FACULTY OF ENGINEERING

Scheme of Instruction & Examination

(CBCS Curriculum for the Academic Year 2019-2020)

and

Syllabi

B.E. VII and VIII Semester

of

Four Year Degree Programme

In

Civil Engineering

(With effect from the academic year 2019– 2020)
(As approved in the faculty meeting held on 25-06-2019)

Issued by
Dean, Faculty of Engineering
Osmania University, Hyderabad – 500 007
2019

SCHEME OF INSTRUCTION & EXAMINATION
B.E. VII - Semester
(CIVIL ENGINEERING)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	Credits
Theory Courses										
1	**PC 701 CE**	Str. Engg. Design and Drawing – II (Steel)	3	1	-	4	30	70	3	3
2	**PC 702 CE**	Estimation Costing & Specifications	3	1	-	4	30	70	3	3
3	**PC 703 CE**	Finite Element Techniques	3	-	-	3	30	70	3	3
4	**PC 704 CE**	Prestressed Concrete	3	-	-	3	30	70	3	3
5	**PC 705 CE**	Foundation Engineering	3	-	-	3	30	70	3	3
6		Open Elective – II	3	-	-	3	30	70	3	3
7		Open Elective – III	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
8	**PC 751 CE**	Computer Application Lab	-	-	2	2	25	50	3	1
9	**PW 761 CE**	Project Work – I	-	-	4	4	50	-	-	2
10	**SI 762 CE**	Summer Internship	-	-	-	-	50	-	-	2
			21	**02**	**06**	**29**	**335**	**540**		**26**

Open Elective – II			Open Elective – III		
S. No.	Course Code	Course Title	S. No.	Course Code	Course Title
1	**OE 771 CE****	Green Building Technologies	1	**OE 781 CE****	Road Safety Engineering
2	**OE 772 CS**	Data Science Using R Programming	2	**OE 782 IT**	Software Engineering
3	**OE 773 EC**	Fundamentals of IoT	3	**OE 783 EC**	Principles of Electronic Communications
4	**OE 774 EE**	Non-Conventional Energy Sources	4	**OE 784 EE**	Illumination and Electric Traction systems
5	**OE 775 ME**	Entrepreneurship	5	**OE 785 ME**	Mechatronics

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 practical class can be of two and half hour (clock hours) duration as per the requirement of a
          particular laboratory.

Note-2: * The students have to undergo a Summer Internship of four weeks' duration after VI semester and
          credits will be awarded in VII semester after evaluation.
       ** Subject is not offered to the students of Civil Engineering Department.

Course Code	Course Title						Core / Elective
PC 701 CE	**Structural Engineering Design and Drawing – II (Steel)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Steel Structures	3	1	-	-	30	70	3

Course Objectives
- ➢ Understand the basic concepts of welded plate girder design.
- ➢ Learn the basic principles of gantry girder design.
- ➢ Study the various types of bridges, bridge bearings and their design procedures.

Course Outcomes

After completing this course, the student will be able to
1. Analyse and design the plate girder and gantry girder.
2. Design the railway steel bridges and bridge bearings.

UNIT – I

Plate Girders: Design of welded plate girders for static loads, connections, intermediate and bearing stiffeners, web and flange splices.

UNIT – II

Gantry Girders: Basic principles, codal provisions and detailed design.
Bearings: Types and materials, detailed design of bearings for bridges.

UNIT – III

Bridges: Deck and trough type bridges, economical span, bridge rules (Railway Board, Ministry of Railways), detailed design of plate girder bridges and truss bridges.

