled Sections: compactness and non-compactness, slenderness, residual stresses.

Design of Steel Structures: Inelastic Bending Curvature, Plastic Moments, Design Criteria
Stability, Strength, Drift.

Stability of Beams: Local Buckling of Compression Flange & Web, Lateral Torsional Buckling.

Stability of Columns: Slenderness Ratio, Local Buckling of Flanges and Web, Bracing of Column
about Weak Axis.

Method of Designs: Allowable Stress Design, Plastic Design, Load and Resistance Factor Design;

Strength Criteria: Beams - Flexure, Shear, Torsion, Columns - Moment Magnification Factor,
Effective Length, PM Interaction, Biaxial Bending, Joint Panel Zones.

Drift Criteria: P Effect, Deformation Based Design;

Connections: Welded, Bolted, Location Beam Column, Column Foundation, Splices.

Reference Books:

Design of Steel Structures - Vol. II, Ramchandra. Standard Book House, Delhi.

Design of Steel Structures - Arya A. S., Ajmani J. L., Nemchand and Bros., Roorkee.

The Steel Skeleton- Vol. II, Plastic Behaviour and Design - Baker J. F., Horne M. R., Heyman
J., ELBS.

Plastic Methods of Structural Analysis, Neal B. G., Chapman and Hall London.

IS 800: 2007 – General Construction in Steel - Code of Practice, BIS, 2007.

SP – 6 - Handbook of Structural Steel Detailing, BIS, 1987

Design of Formwork (Credits - 3:0:0 = 3)

Subject Code:MSET-212

Teaching Scheme

Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to

Select proper formwork, accessories and material.

Design the form work for Beams, Slabs, columns, Walls and Foundations.

Design the form work for Special Structures.

Understand the working of flying formwork.

Judge the formwork failures through case studies.

Syllabus Content:

Introduction:Requirements and Selection of Formwork.

Formwork Materials- Timber, Plywood, Steel, Aluminium, Plastic, and Accessories. Horizontal and Vertical Formwork Supports.

Formwork Design: Concepts, Formwork Systems and Design for Foundations, Walls, Columns, Slab and Beams.

Formwork Design for Special Structures: Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Bridges.

Flying Formwork: Table Form, Tunnel Form, Slip Form, Formwork for Precast Concrete, Formwork Management Issues –Pre- and Post-Award.

Formwork Failures: Causes and Case studies in Formwork Failure, Formwork Issues in Multi-Story Building Construction.

Reference Books:

Formwork for Concrete Structures, Peurify, Mc Graw Hill India, 2015.

Formwork for Concrete Structures, Kumar Neeraj Jha, Tata McGraw Hill Education, 2012. IS 14687: 1999, False work for Concrete Structures - Guidelines, BIS.

Design of High Rise Structures (Credits - 3:0:0 = 3)

Subject Code:MSET-213

Teaching Scheme

Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to

Analyse, design and detail Transmission/ TV tower, Mast and Trestles with different loading conditions.

Analyse, design and detail the RC and Steel Chimney.

Analyse. design and detail the tall buildings subjected to different loading conditions using relevant codes.

Syllabus Content:

Design of transmission/ TV tower, Mast and trestles: Configuration, bracing system, analysis and design for vertical transverse and longitudinal loads.

Analysis and Design of RC and Steel Chimney, Foundation design for varied soil strata.

Tall Buildings: Structural Concept, Configurations, various systems, Wind and Seismic loads, Dynamic approach, structural design considerations and IS code provisions. Firefighting design provisions.

Applicationof software in analysis and design.

Reference Books:

Structural Design of Multi-storeyed Buildings, Varyani U. H., 2nd Ed., SouthAsian Publishers, New Delhi, 2002.

Structural Analysis and Design of Tall Buildings, Taranath B. S., Mc Graw Hill, 1988.

Illustrated Design of Reinforced ConcreteBuildings(GF+3storeyed), Shah V. L. &Karve S. R., Structures Publications, Pune, 2013.

Design of Multi Storeyed Buildings, Vol. 1 & 2, CPWD Publications, 1976.

