

**SCHEME OF INSTRUCTION & EXAMINATION  
B.E. VIII - SEMESTER  
(CIVIL ENGINEERING)**

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
<b>Theory Courses</b>										
1	PC 801 CE	Construction Management & Technology	3	-	-	3	30	70	3	3
2		Professional Elective – III	3	-	-	3	30	70	3	3
3		Professional Elective – IV	3	-	-	3	30	70	3	3
4		Professional Elective – V	3	-	-	3	30	70	3	3
5	MC 901 EG	Gender Sensitization	3	-	-	3	30	70	3	-
<b>Practical/ Laboratory Courses</b>										
6	PW 961 CE	Project Work – II	-	-	16	16	50	100	-	8
7		Mandatory Course	-	-	3	3	50	-	3	-
			<b>15</b>	<b>-</b>	<b>19</b>	<b>34</b>	<b>250</b>	<b>450</b>		<b>20</b>

Professional Elective – III			Professional Elective – IV		
S. No.	Course Code	Course Title	S. No.	Course Code	Course Title
1	PE 821 CE	Retrofitting and Rehabilitation of Structures	1	PE 831 CE	Structural Dynamics
2	PE 822 CE	Computer Aided Analysis and Design	2	PE 832 CE	Design with Geosynthetics
3	PE 823 CE	Applied Hydrology	3	PE 833 CE	Groundwater Management
4	PE 824 CE	Introduction to Climate Change	4	PE 834 CE	Intelligent Transportation Systems
Professional Elective – V			Mandatory Course		
1	PE 841 CE	Prefabrication Engineering	1	MC 951 SP	Yoga Practice
2	PE 842 CE	Principles of Green Building Practices	2	MC 952 SP	NSS
3	PE 843 CE	Advanced Reinforced Concrete Design	3	MC 953 SP	Sports
4	PE 844 CE	Traffic Engineering & Infrastructure Design			

PC: Professional Course

PE: Professional Elective

L: Lectures

T: Tutorials

P: Practical

D: Drawing

CIE: Continuous Internal Evaluation

SEE: Semester End Examination (Univ. Exam)

**Note:** 1) Each contact hour is a Clock Hour

2) The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete the experiment

Course Code	Course Title				Core / Elective		
<b>PC 801 CE</b>	<b>Construction Management &amp; Technology</b>				<b>Core</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
<b>Engineering Mathematics &amp; Estimation and Costing</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>30</b>	<b>70</b>	<b>3</b>
<b>Course Objectives</b> <ul style="list-style-type: none"> <li>➤ Describe different techniques of construction management projects.</li> <li>➤ Illustrate economics of construction management projects.</li> <li>➤ Study the Safety Engineering practices of construction management projects.</li> </ul> <b>Course Outcomes</b> After completing this course, the student will be able to <ol style="list-style-type: none"> <li>1. Understand and apply various techniques involved in planning and construction stages.</li> <li>2. Analyse and optimize the materials used in construction.</li> <li>3. Assess and prevent the conflicts and accidents that may occur during various stages of construction.</li> </ol>							

**UNIT – I**

**Introduction:** Objectives of planning, construction stages, Sequence of events in general Civil Engineering construction projects, Construction Schedule. Development of management techniques, Bar charts, Gantt charts, CPM and PERT techniques, Network analysis examples.

**UNIT - II**

**Introduction to Cost Analysis:** Cost reduction in construction management. Cost time analysis, Crashing the Network, Optimization, Resource Levelling and smoothing.

**UNIT – III**

**Development of Operations Research (OR):** Quantitative Analysis and Decision Making, need for linear programming, standard form of Linear programming, Graphical Method, Case studies.

**UNIT – IV**

**An algebraic overview of Simplex Method:** solving minimization and maximization problems, case studies.

**UNIT – V**

**Safety Engineering:** Safety program, Direct and Indirect loss due to accident, Classification of Construction accidents and causes, Location hazards and their elimination, Safety in demolition of buildings, Safety in storage and handling of materials and equipments.

**Suggested Readings:**

1. Robert L. Peurifoy and William B. Ledbetter, *Construction Planning, Equipment, and Methods*, McGraw-Hill International Editions, New Delhi, 1985
2. Frank Harris and Ronald McCaffer, *Modern Construction Management*. Wiley-Blackwell, 2001.
3. Mahesh Varma, *Construction Equipment and Its Planning and Application*, Metropolitan Book Company Pvt Ltd., New Delhi, 1994.
4. H.N. Ahuja, *Construction Performance Control by Networks*, John Wiley & Sons, New York, 1976.

Course Code	Course Title				Core / Elective		
<b>PE 821 CE</b>	<b>Retrofitting and Rehabilitation of Structures</b>				<b>Elective</b>		
Prerequisites	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
<b>Concrete Technology</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>30</b>	<b>70</b>	<b>3</b>
<b>Course Objectives</b> <ul style="list-style-type: none"> <li>➤ Understand the basic concepts of building maintenance.</li> <li>➤ Understand the causes, mechanisms and prevention of deterioration of structures.</li> <li>➤ Understand the methods of condition assessment of structures.</li> <li>➤ Learning the materials, methodology and techniques of repair.</li> <li>➤ Learning the methods and strategies of retrofitting of structures.</li> </ul> <b>Course Outcomes</b> After completing this course, the student will be able to <ol style="list-style-type: none"> <li>1. Distinguish between various definitions related to building repair and maintenance.</li> <li>2. Differentiate the types of defects, damage and explain the various deterioration mechanisms in structures.</li> <li>3. Classify and explain the various non-destructive tests and condition assessment procedures.</li> <li>4. Describe various repair materials and techniques.</li> <li>5. Explain the various retrofitting and rehabilitation procedures.</li> </ol>							

**UNIT – I**

**Introduction to Building Maintenance:** Definitions of repair, renovation, remodelling, restoration, retrofitting and rehabilitation. Need for maintenance, types of maintenance, routine maintenance works in buildings.

**Types of Defects and Damages in Structures:** During pre-construction stage, construction stage and post construction stage. Cracks – Types, Causes and Characteristics

**UNIT – II**

**Mechanisms of Deterioration of Structures & Their Prevention:** Concrete Structures: Defects in fresh concrete - Early frost damage, plastic shrinkage, plastic settlement (subsidence), subgrade settlement, formwork movements. Deterioration in hardened concrete: (a) Physical causes - aggregate shrinkage, drying shrinkage, crazing (b) Chemical causes: acid attack, sulphate attack, chloride attack, carbonation, alkali aggregate reaction, corrosion of reinforcement, (c) Thermal causes: Freeze-thaw, temperature variations, differential thermal expansions, humidity influences, (d) Structural causes: improper design loads, accidental overloads, creep

**Steel Structures:** Causes and types of deterioration, mechanism of corrosion, prevention of deterioration, influence of design details, design and fabrication errors, stresses due to erection.