*Suggested Readings***:**
1. N. Subramanyam, *Design of Steel Structures*, Oxford University Press, 2008.
2. B.C. Punmia, *Comprehensive Design of Steel structures*, Laxmi Publishers, 2001.
3. P. Dayaratnam, *Design of steel Structures*, S. Chand & Company Ltd, 2003.
4. N. Krishna Raju, *Design of Bridges*, Oxford and IBH Publishers, New Delhi, 1998.
5. Relevant *I.S. Code books* on Design of Steel Structures.

e-Resources:
1. http://nptel.ac.in
2. http://mhrd.gov.in/e-contents
3. http://spoken-tutorial.org/

Course Code	Course Title						Core / Elective
PC 702 CE	**Estimation Costing & Specifications**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Building Material and Construction	3	1	-	-	30	70	3

Course Objectives
- ➢ Understand the basic principles and specifications for estimations
- ➢ Know the basic procedures for Tenders and Tender documents
- ➢ Understand the detailed estimation of buildings, roads and Irrigation structures

Course Outcomes
By the end of this course, the students will be able to
1. prepare tender documents
2. prepare estimates for various engineering structures
3. prepare schedule for civil engineering works

UNIT – I
Basic Principles and Specifications: General and detailed specifications of works, departmental procedures to the construction works, types of estimates, various types of contract, turnkey projects, essentials of contracts and conditions of contracts, schedule of rates, standard data, rate analysis, bill of quantities.

UNIT – II
Tenders and Documentation: Tenders, preparation of tenders, tender documentation, Tender notice, work order, earnest money deposit, and security money deposits, comparative statements, additional conditions mentioned by tender, and those implications. Measurement book and muster roll, advances in tender procedures. National/International bidding. BOT, BOOT and PPP projects. Role of IT in tenders and construction industry.

UNIT – III
Estimation of Buildings and Roads: Traditional residential buildings, advanced buildings (earth work, footings, columns, beams and slabs etc.) by long wall and short wall method and centre line method, bar bending schedules, estimation of reinforcement quantities.
Estimation of road works: Using levels (cross sections and longitudinal sections).

UNIT – IV
Estimation of Irrigation Structures: Pipe culvert, slab culvert, simple bridge, irrigation canal including earth work (cutting and banking), retaining walls, overhead water tank and aqueduct.

UNIT – V
Softwares in estimation: Preparation of estimates using computer software/excel sheets/available softwares, introduction to MS Project.

Suggested Readings:
1. Dutta, B.N. (2016). *Estimating and Costing in Civil Engineering: Theory and Practice*. UBS Publishers' Distributers Pvt. Ltd., New Delhi.
2. Chakraborthi, M. (2002). *Estimating, Costing and Specifications in Civil Engineering*. Chakraborthi, Kolkata.
3. Jagjit Singh. (1996). *Estimating and Costing in Civil Engineering*. Galgotia Publications, New Delhi

Course Code	Course Title						Core / Elective
PC 703 CE	**Finite Element Techniques**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Numerical Methods	3	-	-	-	30	70	3

Course Objectives
  ➢ To introduce the transition from 2D to 3D structural problems (linear and non-linear).
  ➢ Analyse all kinds of loads and their respective effects.
  ➢ To introduce a high-end computer oriented numerical analysis tool.

Course Outcomes
After completing this course, the student will be able to
  1. Define the behavior of structural elements (2D and 3D).
  2. Analyse and evaluate structural frames through stiffness matrices.
  3. Model structures using FEM based software's such as ANSYS, ABAQUS, MSC NASTRAN and so on.

UNIT - I
Introduction to Finite Method: Variational approach, Rayleigh-Ritz and Galerkin's methods. Stiffness matrix for two noded bar, truss, and beam elements, problems with three degrees of freedom.

UNIT – II
Stiffness Matrix: Two noded beam element with three degrees of freedom per node. Transformation, generation of stiffness matrix for frames. Strain-displacement and stress – strain relationship in an elastic continuum (linear problems). Equations of equilibrium, and boundary conditions. Plane stress and plane strain problems.