Tall Building Structures, Smith Byran S. and Coull Alex, Wiley India. 1991.

High Rise Building Structures, Wolfgang Schueller, Wiley., 1971.

Tall Chimneys, Manohar S. N., Tata Mc Graw Hill Publishing Company, New Delhi

Design of Masonry Structures (Credits- 3:0:0 = 3)

Subject Code:MSET-214

Teaching Scheme

Lectures: 3 hrs/week

Course outcomes:At the end of the course, students will be able to

- Understand the masonry design approaches.
- Analyse Reinforced Masonry Members.
- Determine interactions between members.
- Determine shear strength and ductility of Reinforced Masonry members.
- Check the stability of walls
- Perform elastic and Inelastic analysis of masonry walls.

Syllabus Contents:

Introduction:Historical Perspective, Masonry Materials, Masonry Design Approaches, Overview of Load Conditions, Compression Behaviour of Masonry, Masonry Wall Configurations, Distribution of Lateral Forces.

Flexural Strength of Reinforced Masonry Members: In plane and Out-of-plane Loading.

Interactions: Structural Wall, Columns and Pilasters, Retaining Wall, Pier and Foundation. **Shear Strength** and Ductility of Reinforced Masonry Members.

Prestressed Masonry - Stability of Walls, Coupling of Masonry Walls, Openings, Columns, Beams.

Elastic and Inelastic Analysis, Modeling Techniques, Static PushOver Analysis and use of Capacity Design Spectra.

Reference Books:

Design of Reinforced Masonry Structures, Narendra Taly, ICC, 2nd Edn,

Masonry Structures: Behavior and Design, Hamid Ahmad A. and Drysdale Robert G., 1994.

Mechanics of Masonry Structures, Editor: Maurizio Angelillo, 2014.

Earthquake-resistant Design of Masonry Buildings, Toma evi Miha, Imperial College Press, 1999.

Design of Advanced Concrete Structures (Credits - 3:0:0 = 3)

Subject Code:MSET-221

Teaching Scheme

Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to
Analyse the special structures by understanding their behaviour.
Design and prepare detail structural drawings for execution citing relevant IS codes.

Syllabus Contents:

Design philosophy, Modeling of Loads, Material Characteristics.

Reinforced Concrete - P-M, M-phi Relationships, Strut-and- Tie Method, Design of Deep Beam and Corbel, Design of Shear Walls, Compression Field Theory for Shear Design, Design against Torsion; IS, ACI and Eurocode.

Steel Structures -- Stability Design, Torsional Buckling - Pure, Flexural and Lateral, Design of Beam-Columns, Fatigue Resistant Design, IS code, AISC Standards and Eurocode.

References Books:

- Reinforced Concrete Design, Pillai S. U. and Menon D., Tata McGraw-Hill, 3rd Ed, 1999. Design of Steel Structures, Subramaniam N., Oxford University Press, 2008.
Reinforced Concrete Structures, Park R. and Paulay T., John Wiley & Sons, 1995.
Advanced Reinforced Concrete Design, Varghese P. C., Prentice Hall of India, New Delhi.
Unified Theory of Concrete Structures, Hsu T. T. C. and Mo Y. L., John Wiley & Sons, 2010.
Steel Structures Design and Behavior Emphasizing Load and Resistance Factor Design, Salmon C. G., Johnson J. E. and Malhas F. A., Pearson Education, 5th Ed, 2009.
Design of Steel Structures - Vol. II, Ramchandra. Standard Book House, Delhi.
Plastic Methods of Structural Analysis, Neal B.G., Chapman and Hall London.

Advanced Design of Foundations (Credits- 3:0:0 = 3)

Subject Code:MSET-222

Teaching Scheme

Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to
Decide the suitability of soil strata for different projects.
Design shallow foundations deciding the bearing capacity of soil.
Analyze and design the pile foundation.
Understand analysis methods for well foundation.

Syllabus Contents:

Planning of Soil Exploration for Different Projects, Methods of Subsurface Exploration, Methods of Borings along with Various Penetration Tests.