**UNIT – III**

**Condition Assessment and Non-destructive Testing & Evaluation:** Definition, objectives and stages of condition assessment, Destructive and partially destructive tests. Non-destructive tests (NDTs). Classification of NDT procedures, Visual Inspection, Ultrasonic Testing methods (Impact echo, Pulse velocity, Pulse echo), Rebound hammer (IS 13311), Windsor probe test, Half-cell potential measurement, Electrical resistivity measurement, Carbonation depth measurements, Petrographic Analysis, Electromagnetic methods for Rebar detection, Ground Penetrating radar, Infrared thermography, Radiography, Radio isotope gauges, Remote viewing, Hammer sounding, Chain drag techniques.

**UNIT – IV**

**Repair Materials and Techniques:** Repair Methodology, Repair materials (cement-based, polymer-based, resin based, microcrete, composites, etc.), compatibility considerations, Repair techniques: Using mortars, dry pack, epoxy bonded pack, pre-placed aggregate concrete, gunite, shotcrete, grouting, polymer impregnation, resin injection, routing & sealing, stitching, surface patching, overlays & surface coatings, autogenous healing, gravity filling, drilling and plugging

**UNIT – V**

**Retrofitting & Rehabilitation Procedures:** Strengthening of Existing Structures – Overview, general procedures, Techniques: section enlargement, composite construction, post-tensioning, stress reduction, strengthening by reinforcement, methods of strengthening in beams, slabs, columns (plate bonding, RC jacketing, FRP methods, concrete overlays, etc.) strengthening of substructure (shoring, underpinning)

**Suggested Readings:**

1. Varghese P. C. (2015), *Maintenance, Repair & Rehabilitation & Minor Works of Buildings*, PHI Learning Pvt. Ltd, Delhi.
2. Modi P.I. and Patel C.N. (2016), *Repair and Rehabilitation of Concrete Structures*, PHI Learning Pvt. Ltd, Delhi.
3. Peter H. Emmons, (2001), *Concrete Repair and Maintenance Illustrated*, Galgotia Publications, New Delhi.
4. Johnson.S.M., (1980), *Deterioration, Maintenance and Repair of Structures*, Krieger Publishing, Melbourne, Florida.
5. Guha. P.K., (1998), *Maintenance and Repairs of Buildings*, New Central Book Agency Ltd., Kolkata.
6. SP: 25-1984, (1999), *Handbook on Causes and Prevention of Cracks in Buildings*, BIS, New Delhi.
7. Guide Book on *Non-destructive Testing of Concrete Structures*, Training course series No. 17, International Atomic Energy Agency, Vienna, 2002.
8. Hand book on *"Repair and Rehabilitation of RCC Buildings"*, Published by Director General, CPWD, Govt. of India, 2002.



Course Code	Course Title				Core / Elective		
<b>PE 822 CE</b>	<b>Computer Aided Analysis and Design</b>				<b>Elective</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

**Course Objectives**

- To learn the software skills for structural design.
- To understand the computing techniques in the field of structural design.
- To study the different software packages for analysis and design.

**Course Outcomes**

After completing this course, the student will be able to

1. Describe the importance of CAD and different software.
2. Analyse and design structural components.
3. Analyse and design multi-storied structure.
4. Analyse and design industrial structural components.
5. Analyse and design multi-storied industrial structure.

**UNIT – I**

**Introduction:** Introduction to computer aided analysis and design using different software packages.

**UNIT – II**

**Structural Components:** Analysis and design of reinforced concrete slabs, beams, columns and footings using different software packages.

**UNIT – III**

**Multi-storied Structure:** Analysis and design of multi-storied reinforced concrete building using different software packages.

**UNIT – IV**

**Industrial Structural Components:** Analysis and design of industrial roof steel trusses, beams, columns, column bases, plate girders, gantry girders and connections using different software packages.

**UNIT – V**

**Multi-storied Industrial Structure:** Analysis and design of multi-storied industrial steel structure using different software packages.

**Suggested Readings:**

1. C. S. Krishnamoorthy and S. Rajeev, *Computer Aided Design and Analytical Tools*, Narosa, 1993.
2. N. Bicanic, Harald Mang, *Computer Aided Analysis and Design of Concrete Structures*, 1990.
3. F. Damjanic, *Computer-aided analysis and design of concrete structures*, Pineridge Press, 1984.
4. S. R. Karve, V. L. Shah, *Illustrated Design of Reinforced Concrete Buildings*, Structures Publications.
5. Srinivasa Prakash Regalla, *Computer Aided Analysis and Design*, 2010.

Course Code	Course Title				Core / Elective		
<b>PE 823 CE</b>	<b>Applied Hydrology</b>				<b>Elective</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

**Course Objectives**

To make the student familiar with the concepts of

- Flood characteristics and flood forecasting systems.
- Various methods of flood routing and hydrologic routing.
- Flood mitigation and estimating its benefits, land management and flood plain management.
- Flood plain adjustments and regulations.
- Hydrologic time series analysis.

**Course Outcomes**

After completing this course, the student will be able to

1. Describe flood characteristics and forecasting flood with provided data (if available).
2. Compute and predict the future floods through mathematics of flood routing and can review as well as interpret scientific information.
3. Enable themselves to make/decide necessary flood plain adjustments and regulations theoretically.
4. Analyse hydrologic time series data.

**UNIT – I**

**Flood Characteristics and Forecasting:** Measureable features of a flood (Elevation, discharge, volume, and duration), flood forecasting (unit hydrograph method, meteorological and snow data, and snow field air temperatures), operation of flood forecasting systems.

**Space-Time Characteristics of Rainfall:** Policy criteria for design flood of a major and minor reservoir, spillways, diversion dams and barrages, design flood criteria for dams and other hydraulic structures (CWC recommendations).

**UNIT – II**

**Flood Routing:** Mathematics of flood routing, various methods of flood routing, Hydrologic and Hydraulic routing.

**UNIT – III**

**Flood Mitigation:** Flood mitigation reservoirs (purpose, location, size and operation) levees and flood walls (location, maintenance and flood fighting), flood ways, channel improvement, evacuation and flood proofing, land management, flood plain management, estimating benefits of flood mitigation.

**UNIT – IV**

**Flood Plain Adjustments and Regulations:** Results of controlling floods, alternatives to controlling floods, range of possible adjustments, practical range of choice, critical characteristics of flood hazards, classification of flood plain land, and regulation of flood plain use, river training works (guide banks, approach and afflux embankments, spurs / groynes, artificial cut-offs, bank protection, pitched banks, and miscellaneous methods).