UNIT – III
Formulation of Finite Element Method: Using principle of virtual displacement. Determination of stiffness matrix for three noded triangular element (constant strain triangle), and four noded rectangular element for plane stress and plane strain problems. Convergence criteria for selection of displacement models. Discretisation of continuum. Assembly of global stiffness and load matrices. Displacement boundary conditions.

UNIT – IV
Isoparametric Finite Elements: Direct construction of shape functions for higher order elements using natural co-ordinate system. Shape functions for eight noded parabolic curved iso-parametric element. Determination of element stiffness matrix for four noded quadrilateral element. Use of Jacobian, and Gauss quadrature techniques. Load matrix for eight noded rectangular isoparametric element (for body forces and surface traction).

UNIT – V
Strain Displacement: Stress – strain relation for axisymmetric problems. Stiffness matrix for three noded ring element. Volume co-ordinates and stiffness matrix for four noded tetrahedron element. Exposure to FEM based softwares.

Suggested Readings:
  1. O.C. Zienkiewicz and R.L. Taylor*, The Finite Element Method*, Vol. I, McGraw Hill, 1989.
  2. K.J. Bathe, *Finite Element Procedures*, Pearson Education, 2006.

3. S. M. Jalaludeen, *Finite Element Analysis*, Anuradha Publications, 2016.
4. S.S. Bhavakatti, *Finite Element Analysis*, New Age International Publishers, 2005.
5. C.S. Krishna Moorthy, *Finite Element Analysis*, McGraw Hill, 1991.
6. T.R. Chandrupatla, *Finite Element Analysis for Engineering and Technology*, Universities Press, 2004.

Course Code	Course Title					Core / Elective
PC 704 CE	**Prestressed Concrete**					**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Reinforced Cement Concrete	3	-	-	-	30	70	3

Course Objectives
 ➢ Understand the basic concept of prestressed concrete and materials used.
 ➢ Learn the analysis prestress and load balancing concept.
 ➢ Study the flexural and shear design of prestressed concrete beam sections.
 ➢ Learn the design of prestressed concrete continuous beam.
 ➢ Know the concepts of deflections and end blocks of prestressed concrete sections.

Course Outcomes
After completing this course, the student will be able to
   1. Apply the concept of prestressing and determine the losses of prestress.
   2. Analyse the prestressed concrete beam and suggest the cable profile for beam.
   3. Design the prestressed concrete beam for flexure and shear.
   4. Analyse the prestressed continuous beam and determine the concordant cable profile.
   5. Estimate the deflection of a prestressed concrete beam and design the end block.

UNIT – I
Introduction to Prestressed Concrete: Historical development, principles of prestressed concrete. Definition, classification and systems of prestressing. Materials for prestressed concrete.
Loss of prestress: Losses of prestress in pre-tensioned and post-tensioned members.

UNIT – II
Analysis of Prestress: Basic assumptions, analysis of prestress, resultant stress, pressure line, kern points, cable profiles, load balancing concept, stress diagrams for prestress, dead load and live load.

UNIT – III
Simply Supported Continuous Beams: concordant cable profile, analysis of continuous prestressed concrete beams.
Design of Sections: Flexural strength design of rectangular, I and T sections using IS code provisions.

UNIT – IV
Design for Shear: Basic concept of shear design, shear failure, flexural shear failure, shear compression failure, shear tension failure, shear strength of beams (a) unfrocked in flexure and (b) cracked in flexure.

UNIT – V
Deflections: Necessity of deflection estimation, limitations of deflections. Deflections of pre-stressed concrete beams with uniformly distributed and point loads.
End Block: Types of end blocks and Importance of end block, Analysis and design of end block by Guyon method and IS method for not more than two cables.

Suggested Readings:
   1. T.Y. Lin and N.H. Burns, *Design of prestressed concrete structure*, Jon Wiley and Sons, 1982.
   2. A.H. Nilson, *Design of Prestressed Concrete*, John Wiley and Sons, 1982.
   3. N. Krishna Raju, *Design of prestressed concrete structure*, Tata McGraw Hill Book Co., 1996.
   4. G.S. Pandit and S.P. Gupta, *Prestressed Concrete*, CBS Publishers, 1995.