Shallow Foundations, Requirements for Satisfactory Performance of Foundations, Methods of Estimating Bearing Capacity, Settlements of Footings and Rafts, Proportioning of Foundations using Field Test Data, Pressure - Settlement Characteristics from Constitutive Laws.

Pile Foundations, Methods of Estimating Load Transfer of Piles, Settlements of Pile Foundations, Pile Group Capacity and Settlement, Laterally Loaded Piles, Pile Load Tests, Analytical Estimation of Load- Settlement Behavior of Piles, Proportioning of Pile Foundations, Lateral and Uplift Capacity of Piles.

Well Foundation, IS and IRC Code Provisions, Elastic Theory and Ultimate Resistance Methods.

Tunnels and Arching in Soils, Pressure Computations around Tunnels.

Open Cuts, Sheet piling and Bracing Systems in Shallow and Deep Open Cuts in Different Soil Types.

Coffer Dams, Various Types, Analysis and Design, Foundations under uplifting loads, Soil-structure interaction

Reference Books:

Design of foundation system, N.P. Kurian, Narosa Publishing House

Foundation Analysis and Design, J. E. Bowles, Tata McGraw Hill New York

Analysis and Design of Substructures, Sawmi Saran, Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.

Soil Structure Interaction (Credits- 3:0:0 = 3)

Subject Code:MSET-223

Teaching Scheme

Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to

Understand soil structure interaction concept and complexities involved.

Evaluate soil structure interaction for different types of structure under various conditions of loading and subsoil characteristics.

Prepare comprehensive design oriented computer programs for interaction problems based on theory of sub grade reaction such as beams, footings, rafts etc.

Analyze different types of frame structure founded on stratified natural deposits with linear and non-linear stress-strain characteristics.

Evaluate action of group of piles considering stress-strain characteristics of real soils.

Syllabus Contents:

Critical Study of Conventional Methods of Foundation Design, Nature and Complexities of Soil Structure Interaction.

Application of Advanced Techniques of Analysis such as FEM and Finite Difference Method. Relaxation and Interaction for the Evaluation of Soil Structure Interaction for Different Types of Structure under various Conditions of Loading and Subsoil Characteristics.

Preparation of Comprehensive Design Oriented Computer Programs for Specific Problems, Interaction Problems based on Theory of Sub Grade Reaction Such as Beams, Footings, Rafts Etc.

Analysis of Different Types of Frame Structures Founded on Stratified Natural Deposits with Linear and Non-Linear Stress-Strain Characteristics.

Determination of Pile Capacities and Negative Skin Friction, Action of Group of Piles Considering Stress-Strain Characteristics of Real Soils, Anchor Piles and Determination of Pullout Resistance.

Reference Books:

Analytical and Computer Methods in Foundation, Bowels J.E., McGraw Hill Book Co., New York, 1974.

Numerical Methods in Geotechnical Engineering, Desai C.S. and Christian J.T., McGraw Hill Book Co., New York.

Soil Structure Interaction - The real behaviour of structures, Institution of Structural Engineers. Elastic Analysis of Soil Foundation Interaction, Developments in Geotechnical Engg. Vol-17, Elsevier Scientific Publishing Company.

Elastic Analysis of Soil-Foundation Interaction, Selvadurai A.P.S., Elsevier Scientific Publishing Company.

Analysis & Design of substructures, Swami Saran, Oxford & IBH Publishing Co. Pvt. Ltd. Design of Foundation System- Principles & Practices, Kurian N. P., Narosa Publishing

Design of Industrial Structures (Credits- 3:0:0 = 3)

Subject Code:MSET-224

Teaching Scheme

Lectures: 3 hrs/week

Course Outcomes: At the end of the course, the student will be able to:

- Design Steel Gantry Girders.
- Design Steel Portal, Gable Frames.
- Design Steel Bunkers and Silos.
- Design Chimneys and Water Tanks.

Syllabus Contents:

Steel Gantry Girders – Introduction, loads acting on gantry girder, permissible stress, types of gantry girders and crane rails, crane data, maximum moments and shears, construction detail, design procedure.

