Scheme & Syllabus of Master of Technology

(M. Tech – Civil Engineering)

Specialization: Structural Engineering
Batch 2018 onwards

By
Board of Study Civil Engineering
Department of Academics
I.K. Gujral Punjab Technical University
I.K. Gujral Punjab Technical University
Master of Technology in Civil Engineering
Specialization: Structural Engineering

It is a Post Graduate (PG) Programme of 2 years duration (4 semesters)

Eligibility for Admission: B. Tech / B.E Civil Engineering

Courses & Examination Scheme:

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
B. Identify, formulate and solve engineering problems in the domain of structural engineering field.
C. Use different software tools for Analysis and Design structural engineering domain.
D. Design and conduct experiments, analysis and interpret data, for development of simulation experiments.
E. Function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility.
<table>
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<th>Course Type</th>
<th>Course Name</th>
<th>Load Allocations</th>
<th>Marks Distribution</th>
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### List of Audit Course

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Addition
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills.
Semester I

MTST101 - 18 Advanced Structural Analysis (Credits - 3:0:0 = 3)

Course outcomes: At the end of the course, students will be able to
1. Analyze the skeleton structures using stiffness analysis code.
2. 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.
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.
• Computer Methods in Structural Analysis, Meek J. L., E and FN, Span Publication.
• The Finite Element Method, Desai and Able, CBS Publication.
Teaching Scheme
Lectures: 3 hrs/week

Course outcomes: At the end of the course, students will be able to
1. Solve simple problems of elasticity and plasticity understanding the basic concepts.
2. 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, Stain 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.
Torsion of Prismatic Bars: Saint Venant’s Method, Prandtl’s Membrane Analogy, Torsion of rectangular Bar, Torsion of Thin Tubes.

References:
• Elasticity, Sadd M. H., Elsevier, 2005.
• Computational Elasticity, Ameen M., Narosa, 2005.
Program Elective I

MTST901 - 18 Theory of Thin Plates and Shells (Credits - 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to
1. Use analytical methods for the solution of thin plates and shells.
2. Use analytical methods for the solution of shells.
3. Apply the numerical techniques and tools for the complex problems in thin plates.
4. Apply the numerical techniques and tools for the complex problems in shells.

Syllabus Contents:
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.
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 KriegerW., McGraw Hill.
• Stresses in Plates and Shells, UguralAnsel C., McGraw Hill.
• Thin Elastic Shells, KrausH., John Wiley and Sons.
• Theory of Plates, ChandrashekharaK., Universities Press.
• Design and Construction of Concrete Shells, RamaswamyG.S.
Program Elective I
MTST902 - 18- Theory and Applications of Cement Composites (Credits- 3:0:0=3)

Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to
1. Formulate constitutive behaviour of composite materials – Ferrocement, SIFCON and Fibre Reinforced Concrete - by understanding their strain- stress behaviour.
2. Classify the materials as per orthotropic and anisotropic behaviour.
3. Estimate strain constants using theories applicable to composite materials.
4. Analyse and design structural elements made of cement composites.

Syllabus Content:
Mechanical Properties of Cement Composites: Behavior of Ferrocement, Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion.
Analysis and Design of Cement Composite Structural Elements - Ferrocement, SIFCON and Fibre Reinforced Concrete.

Reference Books:

Program Elective I
MTST903 - 18 - Theory of Structural Stability (Credits- 3:0:0 = 3)

Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to
1. Determine stability of columns and frames
2. Determine stability of beams and plates
3. Use stability criteria and concepts for analysing discrete and continuous systems,

Syllabus Contents:
Stability of Frames: Member Buckling versus Global Buckling, Slenderness Ratio of Frame Members.
Stability of Beams: lateraltorsion buckling.
Stability of Plates: axialflexural buckling, shearflexural buckling, buckling under combinedloads.
Introduction to Inelastic Buckling and Dynamic Stability.

Reference Books:
Program Elective II
MTST904–18- Analytical and Numerical Methods for Structural Engineering (Credits - 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to
1. Solve ordinary and partial differential equations in structural mechanics using numerical methods.
2. 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.
Finite Difference scheme: Implicit & Explicit scheme.