Course Code	Course Title						Core / Elective
PC 705 CE	**Foundation Engineering**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Soil Mechanics	3	-	-	-	30	70	3

Course Objectives
 - ➢ Learn the definition, necessity, types and suitability of different foundation systems.
 - ➢ Understand the procedures of geotechnical design of foundations.
 - ➢ Understand the necessity and usage of different foundation construction related aspects.
 - ➢ Learn about different methods of geotechnical investigations and its role in selection and design of foundations.

Course Outcomes
After completing this course, the student will be able to
 1. Understand the stress distribution in soils.
 2. Calculate bearing capacity of shallow foundation.
 3. Design pile foundation and machine foundation.
 4. To learn various aspects of foundation.

UNIT – I
Stress Distribution in Soils: Boussinesq's theory – Computation of increment in vertical stress due to application of a point load (its distribution on horizontal, vertical planes), uniformly distributed circular and rectangular areas –Pressure bulb – Significant depth - Construction and use of Newmark's chart – Westergaard's theory – Validity of elastic theories – Contact pressure distribution.

UNIT – II
Introduction to Foundations: Functional requirements – types – differentiation of shallow and deep foundations – suitability
Safe Bearing Capacity of Shallow Foundations: Definitions - (a) Based on theories –Types of shear failures - Terazaghi's theory for safe bearing capacity of shallow foundations – Effect of type of shear failure / shape of the footing / water table – Provisions of IS: 6403-1981 (b) Based on field tests: Plate load test / Standard Penetration test
Allowable Bearing Capacity of Shallow Foundations: Settlement Analysis – Total settlement – Elastic settlement – Consolidation settlement (ultimate & after any given period – correction for construction period) – Permissible uniform & differential settlements – Proportioning of footings.

UNIT – III
Pile Foundations: Necessity – types based on load transfer mechanism / material / method of installation / functional use – Estimation of vertical load carrying capacity of a single pile – static formulae / Dynamic formulae / Pile load tests – Cyclic pile load test for separation of total capacity in to bearing and friction components – Pile groups – necessity – efficiency of Pile groups - estimation of group capacity – Negative Skin friction – Concept of Piled raft foundation.

UNIT – IV
Caissons: Necessity – types – Essential components of open (well) / box (floating) / Pneumatic caissons - suitability – Sinking of caissons – correction for tilt & shift.
Machine Foundations: differentiation with static foundations – vibration characteristics (frequency / amplitude/ resonance) – types of machines and machine foundations – additional design requirements

Geotechnical Investigations: Necessity – Principles of exploration - objectives – Soil profile – collection of disturbed & undisturbed soil samples – samplers & quality of samples - methods – Trial pit / Bore hole method – Log of bore hole details

UNIT – V
Foundation construction related aspects.
Timbered / braced excavations: Necessity - methods – suitability – distribution of pressure – reaction of struts.
Dewatering: Necessity – methods – sumps (ditches) / well point system (single /multi-stage) / deep well system / elector-osmosis method – merits & demerits – suitability **Coffer dams**: necessity – types – suitability
Underpinning: Necessity – methods (pin / pile) - suitability
Geosynthetics: Classification – functions – applications.

Suggested Readings:
1. Bowles, E. (2012). "*Foundation analysis and Design*", McGraw-Hill Publications.
2. Das, B.M. (2012). "*Principles of Foundation Engineering*", Sengrece Publications.
3. Arora, K.R. (2012). "*Soil Mechanics & Foundation Engineering*" Standard Publications.
4. Verghese, P.C. (2012). "*Foundation Engineering*", PHI Publications.