Portal Frames – Design of portal frame with hinge base, design of portal frame with fixed base – Gable Structures – Lightweight Structures

Steel Bunkers and Silos – Design of square bunker – Jansen's and Airy's theories – IS Code provisions – Design of side plates – Stiffeners – Hooper – Longitudinal beams Design of cylindrical silo – Side plates – Ring girder – stiffeners.

Chimneys – Introduction, dimensions of steel stacks, chimney lining, breech openings and access ladder, loading and load combinations, design considerations, stability consideration, design of base plate, design of foundation bolts, design of foundation.

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.

Reference Books:

Design of Steel Structure, Punmia B. C., Jain Ashok Kr., Jain Arun Kr., 2nd Ed., Lakshmi Publishers, 1998.

Design of Steel Structures, Ram Chandra, 12th Ed., Standard Publishers, 2009.

Design of Steel Structures, Subramaniam.

Testing Lab (Credits- 0:0:4 = 2)

Subject Code:MSEP-201

Teaching Scheme

Lectures: 2 hrs/week,

Course Outcomes: At the end of the course, students will be able to

Understand the response of structures.

Prepare the models.

Conduct model testing for static loading

Conduct model testing for free and forced vibrations

Syllabus Content:

Response of structures and its elements against extreme loading events.

Model Testing: Static - testing of plates, shells, and frame models.

Model Testing: Free and forced vibrations, Evaluation of dynamic modulus.

Beam vibrations, Vibration isolation, Shear wall building model, Time and frequency-domain study, Vibration Characteristics of RC Beams using Piezoelectric Sensors etc.

Numerical Analysis Lab (Credits- 0:0:4 = 2)

Subject Code:MSEP-202

Teaching Scheme

Lectures: 2 hrs/week

Course Outcomes: At the end of the course, students will be able to

Find Roots of non-linear equations by Bisection method and Newton's method.

Do curve fitting by least square approximations

Solve the system of Linear Equations using Gauss - Elimination/ Gauss - Seidal Iteration/
Gauss - Jordan Method

To Integrate Numerically Using Trapezoidal and Simpson's Rules

To Find Numerical Solution of Ordinary Differential Equations by Euler's Method,
Runge- Kutta Method.

Syllabus Contents:

Find the Roots of Non-Linear Equation Using Bisection Method.

Find the Roots of Non-Linear Equation Using Newton's Method.

Curve Fitting by Least Square Approximations.

Solve the System of Linear Equations Using Gauss - Elimination Method.

Solve the System of Linear Equations Using Gauss - Seidal Iteration Method.

Solve the System of Linear Equations Using Gauss - Jordan Method.

Integrate numerically using Trapezoidal Rule.

Integrate numerically using Simpson's Rules.

Numerical Solution of Ordinary Differential Equations By Euler's Method.

Numerical Solution of Ordinary Differential Equations By Runge- Kutta Method.

Mini Project (Credits- 0:0:4 = 2)

Subject Code:MSEP-203

Teaching Scheme

Lectures: 4hrs/week

Course Outcomes: At the end of the course, the student will be able to:

Identify structural engineering problems reviewing available literature.

Study different techniques used to analyze complex structural systems.

work on the solutions given and present solution by using his/her technique applying engineering principles.

Syllabus Contents:

Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution.

Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the departmental committee.

Design of Prestressed Concrete Structures

(Credits- 3:0:0 = 3)

Subject Code:MSET-311

Teaching Scheme

Lectures: 3 hrs/week

Course outcomes: At the end of the course, students will be able to

Find out losses in the prestressed concrete. Understand the basic aspects of prestressed concrete fundamentals, including pre and post-tensioning processes.

Analyse prestressed concrete deck slab and beam/ girders.

Design prestressed concrete deck slab and beam/ girders.

Design of end blocks for prestressed members.

Syllabus Contents:

Introduction to prestressed concrete: types of prestressing, systems and devices, materials, losses in prestress. Analysis of PSC flexural members: basic concepts, stresses at transfer and service loads, ultimate strength in flexure, code provisions.