Reference Books:
Program Elective II
MTST905 - 18– Structural Health Monitoring (Credits - 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

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

Syllabus Contents:

Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance.
Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.
Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.
Introduction to Repairs and Rehabilitations of Structures: 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,
Teaching Scheme
Lectures: 3 hrs/week

**Course Outcomes:** At the end of the course, students will be able to
1. Use Variational principle for optimization
2. Apply optimization techniques to structural steel and concrete members.
3. Design using frequency constraint.

**Introduction:** Simultaneous Failure Mode and Design, Classical External Problems.
**Calculus of Variation:** Variational Principles with Constraints,
**Linear Programming,** Integer Programming, Nonlinear Programming, Dynamic Programming,
**Geometric Programming** and **Stochastic Programming.**
**Applications:** Structural Steel and Concrete Members, Trusses and Frames.
**Design:** Frequency Constraint, Design of Layouts.

**Reference Books:**
- Elements of Structural Optimization, Haftka, Raphael T., Gürdal, Zafer, Springer.
- Variational methods for Structural optimization, Cherkaev Andrej, Springer
Core Lab1
MTST111– 18–Structural Design Lab (Credits - 0:0:4 = 2)

Teaching Scheme
Lab: 4hrs/week

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

Syllabus Content:
Design and detailed drawing of complete+ 3 structures by individual student using latest relevant IS codes.
Core Lab2
MTST112– 18– Advanced Concrete Lab (Credits - 0:0:4 = 2)

Teaching Scheme
Lab: 4hrs/week

**Course Outcomes:** At the end of the course, students will be able to
1. Design high grade concrete and study the parameters affecting its performance.
2. Conduct Non-Destructive Tests on existing concrete structures.
3. Apply engineering principles to understand behavior of structural/ elements.

**List of Experiments/Assignments:**
1. Study of stress-strain curve of high strength concrete, Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture.
2. Effect of cyclic loading on steel.
3. Non-Destructive testing of existing concrete members.
4. Behavior of Beams under flexure, Shear and Torsion.

**Reference Books:**
- Concrete Technology, Shetty M. S., S. Chand and Co., 2006.
Research Methodology and IPR

Teaching Scheme
Lectures: 2 hrs/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 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.

References:
- Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students”
- Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
Semester II
Core 3 –
MTST201 - 18 Finite Element Method in Structural Engineering (Credits- 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to
1. Use Finite Element Method for structural analysis.
2. Execute the Finite Element Program/ Software.
3. Solve continuum problems using finite element analysis.

Syllabus Contents:


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

Reference Books:
Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to
1. Analyze and study dynamics response of single degree freedom system using fundamental equation of motion.
2. Analyze and study dynamics response of Multi degree of freedom system using fundamental theory and equation of motion.
3. Use the available software for dynamic analysis.

Syllabus Contents:

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.

Reference Books:
- Structural Dynamics and Introduction to Earthquake Engineering, Chopra A. K.
- Dynamics of Structures, Humar J. L., Prentice Hall.
- Dynamics of Structures, Hart and Wong.
Program Elective III
MTST907 - 18 – Advanced Steel Design (Credits - 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to
1. Design steel structures/ components by different design processes.
2. Analyze and design beams and columns for stability and strength, and drift.
3. 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.
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 - Arya A. S., Ajmani J. L., Nemchand Bros., Roorkee.
Program Elective III
MTST908 - 18 – Design of Formwork (Credits - 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

**Course Outcomes:** At the end of the course, students will be able to
1. Select proper formwork, accessories and material.
2. Design the form work for Beams, Slabs, columns, Walls and Foundations.
3. Design the form work for Special Structures.
4. Understand the working of flying formwork.
5. Judge the formwork failures through case studies.

**Syllabus Content:**
**Introduction:** Requirements and selection of Formwork.
**Formwork Materials**- Timber, Plywood, Steel, Aluminum, 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:**
- IS 14687: 1999, False workfor Concrete Structures - Guidelines, BIS.
Program Elective III
MTST909 - 18 – Design of High Rise Structures (Credits - 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to
1. Analyse, design and detail Transmission/ TV tower, Mast and Trestles with different loading conditions.
2. Analyse, design and detail the RC and Steel Chimney.
3. 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.
Application of software in analysis and design.