Course Code	Course Title					Core / Elective
OE 771 CE	**Green Building Technologies**					**Open Elective-II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits

Prerequisite	L	T	D	P	CIE	SEE	Credits
-	3	-	-	-	30	70	3

Course Objectives
- ➢ To impart knowledge of the principles behind the green building technologies.
- ➢ 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 a green building, along with its features, benefits and rating systems.
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 and sustainable development, 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, etc.

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, efficient lighting technologies, energy efficient 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) Use of local building materials (b) Use of natural and renewable materials like bamboo, timber, rammed earth, stabilized mud blocks, (c) use of 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 waste materials, separation of household waste, on-site and off-site organic waste management

UNIT-V

Indoor Environmental Quality for Occupant Comfort and Wellbeing: Daylighting, 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 Resources* 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
OE 772 CS	**Data Science Using R Programming**						**Open Elective-II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives
- ➢ To learn basics of R Programming environment: R language, R- studio and R packages
- ➢ To learn various statistical concepts like linear and logistic regression, cluster analysis, time series forecasting
- ➢ To learn Decision tree induction, association rule mining and text mining

Course Outcomes:
At the end of the course, the students will be able to
1. Use various data structures and packages in R for data visualization and summarization
2. Use linear, non-linear regression models, and classification techniques for data analysis
3. Use clustering methods including K-means and CURE algorithm

UNIT – I
Data Science: Introduction to data science, Linear Algebra for data science, Linear equations, Distance, Hyper planes, Half spaces, Eigen values, Eigenvectors.

UNIT II
Statistical Modelling, Random variables, Probability mass/density functions, sample statistics, hypothesis testing.

UNIT III
Predictive Modelling: Linear Regression, Simple Linear Regression model building, Multiple Linear Regression, Logistic regression

UNIT IV
Introduction to R Programming, getting started with R: Installation of R software and using the interface, Variables and data types, R Objects, Vectors and lists, Operations: Arithmetic, Logical and Matrix operations, Data frames, functions, Control structures, Debugging and Simulation in R.

UNIT V
Classification: performance measures, Logistic regression implementation in R, K-Nearest neighbours (KNN), K-Nearest neighbours implementation in R, Clustering: K-Means Algorithm, K-Means implementation in R.

Suggested Readings:
1. Nina Zumel, Practical Data Science with R, Manning Publications, 2014.
2. Peter Bruce and Andrew Bruce, Practical Statistics for Data Scientists, O'Reilly, 2017.
3. Hadley Wickham and Garrett Grolemund, R for Data Science, O'Reilly, 2017.
4. Roger D Peng, R Programming for Data science, Lean Publishing, 2016.
5. Rafael A Irizarry, Introduction to Data Science, Lean Publishing,2016.

Course Code	Course Title						Core / Elective
OE 773 EC	**Fundamentals of IoT**						**Open Elective-II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives:
  ➢ Discuss fundamentals of IoT and its applications and requisite infrastructure
  ➢ Describe Internet principles and communication technologies relevant to IoT
  ➢ Discuss hardware and software aspects of designing an IoT system
  ➢ Describe concepts of cloud computing and Data Analytics
  ➢ Discuss business models and manufacturing strategies of IoT products

Course Outcomes:
At the end of the course, the students will be able to
  1. Understand the various applications of IoT and other enabling technologies.
  2. Comprehend various protocols and communication technologies used in IoT
  3. Design simple IoT systems with requisite hardware and C programming software
  4. Understand the relevance of cloud computing and data analytics to IoT
  5. Comprehend the business model of IoT from developing a prototype to launching a product.