**UNIT – V**

**Hydrologic Time Series Analysis:** Independent and Auto-correlated data, structure of hydrologic time series, trend, jump, seasonality, stationarity, Auto-covariance and Auto-correlation Function, Correlogram Analysis, spectral Analysis, Analysis of Multi-Variant Hydrologic series.

***Suggested Readings:***

1. Ven Te Chow (1964), *Hand Book of Applied Hydrology*, McGraw-Hill Publishers, New York.
2. Linsley, R. K. and Franzini A. W. (1992), *Water Resource Engineering*, McGraw-Hill Publishers, New York.
3. Varshney, R. S. (1979), *Engineering Hydrology*, Nem Chand Publishers, Roorkee.
4. Jaya Rami Reddy, P. (1987), *A. Text Book of Hydrology*, Lakshmi Publishers, New Delhi.
5. Daniel H. Hoggan (1989), *Computer Assisted Flood Plain Hydrology and Hydraulics*, McGraw-Hill Publishers, New York.

Course Code	Course Title				Core / Elective		
<b>PE 824 CE</b>	<b>Introduction to Climate Change</b>				<b>Elective</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
<b>Environmental Science</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>30</b>	<b>70</b>	<b>3</b>

**Course Objectives**

- To understand basic concepts of General Circulation Models and their importance.
- To know the features of Indian Summer Monsoon Rainfall (ISMR) and their characteristics.
- To understand the downscaling principles of statistical downscaling and dynamical downscaling.

**Course Outcomes**

After completing this course, the student will be able to

1. Define the impacts of climate change on natural environment.
2. Explain the fundamentals of global water balance.
3. Explain about climate changes and its impact on climate especially hydrology.
4. Brief introduction of climate modelling especially using statistical downscaling techniques.
5. Bias correction methods in climate science.

**UNIT – I**

**Climate System:** Weather and Climate- Overview of earth-atmosphere- vertical structure of atmosphere- Heat Balance of Earth Atmosphere- Radiation and temperature- Temperature variation- Laws of Radiation- Radiation Balance- variation with latitude

**UNIT – II**

**Introduction of Global water balance:** cycling of water on land- role of water cycle-simple water balance- climate variables affecting precipitation- Precipitation and Weather, Humidity, Vapour Pressure- atmospheric stability-causes of instability-classification of clouds-precipitation process

**UNIT – III**

**Monsoon:** Global wind circulation- clouds- Types of Clouds-Indian summer monsoon Rainfall (ISMR)- characteristics- Inter-annual variability- Floods- droughts- drought Indicators- climate extremes.

**UNIT – IV**

**Causes of Climate Change:** Impacts of climate change on Hydrology-Modelling of climate change-IPCC scenarios- IPCC Assessment Report (AR5)-physical science basis- Coupled Model Inter-comparison Project (CMIP)- CMIP5 data downloading procedure- Reanalysis data products.

**UNIT – V**

**General Circulation Models:** Bias correction methods -Downscaling – Types of downscaling- Dynamical downscaling- Regional Climate Models - concepts of statistical downscaling- data reduction techniques - principal component analysis-application of Regression methods.

**Suggested Readings:**

1. Bonon G B (2008) - *Ecological Climatology*- Cambridge University Press Edition- II
2. RL Wilby, SP Charles, E Zoritaa, B Timbal, PW Hetton, LO Mearns (2004) -*Guide lines for use of climate science from Statistical Modeling models*.
3. *Physical science basis of AR 5 report of IPCC (2013)*- working group I contribution to Assessment Report- <https://ipcc.ch/report/ar5/wg1/>

4. Rasmus E Benestad, Inger Hanson Baver, Delinag Chen (2008) *Empirical Downscaling World*, Scientific Publishing Co. Ltd.
5. Vente Chow (1964)- *Hand Book of Applied Hydrology*- - Mc Graw Hill Co.

Course Code	Course Title					Core / Elective	
<b>PE 831 CE</b>	<b>Structural Dynamics</b>					<b>Elective</b>	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
<b>Engineering Mechanics, Solid Mechanics &amp; Theory of Structures</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>30</b>	<b>70</b>	<b>3</b>

**Course Objectives**

- Study the various types as well as characteristics of loading and formulate the equations of motion.
- Learn the response of un-damped and damped SDOF and MDOF systems under various loadings.
- Employ the approximate and iterative methods to model continuous vibratory systems.
- Understand the dynamic response by numerical methods.

**Course Outcomes**

After completing this course, the student will be able to

1. Know the objectives of dynamic analysis and formulate equation of motion.
2. Study the response of free vibration of Single degree of Freedom (SDOF).
3. Study the response of free vibration of multiple degree of Freedom (MDOF).
4. Interpret the dynamic analysis results for design, analysis and research purposes.
5. Apply the structural dynamics theory to earthquake analysis and response of the structure.

**UNIT – I**

**Objectives of Dynamic Analysis:** Types of prescribed dynamic loading – Characteristics of a dynamic problem – Methods of discretization: Lumped mass Procedure / Consistent mass procedure/generalized displacements – Single Degree Freedom Systems – Formulation of Equation of Motion: D'Alembert's Principle – Influence of Gravity Forces and Ground Motion on equation of motion

**UNIT – II**

**Response of Un-Damped/Damped Free Vibrations of SDOF Systems:** Un-damped/Damped vibrations of SDOF systems subjected to Harmonic loading: Dynamic equilibrium / Accelerometers / Displacement Meters / Resonant Response / Vibration Isolation – Un-damped / Damped vibrations of SDOF systems subjected Periodic loading

**UNIT – III**

**Multi Degree Freedom Systems:** Formulation of Equations of Motion / Evaluation of Lumped Mass Matrix and consistent mass matrix/ Evaluation of Stiffness Matrix.

**Un-damped Free Vibrations:** Analysis of Frequency matrix and mode shape matrices using determinant equation/Flexibility Formulation

**UNIT – IV**

**Normalizing Mode shapes/Analysis** of Dynamic Response/Normal Coordinates/ Uncoupled Equations of Motion for un-damped systems.

**Practical Vibration Analysis:** Stodola Method - Fundamental mode only, Reduction of degrees of freedom, basic concepts in matrix iteration.

**UNIT – V**

**Distributed Parameter Systems:** Partial Differential Equation of Motion – Beam Flexure (Elementary case) – Undamped free vibrations (Elementary case) – Analysis of dynamic response – normal coordinates.