Statically determinate PSC beams: design for ultimate and serviceability limit states for flexure, analysis and design for shear and torsion, code provisions.

Transmission of prestress in pretensioned members; Anchorage zone stresses for posttensioned members.

Statically indeterminate structures - Analysis and design - continuous beams and frames, choice of cable profile, linear transformation and concordancy.

Composite construction with precast PSC beams and cast in-situ RC slab - Analysis and design, creep and shrinkage effects. Partial prestressing - principles, analysis and design concepts, crack-width calculations

Analysis and design of prestressed concrete pipes, columns with moments.

References:

Design of Prestressed Concrete Structures, Lin T.Y., Asia Publishing House, 1955.

Prestressed Concrete, Krishnaraju N., Tata McGraw Hill, New Delhi, 1981.

Limited State Design of Prestressed Concrete, Guyan Y., Applied Science Publishers, 1972.

IS: 1343- Code of Practice for Prestressed Concrete

IRC: 112

Analytical and Finite Element Analysis of Laminated Composite Plates (Credits- 3:0:0 = 3)

Subject Code:MSET-312

Teaching Scheme

Lectures: 3 hrs/week

Course outcomes:At the end of the course, students will be able to

- Analyse the rectangular composite plates using the analytical methods.
- Analyse the composite plates using advanced finite element method.
- Develop the computer programs for the analysis of composite plates.

Syllabus Contents:

Introduction: Displacement Field Approximations for Classical Laminated Plate Theory (CLPT) and First Order Shear Deformation Theory (FSDT), Analytical Solutions for Bending of Rectangular Laminated Plates using CLPT.

Governing Equations. Navier Solutions of Cross-Ply and Angle-Ply Laminated Simply-Supported Plates, Determination of Stresses. Levy Solutions for Plates with Other Boundary Conditions, Analytical Solutions for Bending of Rectangular Laminated Plates Using FSDT.

Finite Element Solutions for Bending of Rectangular Laminated Plates using CLPT.

Introduction to Finite Element Method, Rectangular Elements, Formation of Stiffness Matrix, Formation of Load Vector, Numerical Integration, Post Computation of Stresses.

Finite Element Solutions for Bending of Rectangular Laminated Plates using FSDT.

Finite Element Model, C^0 Element Formulation, Post Computation of Stresses.

Analysis of Rectangular Composite Plates using Analytical Methods.

References:

Mechanics of Laminated Composites Plates and Shells, Reddy J. N., CRC Press.

Fracture Mechanics of Concrete Structures

(Credits- 3:0:0 = 3)

Subject Code:MSET-313

Teaching Scheme

Lectures: 3 hrs/week

Course outcomes:At the end of the course, students will be able to

- Identify and classify cracking of concrete structures based on fracture mechanics.
- Implement stress intensity factor for notched members
- apply fracture mechanics models to high strength concrete and FRC structures.
- Compute J-integral for various sections understanding the concepts of LEFM.

Syllabus Contents:

Introduction:Basic Fracture Mechanics, Crack in a Structure, Mechanisms of Fracture and Crack Growth, Cleavage Fracture, Ductile Fracture, Fatigue Cracking, Environment assisted Cracking, Service Failure Analysis.

Stress at Crack Tip: Stress at Crack Tip, Linear Elastic Fracture Mechanics, Griffith's Criteria, Stress Intensity Factors, Crack Tip Plastic Zone, Erwin's Plastic Zone Correction, R curves, Compliance, J Integral, Concept of CTOD and CMD.

Material Models: General Concepts, Crack Models, Band Models, Models based on Continuum Damage Mechanics, Applications to High Strength Concrete, Fibre Reinforced Concrete, Crack Concepts and Numerical Modeling.

Reference Books:

Fracture Mechanics, Suri C. T. and Jin Z.H., 1st Edition, Elsevier Academic Press, 2012.

Elementary Engineering Fracture Mechanics, Broek David, 3rd Rev. Ed. Springer, 1982.

Fracture Mechanics of Concrete Structures – Theory and Applications, Elfgreen L., RILEM Report, Chapman and Hall, 1989.