UNIT - I
Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT: Things in IoT, IoT protocols, Logical Design of IoT: IoT functional Blocks, Communication Models, APIs, IoT enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics (Ref 1)
IoT Applications: Smart Home, Smart Cities, Smart Environment, Smart Energy, Smart Retail and Logistics, Smart Agriculture and Industry, Smart Industry and smart Health (Ref1)

UNIT – II
Internet Principles and communication technology: Internet Communications: An Overview – IP, TCP, IP protocol Suite, UDP. IP addresses – DNS, Static and Dynamic IP addresses, MAC Addresses, TCP and UDP Ports, Application Layer Protocols – HTTP, HTTPS, Cost Vs Ease of Production, Prototypes and Production, Open Source Vs Closed Source. Prototyping Embedded Devices – Sensors, Actuators, Microcontrollers, SoC, Choosing a platform, Prototyping Hardware platforms – Arduino, Raspberry Pi. Prototyping the physical design – Laser Cutting, 3D printing, CNC Milling (Ref 2)

UNIT – III
API Development and Embedded programming: Getting started with API, writing a new API, Real time Reactions, Other Protocols, Techniques for writing embedded code: Memory management, Performance and Battery Life, Libraries, Debugging. (Ref 2)
Developing Internet of Things: IoT design Methodology, Case study on IoT System for weather monitoring (Ref 1)

UNIT – IV
IoT Systems - Logical Design using Python: Introduction to Python, Data Types and Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/Time Operations., Classes, Python packages for IoT (Ref 1 and Ref 3) IoT Physical Devices and Endpoints: Raspberry Pi, Interfaces of Pi, Programming pi with Python - Controlling LED and LDR using Pi with python programming.

UNIT – V

Cloud computing and Data analytics and IoT Product Manufacturing: Introduction to Cloud storage models and Communication APIs, Amazon web services for IoT, Skynet IoT Messaging Platform. Introduction to Data Analytics for IoT (Ref 1). Case studies illustrating IoT Design – Smart Lighting, Weather Monitoring, Smart Irrigation. (Ref 1) Business model for IoT product manufacturing, IoT Start-ups, Mass manufacturing, Ethical issues in IoT. (Ref 2)

Suggested Readings:

1. Internet of Things (A Hands-On-Approach), Vijay Madisetti, Arshdeep Bahga, VPT Publisher, 1st Edition, 2014.
2. Designing the Internet of Things, Adrian McEwen (Author), Hakim Cassimally. Wiley India Publishers.
3. Fundamentals of Python, Kenneth A Lambert and B.L. Juneja, Cengage Learning
4. *Internet of Things* - Converging Technologies for smart environments and Integrated ecosystems, River Publishers.
5. *Internet of things* -A hands on Approach, Arshdeep Bahga, Universities press.

Course Code	Course Title						Core / Elective
OE 774 EE	**Non-Conventional Energy Sources**						**Open Elective-II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

To impart the knowledge of basics of different non-conventional types of power generation & power plants in detail so that it helps them in understanding the need and role of Non-Conventional Energy sources particularly when the conventional sources are scarce in nature

Course Outcomes

On completion of course the student will be able to:

1. Understand the different nonconventional sources and the power generation techniques to generate electrical power.
2. Understand the Solar energy power development and different applications.
3. Understand different wind energy power generation techniques and applications.
4. Design a prescribed engineering sub-system
5. Recognize the need and ability to engage in lifelong learning for further developments in this field.

UNIT-I

Review of Conventional and Non-Conventional energy sources - Need for non-conventional energy sources Types of Non- conventional energy sources - Fuel Cells - Principle of operation with special reference to H2 °2 Cell - Classification and Block diagram of fuel cell systems - Ion exchange membrane cell - Molten carbonate cells - Solid oxide electrolyte cells - Regenerative system- Regenerative Fuel Cell - Advantages and disadvantages of Fuel Cells-Polarization - Conversion efficiency and Applications of Fuel Cells.

UNIT-II

Solar energy - Solar radiation and its measurements - Solar Energy collectors -Solar Energy storage systems - Solar Pond - Application of Solar Pond - Applications of solar energy.