***Suggested Readings:***

1. Walter C. Hurty & Moshe F. Rubinstein, (1964). *Dynamics of Structures*, Prentice Hall India.
2. Clough, Ray. W, and Penzien, Joseph (1982). *Dynamics of Structures*, McGraw Hill Company Limited, New Delhi.
3. Mario Paz, (1987). *Structural Dynamics*, CBS Publishers.
4. Chopra, A. K, (1996). *Dynamics of Structures*, Prentice Hall India.

Course Code	Course Title				Core / Elective		
<b>PE 832 CE</b>	<b>Design with Geosynthetics</b>				<b>Elective</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
<b>Theory of Structures-I</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>30</b>	<b>70</b>	<b>3</b>

**Course Objectives**

- To understand the necessity for use of geosynthetics.
- To appreciate different types of geosynthetic products and the functions served by each.
- To understand the applications of geosynthetics in various civil engineering fields.
- To learn the design of geosynthetic applications and concept of design by function.
- To understand the construction practices.

**Course Outcomes**

After completing this course, the student will be able to

1. Understand the basic concept, manufacturing process and design process of geosynthetic.
2. Comprehend different properties and test methods of geotextile.
3. Describe the different properties and test methods of geogrid and geonet.
4. Explain the different properties, test methods and design process of geomembranes.
5. Design geo-composites for basic functions like separation, reinforcement and so on.

**UNIT – I**

**An Overview of Geosynthetics:** Introduction – Classification & basic description of Geosynthetics – manufacturing process – Over view of Geotextiles, Geogrids, Geonets, Geomembranes and Geocomposites.

**Design Methods:** Design by cost & availability – Design by specification – Design by function.

**UNIT – II**

**Geotextile Properties and Test Methods:** Physical, Mechanical, Hydraulic, Endurance and Degradation properties.

**Designing with Geotextiles:** Geotextile functions and mechanisms – Designing for separation – Designing for reinforcement – Designing for stabilization – Designing for filtration – Designing for drainage – designing for multi functions.

**UNIT – III**

**Geogrid Properties and Test methods:** Physical, Mechanical, Endurance and Environmental properties.

**Designing with Geogrids:** Designing for geogrid reinforcement

**Geonets Properties and Test methods:** Physical, Mechanical, Hydraulic, Endurance and Environmental properties.

**Designing with Geonets:** Designing for geonet drainage

**UNIT – IV**

**Geomembrane Properties and Test methods:** Physical, Mechanical, chemical, biological, thermal and Identification properties.

**Designing with Geomembranes:** Liquid containment liners – Covers for reservoirs – Canal liners – Landfill liners – Caps & closures – Underground storage tanks etc.

**UNIT – V**

**Designing with Geocomposites:** Geocomposites for separation – reinforcement – filtration – drainage – liquid/ vapour barriers, Construction Methods & Techniques Using Geosynthetics.



***Suggested Readings:***

1. Robert, M. K. (1990). *Designing with Geosynthetics*. Prentice Hall, Englewood Cliffs, New Jersey.
2. Venkatappa Rao, G and G.V.S.S. Raju (1990). *Engineering with Geosynthetics*. McGraw Hill Publishing Company Ltd, New Delhi.
3. Hang, Tsang, and Fai. *Foundation Engineering Hand Book*. CBS Publications, New Delhi.
4. Purushotham Raj. *Ground Improvement Techniques*. Laxmi Publications, New Delhi.

Course Code	Course Title				Core / Elective		
<b>PE 833 CE</b>	<b>Groundwater Management</b>				<b>Elective</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
<b>Water Resources Engineering-I</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>30</b>	<b>70</b>	<b>3</b>
<p><b>Course Objectives</b>            To make the student familiar with the concepts of</p> <ul style="list-style-type: none"> <li>➤ The importance of hydrologic cycle in improving groundwater.</li> <li>➤ The characteristics of groundwater flow, storage parameters and geophysical methods in groundwater exploration.</li> <li>➤ The socio-economic aspects of groundwater hydrology.</li> <li>➤ Developing numerical solutions for groundwater flow models.</li> </ul> <p><b>Course Outcomes</b>            After completing this course, the student will be able to</p> <ol style="list-style-type: none"> <li>1. Describe the socio-economic aspects of groundwater hydrology.</li> <li>2. Perform geophysical methods for groundwater exploration.</li> <li>3. Compute flow from a groundwater aquifer.</li> <li>4. Identify groundwater contamination sources.</li> <li>5. Analyse various models in ground water.</li> </ol>							

**UNIT – I**

**Introduction:** Ground water in hydrologic cycle, Distribution of subsurface water, ground water potential in India and A.P, occurrence of Ground water in hydrogeologic formations, components of groundwater studies, Darcy's law and its validity. Geophysical methods in groundwater Exploration: surface geophysical methods; Electrical resistivity method, seismic method, magnetic method, determination of aquifer thickness.

**UNIT – II**

**Governing Equations of Groundwater Flow in Aquifers:** 3-D Ground water flow equations in Cartesian and polar coordinates. Equations for steady radial flow into a well in case of confined and unconfined aquifers, Equations for effect of uniform recharge in a fully penetrating unconfined aquifer, well flow near aquifer boundaries. Equations for unsteady radial flow into a well in case of confined aquifer, determination of S and T by Thei's graphical method, Cooper- Jacob's and Chow's method.

**UNIT – III**

**Sources and Types of Groundwater Contamination:** Introduction underground storage tanks, landfills, surface impoundments, waste disposal of injection wells, radioactive contaminants, classification of organic compounds, inorganic compounds in ground water. Mechanism of salt water intrusion, Ghyben-Herzberg relation, slope and shape of the interface, prevention and control of seawater intrusion, case studies involving sea water intrusion.

**UNIT – IV**

**Contaminant Transport:** Introduction, advection process, diffusion and dispersion process, mass transport equation governing flow and transport equations, analytical methods, tests for dispersivity.

**Non-Aqueous Phase Liquids (NAPL'S):** Types general processes, transport; fate of NAPL'S in subsurface.

**UNIT – V**

**Models in Groundwater Analysis:** Major applications of ground water models, sand models, viscous fluid models, membrane models, thermal models, Electric-Analog models, numerical modelling of ground water systems.

***Suggested Readings:***

1. Rastogi, A.K. (2007). *Numerical Groundwater Hydrology*. Penram International Publishing (India) Pvt Ltd.
2. Ven-Te-Chow. (1964). *Hand Book of Applied Hydrology*. McGraw Hill Company, New York.
3. Todd, D.K. (1980). *Groundwater Hydrology*. John Wiley and Sons, New York.
4. Karanth, K. R. (1987). *Groundwater Assessment, Development and Management*. Tata McGraw-Hill publishing company New Delhi.
5. Raghunath H.M (1982). *Ground Water*. Wiley Eastern Ltd, New Delhi.