Reference Books:
Program Elective III  
MTST910 - 18 – Design of Masonry Structures (Credits - 3:0:0 = 3) 

Teaching Scheme  
Lectures: 3 hrs/week

Course outcomes: At the end of the course, students will be able to  
1. Understand the masonry design approaches.  
2. Analyse Reinforced Masonry Members.  
3. Determine interactions between members.  
4. Determine shear strength and ductility of Reinforced Masonry members.  
5. Check the stability of walls  
6. 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 In - elastic Analysis, Modeling Techniques, Static Push Over Analysis and use of Capacity Design Spectra.

Reference Books:  
1. Design of Reinforced Masonry Structures, Narendra Taly, ICC, 2nd Edn,  
Program Elective IV
MTST911 - 18– Design of Advanced Concrete Structures (Credits - 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

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

**Syllabus Contents:**

**Design philosophy,** Modeling of Loads, Material Characteristics.
**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:**
- Design of Steel Structures, Subramaniam N., Oxford University Press, 2008.
- Steel Structures Design and Behavior Emphasizing Load and Resistance Factor Design, Salmon
Program Elective IV
MTST912 - 18 – Advanced Design of Foundations (Credits- 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes: At the end of the course, students will be able to
1. Decide the suitability of soil strata for different projects.
2. Design shallow foundations deciding the bearing capacity of soil.
3. Analyze and design the pile foundation.
4. 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.
Tunnels and Arching in Soils, Pressure Computations around Tunnels.
Open Cuts, Sheeting 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
Program Elective IV
MTST913 - 18 – Soil Structure Interaction (Credits- 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

**Course Outcomes:** At the end of the course, students will be able to
1. Understand soil structure interaction concept and complexities involved.
2. Evaluate soil structure interaction for different types of structure under various conditions of loading and subsoil characteristics.
3. Prepare comprehensive design oriented computer programs for interaction problems based on theory of sub grade reaction such as beams, footings, rafts etc.
4. Analyze different types of frame structure founded on stratified natural deposits with linear and non-linear stress-strain characteristics.
5. Evaluate action of group of piles considering stress-strain characteristics of real soils.

**Syllabus Contents:**
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:**
- Soil Structure Interaction - The real behaviour of structures, Institution of Structural Engineers.
Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes: At the end of the course, the student will be able to:
1. Design Steel Gantry Girders.
2. Design Steel Portal, Gable Frames.
3. Design Steel Bunkers and Silos.
4. 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
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.


Reference Books:
- Design of Steel Structures, Subramaniyam.

Core Lab 3 –
MTST113 – 18 - Model Testing Lab(Credits- 0:0:4 = 2)
Teaching Scheme
Lectures: 4hrs/week,
Course Outcomes: At the end of the course, students will be able to
1. Understand the response of structures.
2. Prepare the models.
3. Conduct model testing for static loading
4. 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 frames models.
- Beam vibrations, Vibration isolation, Shear wall building model, Time and frequency-domain study, Vibration Characteristics of RC Beams using Piezoelectric Sensors etc.

Core Lab 4
MTST114 – 18 – Numerical Analysis Lab (Credits- 0:0:4 = 2)

Teaching Scheme
Lectures: 4hrs/week

Course Outcomes: At the end of the course, students will be able to
1. Find Roots of non-linear equations by Bisection method and Newton’s method.
2. Do curve fitting by least square approximations
3. Solve the system of Linear Equations using Gauss - Elimination/ Gauss - Seidal Iteration/ Gauss - Jorden Method
4. To Integrate Numerically Using Trapezoidal and Simpson’s Rules

**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 - Jorden Method.
- Integrate numerically using Trapezoidal Rule.
- Integrate numerically using Simpson’s Rules.
- Numerical Solution of Ordinary Differential Equations By Euler’s Method.

**Core**

MTST231 – 18 Mini Project (Credits- 0:0:4 = 2)

Teaching Scheme

Lectures: 4hrs/week

**Course Outcomes:** At the end of the course, the student will be able to:
1. Identify structural engineering problems reviewing available literature.
2. Study different techniques used to analyze complex structural systems.
3. 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.