UNIT-III

Wind energy- Principles of wind energy conversion systems - Nature of wind - Power in the Wind-Basic components of WECS -Classification of WECS -Site selection considerations -Advantages and disadvantages of WECS -Wind energy collectors -Wind electric generating and control systems - Applications of Wind energy -Environmental aspects.

UNIT- IV

Energy from the Oceans - Ocean Thermal Electric Conversion (OTEC) methods - Principles of tidal power generation -Advantages and limitations of tidal power generation -Ocean waves - Wave energy conversion devices -Advantages and disadvantages of wave energy - Geo-Thermal Energy - Types of Geo-Thermal Energy Systems - Applications of Geo-Thermal Energy.

UNIT-V

Energy from Biomass - Biomass conversion technologies / processes - Photosynthesis - Photosynthetic efficiency - Biogas generation - Selection of site for Biogas plant - Classification of Biogas plants - Details of commonly used Biogas plants in India - Advantages and disadvantages of Biogas generation -Thermal gasification of biomass -Biomass gasifiers.

Suggested Readings:

1. Rai G.D, *Non-Conventional Sources of Energy,* Khandala Publishers, New Delhi, 1999.
2. M.M. El-Wakil, Power *Plant Technology.* McGraw Hill, 1984.

Course Code	Course Title						Core / Elective
OE 775 ME	**Entrepreneurship**						**Open Elective-II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives
➢ To motivate students to take up entrepreneurship in future
➢ To learn nuances of starting an enterprise & project management
➢ To understand the design principles of solar energy systems, their utilization and performance evaluation
➢ To understand the behavioural aspects of entrepreneurs and time management

Course Outcomes
At the end of the course, the students will be able to
1. Understand Indian Industrial Environment, Entrepreneurship and Economic growth, Small and Large Scale Industries, Types and forms of enterprises.
2. Identify the characteristics of entrepreneurs, Emergence of first generation entrepreneurs, Conception and evaluation of ideas and their sources.
3. Practice the principles of project formulation, Analysis of market demand, Financial and profitability analysis and Technical analysis.
4. Apply the concepts of Project Management during construction phase, project organization, project planning and control using CPM, PERT techniques
5. Understand the Behavioural aspects of entrepreneurs, Time Management, Various approaches of time management, their strengths and weakness. The urgency addiction and time management matrix.

UNIT-I

Indian Industrial Environment-competence, Opportunities and Challenges. Entrepreneurship and Economic growth. Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries. Types of enterprises.

UNIT-II

Identification and characteristics of entrepreneurs. Emergence of First generation entrepreneurs, environmental influence and women entrepreneurs. Conception and evaluation of ideas and their sources. Choice of Technology - Collaborative interaction for Technology development.

UNIT-III

Project formulation, Analysis of market demand, Financial and profitability analysis and Technical analysis, project financing in India.

UNIT-IV

Project Management during construction phase, project organization, project planning and control using CPM, PERT techniques. Human aspects of project management. Assessment of tax burden.

UNIT-V

Behavioural aspects of entrepreneurs: Personality - determinants, attributes and models. Leadership concepts and models. Values and attitudes. Motivation aspects. Change behaviour. Time Management: Various approaches of time management, their strengths and weaknesses. The urgency addiction and time management matrix.

Suggested Readings:
1. Vasant Desai, *"Dynamics of Entrepreneurial Development and Management",* Himalaya Publishing House, 1997
2. Prasanna Chandra, *"Project-Planning, Analysis, Selection, Implementation and Review",* Tata McGraw-Hill Publishing Company Ltd. 1995.
3. Stephen R. Covey and A. Roger Merrill, *"First Things First",* Simon and Schuster Publication, 1994.
4. G.S. Sudha, *"Organizational Behaviour",* 1996.
5. Robert D. Hisrich, Michael P. Peters, *"Entrepreneurship",* Tata Me Graw Hill Publishing Company Ltd., 5^{lh} Ed., 2005.