Fracture Mechanics – Applications to Concrete, Victor, Li C., Bazant Z. P., ACI SP 118, ACI Detroit, 1989.

Design of Plates and Shells (Credits- 3:0:0 = 3)

Subject Code:MSET-314

Teaching Scheme

Lectures: 3 hrs/week, –

Course Outcomes: At the end of the course, the student will be able to:

- Analyse and design prismatic folded plate systems.
- Analyse and design shells using approximate solutions
- Analyse and Design Cylindrical Shells
- Design Doubly Curved Shells using Approximate Solutions.

Syllabus Contents:

- Prismatic folded Plate Systems
- Shell Equations
- Approximate Solutions
- Analysis and Design of Cylindrical Shells
- Approximate Design methods for Doubly Curved Shells.

Reference Books:

- Theory of Plates and Shells, Timoshenko and Woinowsky-Krieger S., Tata Mc Graw Hill Edition, 2010.
- Design and Construction of Concrete Shell Roofs, Ramaswamy G. S., 1st Edition, 2005.
- Design of Reinforced Concrete Shells & Folded Plate, Varghese P. C., 1st Edition, PHI.
- Design of Plate and Shell Structures, Jawad Maan H., Springer Science.

Dissertation I (Credits- 0:0:20 = 10)

Subject Code:MSEP-301

Teaching Scheme

Lectures: 3hrs/week Mid Sem Evaluation weightage - 30%

End Sem Evaluation weightage - 70%

Course Outcomes: At the end of the course, the student will be able to:

Identify structural engineering problems reviewing available literature.

Identify appropriate techniques to analyze complex structural systems.

Apply engineering and management principles through efficient handling of project

Syllabus Contents:

Dissertation-I will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions and must bring out individual's contribution.

Continuous assessment of Dissertation – I and Dissertation – II at Mid Sem and End Sem will be monitored by the departmental committee.

Dissertation II (Credits- 0:0:32 = 16)

Subject Code:MSEP-401

Teaching Scheme

Contact Hours: 3hrs/week

Course Outcomes: At the end of the course, the student will be able to:

Solve complex structural problems by applying appropriate techniques and tools.

Exhibit good communication skill to the engineering community and society.

Demonstrate professional ethics and work culture.

Syllabus Contents:

Dissertation – II will be extension of the to work on the topic identified in Dissertation – I.

Continuous assessment should be done of the work done by adopting the methodology decided involving numerical analysis/ conduct experiments, collection and analysis of data, etc. There will be presubmission seminar at the end of academic term. After the approval the student has to submit the detail report and external examiner is called for the viva-voce to assess along with guide.

OPEN ELECTIVES

Subject:Business Analytics

Subject Code:MOET-391

Teaching scheme

Lecture: - 3 h/week

Course Code	
Course Name	Business Analytics
Credits Prerequisites	

Total Number of Lectures: 48

Course objective	
<p>Understand the role of business analytics within an organization.</p> <p>Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.</p> <p>To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.</p> <p>To become familiar with processes needed to develop, report, and analyze business data.</p> <p>Use decision-making tools/Operations research techniques.</p> <p>Mange business process using analytical and management tools.</p> <p>Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.</p>	
LECTURE WITH BREAKUP	NO. OF LECTURES
<p>Unit1:</p> <p>Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics.</p> <p>Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.</p>	9
<p>Unit 2:</p> <p>Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression.</p> <p>Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.</p>	8
<p>Unit 3:</p> <p>Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.</p> <p>Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.</p>	9
<p>Unit 4:</p> <p>Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression</p>	

Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.	10
Unit 5: Decision Analysis: Formulating Decision Problems, Decision Strategies with the without 8 Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.	
Unit 6: Recent Trends in : Embedded and collaborative business intelligence, Visual data 4 recovery, Data Storytelling and Data journalism.	

COURSE OUTCOMES	
<p>Students will demonstrate knowledge of data analytics.</p> <p>Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.</p> <p>Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.</p> <p>Students will demonstrate the ability to translate data into clear, actionable insights.</p>	

Reference:

Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
 Business Analytics by James Evans, persons Education.