Course Code	Course Title				Core / Elective		
<b>PE 834 CE</b>	<b>Intelligent Transportation Systems</b>				<b>Elective</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
<b>Transportation Engineering</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>30</b>	<b>70</b>	<b>3</b>
<b>Course Objectives</b> <ul style="list-style-type: none"> <li>➤ To introduce the concept of intelligent transportation systems.</li> <li>➤ To understand the functional area of ITS.</li> <li>➤ To study the ITS architecture and its applications.</li> </ul> <b>Course Outcomes</b> <ol style="list-style-type: none"> <li>1. Able to plan and specification requirements using ITS</li> <li>2. Able to plan and management aspects for ITS</li> <li>3. Able to prepare architecture and application for ITS</li> </ol>							

**UNIT – I**

**Fundamentals of Intelligent Transportation System (ITS):** Basics of ITS s, The historical context of ITS from both public policy and market economic perspectives, Types of ITS; Historical Background, Benefits of ITS.

**UNIT – II**

**Data Requirements for ITS:** Importance of telecommunications in the ITS system. Information Management, Traffic management Centres (TMC). Application of sensors to Traffic management; Traffic flow sensor technologies; Transponders and Communication systems; Data fusion at traffic management centres; Sensor plan and specification requirements; Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques - Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, data collection using videos.

**UNIT – III**

**Functional Areas of ITS:** Advanced Traffic Management Systems (ATMS), Advanced Traveller Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation System (APTS), Advanced Rural Transportation Systems (ARTS). ITS User Needs and Services – Travel and Traffic Management, Public Transportation management, Electronic Payment, Commercial Vehicle Operations, Emergency management, Advances Vehicle safety systems, information Management.

**UNIT – IV**

**ITS Architecture:** Regional and Project ITS architecture; Concept of operations; ITS Models and Evaluation Methods; Planning and human factor issues for ITS, Case studies on deployment planning and system design and operation; ITS and Safety, and ITS Security ITS as a technology deployment program, research, development and business models/modules, ITS Planning.

**UNIT – V**

**ITS Applications:** Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road –pricing; Transportation network operations; commercial vehicle operations and intermodal freight; public transportation applications; ITS and regional strategic transportation planning, including regional architectures: ITS and changing transportation institutions Automated Highway Systems- Vehicles in Platoons – Integration of Automated Highway

Systems. ITS Programs in the world – Overviews of ITS implementation in developed countries, IRS in developing countries.

***Suggested Readings:***

1. Joseph, S.S. (2008). "*Perspectives on Intelligent Transportation Systems*", Springer publishers, USA.
2. Chowdhury, M. A., Sadek, A. and Boston, M.A. (2003). "*Fundamentals of Intelligent Transportation Systems Planning*", Artech House, -USA.
3. Kan Paul and Chen Jhon Miles (2007). "*Intelligent Transportation Systems*", Hand Book 2000: Recommendations for World Road Association (PIARC).
4. USDT. (2007), "*National ITS Architecture Documentation*", U.S. Department of Transportation, USA.

Course Code	Course Title					Core / Elective	
<b>PE 841 CE</b>	<b>Prefabrication Engineering</b>					<b>Elective</b>	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
<b>Project Management, Building Materials &amp; Design of Concrete and Steel Structures</b>	3	-	-	-	30	70	3

**Course Objectives**

- To understand prefabrication use in Civil Engineering.
- To understand various elements of prefabrication.
- To understand various prefabrication manufacturing aspects.

**Course Outcomes**

After completing this course, the student will be able to

1. Understand various types of prefabrication methods.
2. Analyse and eliminate erection stresses which are induced in structural elements.
3. Design simple prefabricated elements and joints.
4. Manage and control various steps involved in production of precast elements.
5. Design and detailing of precast unit.

**UNIT – I**

**General Principles of Prefabrication:** Comparison with monolithic construction, types of prefabrication, site and plant prefabrication, economy of prefabrication, modular coordination, standardization.

**UNIT – II**

**Prefabricated Load Carrying Members:** Planning for components of prefabricated structures, disuniting of structures, design of simple rectangular beams and I-beams, handling and erection stresses, elimination of erection stresses, beams, columns, symmetric frames.

**UNIT – III**

**Prefabricated Elements:** Roof and floor panels, ribbed floor panels, wall panels, footings **Joints:** Joints for different structural connections, effective sealing of joints for water proofing, provisions for non-structural fastenings, expansion joints in precast construction.

**UNIT – IV**

**Production Technology:** Choice of production setup, manufacturing methods, stationary and mobile production, planning of production setup, storage of precast elements, dimensional tolerances, acceleration of concrete hardening.

**Hoisting Technology:** Equipment for hoisting and erection, techniques for erection of different types of members like beams, slabs, wall panels and columns, vacuum lifting pads.

**UNIT – V**

**Applications:** Designing and detailing of precast unit for factory structures, purlins, principal rafters, roof trusses, lattice girders, gable frames, single span single storied simple frames, single storied buildings, slabs, beams and columns.

**Suggested Readings:**

1. Mokka L, (1964), *Prefabricated Concrete for Industrial and Public Structures*, Publishing House of the Hungarian Academy of Sciences, Budapest.

2. *Proceedings of the Advanced Course on Design and Construction of Prefabricated Residential Buildings*, (1974), Organized by SERC, Madras.
3. Glover.C.W., (1965), *Structural Precast Concrete*, Asia Publishing House, India.
4. Koncz. I.T., (1968), *Manual of Precast Concrete Construction*, Vol. I, II, III & IV, Berlin.
5. Lewicki. B., (1966), *Building with Large Prefabricates*, Elsevier Publishing Co., London.
6. Structural Design Manual (1978), *Precast Concrete Connection Details*, Society for the Studies in the use of Precast Concrete, Netherland Betor Verlag.
7. Murashev.V, Sigalov. E, and Bailov. V, (1968), *Design of Reinforced Concrete Structures*, Mir Publishers.
8. CBRI, (1990), *Building Materials and Components*, India.
9. Gerostiza. C.Z., Hendrickson. C, and Rehat. D. R, (1989), *Knowledge Based Process Planning for Construction and Manufacturing*, Academic Press, Inc.
10. Warszawski. A, (1990), *Industrialization and Robotics in Building – A Management Approach*, Harper & Row.

Course Code	Course Title				Core / Elective		
<b>PE 842 CE</b>	<b>Principles of Green Building Practices</b>				<b>Elective</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	L			
-	3	-	-	-	30	70	3

**Course Objectives**

- To impart knowledge of the principles and practices of the green buildings.
- To know the importance of sustainable use of natural resources and energy.
- To understand the principles of effective energy and resources management in buildings.
- To bring awareness of the basic criteria in the green building rating systems.
- To understand the methodologies to reduce, recycle and reuse towards sustainability.