**Program Elective V**

MTST915 – 18 - Design of Prestressed Concrete Structures (Credits- 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week
**Course outcomes:** At the end of the course, students will be able to
1. Find out losses in the prestressed concrete. Understand the basic aspects of prestressed concrete fundamentals, including pre and post-tensioning processes.
2. Analyses prestressed concrete deck slab and beam/ girders.
3. Design prestressed concrete deck slab and beam/ girders.
4. 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 concordance.
**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:**
- Prestressed Concrete, Krishnaraju N., Tata McGraw Hill, New Delhi, 1981.
- IS: 1343 - Code of Practice for Prestressed Concrete
- IRC: 112

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**Program Elective V**

**MTST916 – 18 - Analysis of Laminated Composite Plates** *(Credits: 3:0:0 = 3)*

Teaching Scheme
Lectures: 3 hrs/week
Course outcomes: At the end of the course, students will be able to
1. Analyse the rectangular composite plates using the analytical methods.
2. Analyse the composite plates using advanced finite element method.
3. 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.
Finite Element Solutions: Finite Element Solutions for Bending of Rectangular Laminated Plates using CLPT.

References:

Program Elective V
MTST917 – 18 - Fracture Mechanics of Concrete Structures(Credits- 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week
**Course outcomes:** At the end of the course, students will be able to
1. Identify and classify cracking of concrete structures based on fracture mechanics.
2. Implement stress intensity factor for notched members
3. apply fracture mechanics models to high strength concrete and FRC structures.
4. 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:**

**Program Elective V**

MTST918 – 18- Design of Plates and Shells(Credits- 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week.

**Course Outcomes:** At the end of the course, the student will be able to:
1. Analyse and design prismatic folded plate systems.
2. Analyse and design shells using approximate solutions
3. Analyse and Design Cylindrical Shells
4. 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:**
- Design of Reinforced Concrete Shells & Folded Plate, Varghese P. C., 1st Edition, PHI.
- Design of Plate and Shell Structures, Jawad Maan H., Springer Science.

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**Core –**

**MTST – 232 – 18 Dissertation I (Credits- 0:0:20 = 10)**

**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 individuals contribution.
• Continuous assessment of Dissertation – I and Dissertation – II at Mid Sem and End Sem will be evaluated by the departmental committee.

Core –
MTST233 – 18 - Dissertation II (Credits- 0:0:32 = 16)

Teaching Scheme
Contact Hours: 3hrs/week

Course Outcomes: At the end of the course, the student will be able to:
1. Solve complex structural problems by applying appropriate techniques and tools.
2. Exhibit good communication skill to the engineering community and society.
3. 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 pre-submission 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**

**MTST919 – 18 Business Analytics**

Teaching scheme
Lecture: - 3 h/week

**Course objective**
1. Understand the role of business analytics within an organization.
2. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
3. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
4. To become familiar with processes needed to develop, report, and analyze business data.
5. Use decision-making tools/Operations research techniques.
6. Manage business process using analytical and management tools.
7. Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Unit 1:

Unit 2:

Unit 3:
Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predictive Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

Unit 4:

Unit 5:

Unit 6:
Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

COURSE OUTCOMES

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

Reference:
OPEN ELECTIVES
MTST920 – 18 Industrial Safety

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, pressurevessels, 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-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.


Reference:

OPEN ELECTIVES
MTST9241 – 18 Operations Research

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes: At the end of the course, the student should be able to
1. Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
2. Students should be able to apply the concept of non-linear programming  
3. Students should be able to carry out sensitivity analysis  
4. Students should be 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:**

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**Open Elective**

**MTST922 – 18 - Cost Management of Engineering Projects**

**Teaching scheme**
Lecture: - 3 h/week

Project: meaning, Different types, why to manage, cost overruns centers, 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


References:
1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

Open Elective
MTST923 – 18 Composite Materials

Teaching scheme
Lecture: - 3 h/week

Advantages and application of composites. Functional requirements of reinforcement and matrix.
Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.


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

TEXT BOOKS:

References:

Open Elective
MTST924 – 18 Waste to Energy

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-IV: Biomass Combustion: Biomass stoves – Improved challahs, 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:

AUDIT 1 and 2: ENGLISH FOR RESEARCH PAPER WRITING

Course objectives:
Students will be able to:
1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title
Ensure the good quality of paper at very first-time submission

**Unit 1:** Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness (4 Hours)

**Unit 2:** Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction (4 Hours)

**Unit 3:** Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

**Unit 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 Hours)

**Unit 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 Hours)

**Unit 6:** Useful phrases, how to ensure paper is as good as it could possibly be the first-time submission (4 Hours)

**Suggested Studies:**


**AUDIT 1 and 2: DISASTER MANAGEMENT**

**Course Objectives:** - Students will be able to:

1. learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in
specific types of disasters and conflict situations.
4. 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

Introduction
Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.
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
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.
Risk Assessment
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.