OPEN ELECTIVES

Subject:Industrial Safety

Subject Code: MOET -392

Teaching scheme

Lecture: - 3 h/week

Unit-I: Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Unit-II: Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-III: Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-IV: Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-V: Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference:

- Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
- Maintenance Engineering, H. P. Garg, S. Chand and Company.
- Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
- Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

OPEN ELECTIVES

Subject: Operations Research

Subject Code: MOET -393

Teaching Scheme

Lectures: 3 hrs/week

Course Outcomes: At the end of the course, the student should be able to

- Students should able to apply the dynamic programming to solve problems of discrete and continuous variables.
- Students should able to apply the concept of non-linear programming
- Students should able to carry out sensitivity analysis
- Student should able to model the real world problem and simulate it.

Syllabus Contents:

Unit 1:

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit 2

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Unit 3:

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit 4

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit 5

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References:

- H.A. Taha, Operations Research, An Introduction, PHI, 2008
- H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
- J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
- Hitler Libermann Operations Research: McGraw Hill Pub. 2009
- Pannerselvam, Operations Research: Prentice Hall of India 2010
- Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

Open Elective

Subject: Cost Management of Engineering Projects

Subject Code: MOET -394

Teaching scheme

Lecture: - 3 h/week

Introduction and Overview of the Strategic Cost Management Process

Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non-technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

- Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
- Charles T. Horngren and George Foster, Advanced Management Accounting Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting

Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

Open Elective

Subject: Composite Materials

Subject Code: MOET -395

Teaching scheme

Lecture: - 3 h/week

UNIT-I: INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II: REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III: Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT-IV: Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V: Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first ply failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.

Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References:

Hand Book of Composite Materials-ed-Lubin.

Composite Materials – K.K.Chawla.

Composite Materials Science and Applications – Deborah D.L. Chung.

Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

Open Elective

Subject:Waste to Energy

Subject Code: MOET -396

Teaching scheme

Lecture: - 3 h/week

Unit-I: Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Unit-II: Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-III: Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-IV: Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-V: Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.

Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.

Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

AUDIT 1 and 2: ENGLISH FOR RESEARCH PAPER WRITING

Course objectives:		
Students will be able to:		
Understand that how to improve your writing skills and level of readability		
Learn about what to write in each section		
Understand the skills needed when writing a Title		
Ensure the good quality of paper at very first-time submission		
Syllabus		
Units	CONTENTS	Hours
1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	4
	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, 4 Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	
	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	4
4	key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,	4
5	skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	4
6	useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	4

Suggested Studies:

- Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
 Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
 Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM.
 Highman's book .
 Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht
 Heidelberg London, 2011

AUDIT 1 and 2: DISASTER MANAGEMENT

<p>Course Objectives: -Students will be able to:</p> <p>learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.</p> <p>critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.</p> <p>develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.</p> <p>critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in</p>		
Syllabus		
Units	CONTENTS	Hours
1	<p>Introduction Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.</p>	4
2	<p>Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.</p>	4
3	<p>Disaster Prone Areas In India Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics</p>	4
4	<p>Disaster Preparedness And Management Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.</p>	4
5	<p>Risk Assessment Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.</p>	4

6	Disaster Mitigation Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	4
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SUGGESTED READINGS:

R. Nishith, Singh AK, “Disaster Management in India: Perspectives, issues and strategies “New Royal book Company.

Sahni, PardeepEt.Al. (Eds.),” Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, New Delhi.

Goel S. L. , Disaster Administration And Management Text And Case Studies” ,Deep &Deep Publication Pvt. Ltd., New Delhi.