**Course Outcomes**

After completing this course, the student will be able to

1. Define sustainability and a green building, along with its features and benefits.
2. Describe the criteria used for site selection and water efficiency methods.
3. Explain the energy efficiency terms and methods used in green building practices.
4. Select materials for sustainable built environment & adopt waste management methods.
5. Describe the methods used to maintain indoor environmental quality.

**UNIT-I**

**Introduction to Green Buildings:** Definition of green buildings, definition of sustainability, typical features of green buildings, benefits of green buildings towards sustainable development. Green building rating systems – GRIHA, IGBC and LEED, overview of the criteria as per these rating systems.

**UNIT- II**

**Site selection and planning:** Criteria for site selection, preservation of landscape, soil erosion control, minimizing urban heat island effect, maximize comfort by proper orientation of building facades, day lighting, ventilation, and so on.

**Water conservation and efficiency:** Rainwater harvesting methods for roof & non-roof, reducing landscape water demand by proper irrigation systems, water efficient plumbing systems, water metering, waste water treatment, recycle and reuse systems.

**UNIT-III**

**Energy Efficiency:** Environmental impact of building constructions, Concepts of embodied energy, operational energy and life cycle energy.

**Methods to reduce operational energy:** Energy efficient building envelopes, Solar Heat Gain Coefficient, U-Values for facade materials, efficient lighting technologies, energy efficient and BEE rated appliances for heating and air-conditioning systems in buildings, zero ozone depleting potential (ODP) materials, wind and solar energy harvesting, energy metering and monitoring, concept of NET ZERO buildings.

**UNIT-IV**

**Building materials:** Methods to reduce embodied energy in building materials: (a) Local building materials. (b) Natural and renewable materials like bamboo, timber, rammed earth, stabilized mud blocks. (c) Materials with recycled content such as blended cements, pozzolana cements, fly ash bricks, vitrified tiles, materials from agro and industrial waste. (d) Reuse of waste and salvaged materials.

**Waste Management:** Handling of construction & demolition waste materials, separation of household waste, handling e-waste, on-site and off-site organic waste management.



**UNIT-V**

**Indoor Environmental Quality:** Day lighting, air ventilation, exhaust systems, low VOC paints, materials & adhesives, building acoustics.

Codes related to green buildings: NBC, ECBC, ASHRAE, UPC etc.

***Suggested Readings:***

1. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
2. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
3. *Alternative building materials and technologies* by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.
4. *Non-Conventional Energy Resource* by G. D. Rai, Khanna Publishers.
5. Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi, 2004.
6. Mike Montoya, *Green Building Fundamentals*, Pearson, USA, 2010.
7. Charles J. Kibert, *Sustainable Construction - Green Building Design and Delivery*, John Wiley & Sons, New York, 2008.
8. Regina Leffers, *Sustainable Construction and Design*, Pearson / Prentice Hall, USA, 2009.

Course Code	Course Title				Core / Elective		
<b>PE 843 CE</b>	<b>Advanced Reinforced Concrete Design</b>				<b>Elective</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
<b>Reinforced Cement Concrete</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>30</b>	<b>70</b>	<b>3</b>
<b>Course Objectives</b> <ul style="list-style-type: none"> <li>➤ Understand the design of curved beams in plan.</li> <li>➤ Understand the analysis and design of portal frames.</li> <li>➤ Learn the analysis and design of an interior panel of substitute frame.</li> <li>➤ Design flat slabs and raft slabs.</li> </ul> <b>Course Outcomes</b> After completing this course, the student will be able to <ol style="list-style-type: none"> <li>1. Design curved and deep beams.</li> <li>2. Design portal frames.</li> <li>3. Design flat slabs and raft foundations.</li> </ol>							

**UNIT – I**

**Beams Curved in Plan:** Introduction, design principles, structural design of beams curved in plan of circular and rectangular types, analysis of bending and torsion moments of circular beams, moments in semi-circular beams supported on three columns.

**Deep Beams:** Introduction, flexural and shear stresses in deep beams, IS codal provisions, design of deep beams, detailing and design of shear walls.

**UNIT-II**

**Portal Frames:** Introduction, definition, IS codal provisions, analysis and design of rectangular portal frames for vertical loading, portal frames with hinges at the base.

**UNIT – III**

**Building Frames:** Substitute frame method of analysis for building frames, analysis and design of frames with single bay two stories and two bays single storied buildings.

**UNIT – IV**

**Flat Slabs:** Introduction, need for flat slab, general notes on flat slabs, advantages and disadvantages of flat slabs components, IS code provisions, design methods, design for flexure and shear, openings in flat slabs.

**UNIT – V**

**Raft Foundations:** Introduction to raft foundation, need for raft foundation-definitions, types, analysis and design of raft foundation for building with column grids up to three by two.

**Suggested Readings:**

1. Krishna Raju N, *Advanced reinforced concrete Design*, CBS publishers, 1986.
2. Shah H. J., *Reinforced Concrete*, Charotar publishers, 2002.
3. Varghese P.C., *Advanced Reinforced Concrete Design*, Prentice Hall of India, 2001.
4. Prakash Rao D.S., *Design Principles and Detailing of Concrete Structures*, Tata McGraw-Hill, 1995.

Course Code	Course Title				Core / Elective		
<b>PE 844 CE</b>	<b>Traffic Engineering &amp; Infrastructure Design</b>				<b>Elective</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

**Course Objectives**

- To provide an overview of concepts involved in geometric design of Highways, horizontal & vertical alignment of roads & pedestrian facilities.
- Identify key design elements for intersections.
- Describe usage of traffic control devices

**Course Outcomes**

Students who successfully complete this course will be able to:

1. Understand the concepts and applications of the elements involved in Highway Infrastructure Design.
2. Design intersections, bus bays, cycle tracks, subways

**UNIT – I**

**Geometric Design of Highways:** Functional classification of Highway system; Design controls - Topography, Driver characteristics, Vehicle characteristics. Traffic, Capacity and Level of Service, Design speed. Objectives of Geometric Design. Road Margins - design specifications; Pavement surface characteristics - Skid Resistance, measurement of skid resistance; Road roughness, measurement of Road roughness; Camber design and standards.

**UNIT – II**

**Horizontal and Vertical Alignment:** Sight Distance - SSD, OSD and ISD. Horizontal curves, Super elevation; computing of super elevation; attainment of super elevation; Extra widening on curves; Transition curves - Objectives and Design. Gradients - Types of Gradients, Design Standards; Summit Curves, Valley curves and Design criteria. Combination of Vertical and Horizontal curves - Grade Compensation. Importance of Sight Distances for Horizontal and Vertical curves.