SUGGESTED READINGS:
2. Sahni, Pardeep Et.Al. (Eds.),” Disaster Mitigation Experiences and Reflections”, Prentice Hall of India, New Delhi.

AUDIT 1 and 2: SANSKRIT FOR TECHNICAL KNOWLEDGE

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

Content

Unit 1
- Alphabets in Sanskrit,
- Past/Present/Future Tense,
- Simple Sentences

Unit 2
- Order
- Introduction of roots
- Technical information about Sanskrit Literature

Unit 3
- Technical concepts of Engineering-Electrical, Mechanical,
- Architecture, Mathematics

Suggested reading
1. “Abhyaspustakam” – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication

Course Output
Students will be able to
1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. 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
2. Imbibe good values in students
3. Let the students know about the importance of character

Syllabus
Unit 1 (4 Hours)
• 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

Unit 2 (6 Hours)
• 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

Unit 3 (6 Hours)
• 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

Unit 4 (6 Hours)
• 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

Suggested Reading

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:
1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. 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.
3. 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.

Unit 1 (4 Hours)
- **History of Making of the Indian Constitution:**
  History, Drafting Committee, (Composition & Working)

Unit 2 (4 Hours)
- **Philosophy of the Indian Constitution:**
  Preamble
  Salient Features

Unit 3 (4 Hours)
- **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.

Unit 4 (4 Hours) **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

Unit 5 (4 Hours)
- **Local Administration:**
  - District’s Administration head: Role and Importance,
  - Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.
  - 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

Unit 6 (4 Hours)

• 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.

Suggested reading
1. The Constitution of India, 1950 (Bare Act), Government Publication.

Course Outcomes:
Students will be able to:
1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. 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.

AUDIT 1 and 2: PEDAGOGY STUDIES

Course Objectives:
Students will be able to:
1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

Unit 1 (4 Hours)

• 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.

Unit 2 (4 Hours)

• Thematic overview: Pedagogical practices are being used by teachers in formal
• and informal classrooms in developing countries.
• Curriculum, Teacher education.

Unit 3 (4 Hours)
• Evidence on the effectiveness of pedagogical practices
• Methodology for the in depth stage: quality assessment of included studies.
• 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.

Unit 4 (4 Hours)
• 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

Unit 5 (4 Hours)
• Research gaps and future directions
• Research design
• Contexts
• Pedagogy
• Teacher education
• Curriculum and assessment
• Dissemination and research impact.

Suggested reading
Course Outcomes:
Students will be able to understand:
1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. 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
1. To achieve overall health of body and mind
2. To overcome stress

Syllabus

Unit 1 (8 Hours)
- Definitions of Eight parts of yog. (Ashtanga)

Unit 2 (8 Hours)
- Yam and Niyam.
- Do’s and Don’t’s in life.
- i) Ahinsa, satya, astheya, bramhacharya and aparigraha
- ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit 3 (8 Hours)
- Asan and Pranayam
  i) Various yog poses and their benefits for mind & body
ii) Regularization of breathing techniques and its effects-Types of pranayam

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

Course Outcomes:
Students will be able to:
1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency.

AUDIT 1 and 2: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENTSKILLS

Course Objectives
1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

Syllabus

Unit 1 (8 Hours)
- 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)

Unit 2 (8 Hours)
- 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.

Unit 3 (8 Hours)

• Statements of basic knowledge.
• Shrimad Bhagwad Geeta: Chapter 2-Verses 56, 62, 68
• Chapter 12-Verses 13, 14, 15, 16,17, 18
• Personality of Role model. Shrimad BhagwadGeeta:
• Chapter 2-Verses 17, Chapter 3-Verses 36,37,42,
• Chapter 4-Verses 18, 38,39
• Chapter 18 – Verses 37,38,63

Suggested reading
1. “Srimad Bhagavad Gita” by Swami Swarup AnandaAdvaita Ashram (Publication Department), Kolkata
2. Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes
Students will be able to
1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students.