AUDIT 1 and 2: SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Objectives

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Syllabus

Unit	Content	Hours
1	Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences	8
2	Order Introduction of roots Technical information about Sanskrit Literature	8
3	Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics	8

Suggested reading

Abhyaspustakam” – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi

Teach Yourself Sanskrit” Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication

India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Output

Students will be able to

- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science & technology can be understood
- Being a logical language will help to develop logic in students

AUDIT 1 and 2: VALUE EDUCATION

Course Objectives

Students will be able to

1. Understand value of education and self- development
 - Imbibe good values in students
 - Let the should know about the importance of character

Syllabus

Unit	Content	Hours
1	Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements	4
2	Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism.Love for nature ,Discipline	6
3	Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature	6
4	Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence ,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively	6

Suggested reading

1 Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

Course outcomes

Students will be able to

- 1.Knowledge of self-development
- 2.Learn the importance of Human values
- 3.Developing the overall personality

AUDIT 1 and 2: CONSTITUTION OF INDIA

Course Objectives:

Students will be able to:

Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.

To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.

To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Syllabus

Units	Content	Hours
1	History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working)	4
2	Philosophy of the Indian Constitution: Preamble Salient Features	4
3	Contours of Constitutional Rights & Duties: Fundamental Rights Right to Equality Right to Freedom Right against Exploitation Right to Freedom of Religion Cultural and Educational Rights Right to Constitutional Remedies Directive Principles of State Policy Fundamental Duties.	4
4	Organs of Governance: Parliament Composition Qualifications and Disqualifications Powers and Functions Executive President Governor Council of Ministers Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions	4
5	Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO o Municipal Corporation. Pachayati raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy	4

6	Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.	4
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Suggested reading

- The Constitution of India, 1950 (Bare Act), Government Publication.
 Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
 M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
 D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:

Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

AUDIT 1 and 2: PEDAGOGY STUDIES

Course Objectives: Students will be able to: Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers. Identify critical evidence gaps to guide the development.		
Syllabus		
Units	Content	Hours
1	Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.	4
2	Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.	2
3	Evidence on the effectiveness of pedagogical practices Methodology for the in depth stage: quality assessment of included studies.	4

	<p>How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.</p>	
4	<p>Professional development: alignment with classroom practices and follow-up support Peer support Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes</p>	4
5	<p>Research gaps and future directions Research design Contexts Pedagogy Teacher education Curriculum and assessment Dissemination and research impact.</p>	2

Suggested reading

- Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, *Compare*, 31 (2): 245-261.
- Agrawal M (2004) Curricular reform in schools: The importance of evaluation, *Journal of Curriculum Studies*, 36 (3): 361-379.
- Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
- Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? *International Journal Educational Development*, 33 (3): 272–282.
- Alexander RJ (2001) *Culture and pedagogy: International comparisons in primary education*. Oxford and Boston: Blackwell.
- Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes:

Students will be able to understand:

- What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

AUDIT 1 and 2: STRESS MANAGEMENT BY YOGA

Course Objectives

- To achieve overall health of body and mind
- To overcome stress

Syllabus

Unit	Content	Hours
1	Definitions of Eight parts of yog. (Ashtanga)	8
2	Yam and Niyam. Do`s and Don`t`s in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	8
3	Asan and Pranayam i) Various yog poses and their benefits for mind & body ii)Regularization of breathing techniques and its effects-Types of pranayam	8

Suggested reading

- ‘Yogic Asanas for Group Tarining-Part-I’ :Janardan Swami Yogabhyasi Mandal, Nagpur
- “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

Course Outcomes:

Students will be able to:

Develop healthy mind in a healthy body thus improving social health also

Improve efficiency

AUDIT 1 and 2: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Objectives

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Syllabus

Unit	Content	Hours
1	Neetisatakam-Holistic development of personality Verses- 19,20,21,22 (wisdom) Verses- 29,31,32 (pride & heroism) Verses- 26,28,63,65 (virtue) Verses- 52,53,59 (dont`s) Verses- 71,73,75,78 (do`s)	8
2	Approach to day to day work and duties. Shrimad BhagwadGeeta: Chapter 2-Verses 41, 47,48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.	8

3	Statements of basic knowledge. Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18 Personality of Role model. Shrimad BhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63	8
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Suggested reading

“Srimad Bhagavad Gita” by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata

Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes

Students will be able to

Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life

The person who has studied Geeta will lead the nation and mankind to peace and prosperity

Study of Neetishatakam will help in developing versatile personality of students.