**UNIT – III**

**Design of Intersections:** Types of Intersections; Design Principles for Intersections; Design At-grade Intersections – Channelization, Objectives; Traffic Islands and Design Standards Rotary Intersection - Concept, Advantages and Disadvantages; Grade separated Interchanges - Types, warrants and Design standards as per IRC.

**UNIT – IV**

**Traffic Signs and Road Markings:** Types of Road Signs; Guidelines for the provision of Road Signs; Caution Signs, Regulatory signs. Information signs - Design standards. Road markings - Objectives of Road markings; Types of Road Marking, Role of Road markings in Road Safety and Traffic Regulation; Specification for Road Marking Highway Appurtenances-Delineators, Traffic Impact Attenuators, Safety Barriers.

**UNIT – V**

**Pedestrian Elements:** Requirements of Pedestrians; Pedestrian facilities on Urban Roads; Cycle Tracks - Guidelines and Design standards; Bus Bays-Types and Guidelines-Design of On street and Off street parking facilities - Guidelines for lay out Design. Design of Subways and foot over bridges.

***Suggested Readings:***

1. *Principles and Practice of Highway Engineering*, L.R. Kadiyali and N.B. Lal, Khanna Publications.
2. *Traffic Engineering and Transportation Planning*, L.R. Kadiyai, Khanna Publications
3. *Highway Engineering*, C.E.G. Justo and S.K. Khanna, Nem Chand and Brother
4. IRC Codes for signs, *Markings and Mixed Traffic Control in Urban Areas*.

Course Code	Course Title				Core / Elective		
<b>MC 901 CE</b>	<b>Gender Sensitization</b>				<b>Mandatory</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	0	0	30	70	3
<p><b>Course Objectives</b></p> <ul style="list-style-type: none"> <li>➤ To develop students' sensibility with regard to issues of gender in contemporary India.</li> <li>➤ To provide a critical perspective on the socialization of men and women.</li> <li>➤ Information about some key biological aspects of genders.</li> <li>➤ Reflect critically on gender violence.</li> <li>➤ Exposure on egalitarian interactions between men and women.</li> </ul> <p><b>Course Outcomes</b></p> <p>After completing this course, the student will be able to</p> <ol style="list-style-type: none"> <li>1. Develop a better understanding of important issues related to gender in contemporary India.</li> <li>2. Sensitize to basic dimensions of the biological, sociological, psychological and legal aspects of gender through discussion of materials derived from research, facts, everyday life, literature and film.</li> <li>3. Get a finer grasp of how gender discrimination works in our society and how to counter it.</li> <li>4. Better equipped to work and live together as equals.</li> <li>5. Develop a sense of appreciation of women in all walks of life.</li> </ol>							

**UNIT – I**

**Understanding Gender:** Why should we study it? Socialization: making women, making men. Introduction, preparing for womanhood, growing up male, first lessons in caste, different masculinities, just relationships, being together as equals, Mary Kom and Onler, Love and acid just do not mix, love letters, mothers and fathers, Further reading: Rosa Parks - the brave heart.

**UNIT – II**

**Gender and Biology:** Missing women, sex selection and its consequences, declining sex ratio, demographic consequence, gender spectrum, beyond the binary, two or many, struggles with discrimination, our bodies, our health.

**UNIT – III**

**Gender and Labour:** Housework, the invisible labour, my mother doesn't work, share the Load, women's work, its politics and economics, fact and fiction, unrecognized and unaccounted work, wages and conditions of work.

**UNIT – IV**

**Issues of Violence:** Sexual harassment - Say No!: Sexual harassment, no eve teasing, coping with everyday harassment, "Chupulu" domestic violence, speaking out, is home a safe place? When women unite, rebuilding lives, new forums for justice, thinking about sexual violence, blaming the victim, I fought for my life, the caste face of violence.

**UNIT – V**

**Gender Studies Knowledge:** Through the lens of gender, point of view, gender and the structure of knowledge. Unacknowledged women artists of Telangana: Whose history? Questions for historians and others: reclaiming a past, writing other histories, missing pages from modern Telangana history.

***Suggested Readings:***

1. A. Suneetha, Uma Bhugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu, *Towards a World of Equals: A Bilingual Text book on Gender*, Telugu Akademi, Hyderabad, 1st Edition, 2015.

Course Code	Course Title				Core / Elective		
<b>PW 961 CE</b>	<b>Project Work – II</b>				<b>Core</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	<b>16</b>	<b>50</b>	<b>100</b>	<b>8</b>
<b>Course Objectives</b>							
<ul style="list-style-type: none"> <li>➤ To enhance practical and professional skills.</li> <li>➤ To familiarize tools and techniques of systematic literature survey and documentation</li> <li>➤ To expose the students to industry practices and team work.</li> <li>➤ To encourage students to work with innovative and entrepreneurial ideas</li> </ul>							
<b>Course Outcomes</b>							
<ol style="list-style-type: none"> <li>1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.</li> <li>2. Evaluate different solutions based on economic and technical feasibility</li> <li>3. Effectively plan a project and confidently perform all aspects of project management</li> <li>4. Demonstrate effective written and oral communication skills</li> </ol>							

The aim of Project work –II is to implement and evaluate the proposal made as part of Project Work - I. Students can also be encouraged to do full time internship as part of project work-II based on the common guidelines for all the departments. The students placed in internships need to write the new proposal in consultation with industry coordinator and project guide within two weeks from the commencement of instruction.

The department will appoint a project coordinator who will coordinate the following:

1. Re-grouping of students - deletion of internship candidates from groups made as part of project Work-I
2. Re-Allotment of internship students to project guides
3. Project monitoring at regular intervals

All re-grouping/re-allotment has to be completed by the 1<sup>st</sup> week of VIII semester so that students get sufficient time for completion of the project.

All projects (internship and departmental) will be monitored at least twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee comprising of faculty members as well as by the supervisor. The first review of projects for 25 marks can be conducted after completion of five weeks. The second review for another 25 marks can be conducted after 12 weeks of instruction.

Common norms will be established for the final documentation of the project report by the respective departments. The students are required to submit draft copies of their project report within one week after completion of instruction.

**Note:** Three periods of contact load will be assigned to each project guide.

Course Code	Course Title				Core / Elective		
<b>MP 951 SP</b>	<b>Yoga Practice</b>				<b>Mandatory</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	20	30	-

**Course Objectives**

- Enhances body flexibility.
- Achieves mental balance.
- Elevates Mind and Body co-ordination.
- Precise time management.
- Improves positive thinking at the expense of negative thinking.

**Course Outcomes**

After completing this course, the student will be able to

1. Students will become more focused towards becoming excellent citizens with more and more discipline in their day-to-day life.
2. An all-round development-physical, mental and spiritual health-takes place.
3. Self-discipline and discipline with respect society enormously increases.
4. University environment becomes more peaceful and harmonious.

**UNIT – I**

**Introduction:** Yoga definition, health definition from WHO, yoga versus health, basis of yoga, yoga is beyond science, Gist of eighteen chapters of Bhagavad-Gita, four types of yoga: Karma, Bhakti, Gnyana and Raja yoga, Internal and External yoga, elements of Ashtanga yoga (Yama, Niyama, Asana, Pranayama, Prathyahara, Dharana, Dhyana and Samadhi), Pancha koshas and their purification through Asana, Pranayama and Dhyana.

**UNIT – II**

**Suryanamaskaras (Sun Salutations):** Definition of sun salutations, seven chakras (Mooladhaar, Swadhishtaan, Manipura, Anahata, Vishuddhi, Agnya and Sahasrar), various manthras (Om Mitraya, Om Ravaye, Om Suryaya, Om Bhanave, Om Marichaye, Om Khagaye, Om Pushne, Om Hiranya Garbhaye, Om Adhityaya, Om Savitre, Om Arkhaya, and Om Bhaskaraya) and their meaning while performing sun salutations, physiology, seven systems of human anatomy, significance of performing sun salutations.

**UNIT – III**

**Asanas (Postures):** Pathanjali's definition of asana, sthiram sukham asanam, 3rd limb of Ashtanga yoga, loosening or warming up exercises, sequence of perform in asanas (standing, sitting, prone, supine and inverted), nomenclature of asanas (animals, trees, rishis and so on), asanas versus chakras, asanas versus systems, asanas versus physical health, activation of Annamaya kosha.

**UNIT – IV**

**Pranayama (Breathing Techniques):** Definition of Pranayama as per Shankaracharya, 4th limb of Ashtanga yoga, various techniques of breathing, Pranayama techniques versus seasons, bandhas and their significance in Pranayama, mudras and their significance in Pranayama, restrictions of applying bandhas with reference to health disorders, Pranayama versus concentration, pranayama is the bridge between mind and body, pranayam versus mental health, activation of Pranamaya kosha through Pranayama.

**UNIT – V**

**Dhyana (Meditation):** Definition of meditation, 7th limb of Ashtanga yoga, types of mind (Conscious and Sub-Conscious), various types of dhyana. Meditation versus spiritual health, Dharana and Dhyana, extention



of Dhyana to Samadhi, Dhyana and mental stress, activation of Manomaya kosha through dhyana, silencing the mind.

***Suggested Readings:***

1. *Light on Yoga* by BKS Iyengar.
2. *Yoga Education for Children, Vol-1* by Swami Satyananda Saraswati.
3. *Light on Pranayama* by BKS Iyengar.
4. *Asana Pranayama Mudra and Bandha* by Swami Satyananda Saraswati.
5. *Hatha Yoga Pradipika* by Swami Mukhtibodhananda.
6. *Yoga education for children, Vol-11* by Swami Niranjanananda Saraswati.
7. *Dynamics of Yoga* by Swami Satyananda Saraswati.

Course Code	Course Title				Core / Elective		
<b>MC 952 SP</b>	<b>National Service Scheme (NSS)</b>				<b>Mandatory</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	20	30	-

**Course Objectives**

- To help in Character Moulding of students for the benefit of society
- To create awareness among students on various career options in different fields
- To remould the students behavior with assertive skills and positive attitudes
- To aid students in developing skills like communication, personality, writing and soft skills
- To educate students towards importance of national integration, participating in electoral process etc. by making them to participate in observing important days.

**Course Outcomes**

After completing this course, the student will be able to

1. Students will become more focused towards becoming excellent citizens with more and more discipline in their day-to-day life.
2. An all-round development-physical, mental and spiritual health-takes place.
3. Self-discipline and discipline with respect society enormously increases.
4. University environment becomes more peaceful and harmonious.

**List of Activities:**

1. Orientation programme about the role of NSS in societal development.
2. Swachh Bharat Program.
3. Guest lectures from eminent personalities on personality development.
4. Plantation of saplings/Haritha Haram Program.
5. Blood Donation / Blood Grouping Camp.
6. Imparting computer education to school children.
7. Creating Awareness among students on the importance of Digital transactions.
8. Stress management techniques.
9. Health Check-up Activities.
10. Observation of Important days like Voters' day, World Water Day and so on.
11. Road Safety Awareness Programs.
12. Energy Conservation Activities
13. Conducting Programs on effective communication skills.
14. Awareness programs on national integration.
15. Orientation on Improving Entrepreneurial Skills.
16. Developing Effective Leadership skills.
17. Job opportunity awareness programs in various defense, public sector undertakings.
18. Skill Development Program.
19. Creating awareness among students on the Importance of Yoga and other physical activities.
20. Creating awareness among students on various government sponsored social welfare schemes for the people.

**Note:** At least Ten Activities should be conducted in the Semester. Each event conducted under Swachh Bharat, Plantation and important days like Voters' day, world water day may be treated as a separate activity.

Course Code	Course Title				Core / Elective		
<b>MC 953 SP</b>	<b>Sports</b>				<b>Mandatory</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	20	30	-

**Course Objectives**

- To develop an understanding of the importance of sport in the pursuit of a healthy and active lifestyle at the College and beyond.
- To develop an appreciation of the concepts of fair play, honest competition and good sportsmanship.
- To develop leadership skills and foster qualities of co-operation, tolerance, consideration, trust and responsibility when faced with group and team problem-solving tasks.
- To develop the capacity to maintain interest in a sport or sports and to persevere in order to achieve success.
- To prepare each student to be able to participate fully in the competitive, recreational and leisure opportunities offered outside the school environment.

**Course Outcomes**

After completing this course, the student will be able to

1. Develop one's character and personal qualities, promote the fair game principles, and form an active life position.
2. Develop and share among members and others education, information, and leadership skills.
3. Encourage members to promote the active participation by all youth in fun and healthy physical activities according to their interests and abilities.

**Requirements:**

- 1) Track Paint (students should bring)
- 2) Shoes
- 3) Volley Ball, Foot Ball and Badminton (Shuttle)
- 4) Ground, Court, indoor stadium and swimming pool

**Evaluation Process:**

Total Marks 50

- 1) 20 marks for internal exam (continuous evaluation)
  - a. 8 marks for viva
  - b. 12 marks for sports & fitness
- 2) 30 marks for end exam
  - a. 10 marks for viva
  - b. 20 marks for sports & fitness