Course Code	Course Title					Core / Elective
OE 781 CE	**Road Safety Engineering**					**Open Elective-III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	0	0	30	70	3

Course Objectives
- ➢ Introduction to various factors considered for road safety and management
- ➢ Explain the road safety appurtenances and design elements
- ➢ Discuss the various traffic management techniques

Course Outcomes

At the end of the course, the students will be able to
1. Prepare accident investigation reports and database
2. Apply design principles for roadway geometrics improvement with various types of traffic safety appurtenances/tools
3. Manage traffic including incident management

UNIT – I

Road Accidents: Causes, scientific investigations and data collection, Analysis of individual accidents to arrive at real causes, statistical methods of analysis of accident data, Basic concepts of Road accident statistics, Safety performance function: The empirical Bayes method Identification of Hazards road location. Application of computer analysis of accident data.

UNIT – II

Safety in Road Design: Operating the road network for safety, highway operation and counter measures, road safety audit, principles-procedures and practice, code of good practice and checklists, vehicle design factors & Driver characteristics influencing road safety.

UNIT – III

Road Signs and Traffic Signals: Classification, Location of Signs, measures of sign effectiveness, Types of visual perception, sign regulations, sign visibility, sign variables, Text versus symbols. Road Marking: Role of Road markings, Classification, visibility. Traffic Signals: Need, Signal face. Illumination and location of Signals, Factors affecting signal design, pedestrians' safety, fixed and vehicle actuated signals. Design of signa1s, Area Traffic control. Delineators, Traffic Impact Attenuators, Road side rest areas, Safety Barriers, Traffic Aid Posts.

UNIT – IV

Traffic Management Techniques: Integrated safety improvement and Traffic Calming Schemes, Speed and load limit, Traffic lights, Safety cameras, Tests on driver and vehicles, pedestrian safety issues, Parking, Parking enforcement and its influence on Accidents. Travel Demand Management; Methods of Traffic management measures: Restriction of Turning Movements, One-way streets, Tidal Flow Operation Methods, Exclusive Bus Lanes and Closing Side-streets; Latest tools and techniques used for Road safety and traffic management. Road safety issues and various measures for road safety; Legislation, Enforcement, Education and Propaganda, Air quality, Noise and Energy Impacts; Cost of Road Accidents.

UNIT – V

Incident Management: Introduction, Characteristics of Traffic Incidents, Types of Incidents, Impacts, Incident management process, Incident traffic management; Applications of ITS: Motorist information, Equipment used; Planning effective Incident management program, Best practice in Incident management

programs. National importance of survival of Transportation systems during and after all natural disasters especially cyclones, earthquakes, floods etc. and manmade disasters like sabotage, terrorism etc.

Suggested Readings:
1. Guidelines on Design and Installation of Road Traffic Signals, IRC:93.
2. Specification for Road Traffic Signals, IS: 7537-1974.
3. Principles and Practice of Highway Engineering by L.R. Kadiyali and N.B. Lal.
4. Hand Book of T.E. Myer Kutz, Editor McGraw Hill, 2004.

Course Code	Course Title					Core / Elective
OE 782 CS	**Software Engineering**					**Open Elective-III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	**T**	**D**	**P**			
-	**3**	**-**	**-**	**-**	30	70	**3**

Course Objectives
- ➢ To introduce the basic concepts of software development- processes from defining a product to shipping and maintaining that product
- ➢ To impart knowledge on various phases, methodologies and practices of software development
- ➢ To understand importance of software modelling using UML
- ➢ To understand the importance of testing in software development and study various testing strategies and software quality metrics.

Course Outcomes
At the end of the course students will be able to:
1. Acquire knowledge about different software development processes and their usability in different problem domains.
2. Understand the process of requirements collection, analysing, and modelling requirements for effective understanding and communication with stakeholders.
3. Design and develop the architecture of real world problems towards developing a blueprint for implementation.
4. Use the UML language to design various models during software development life cycle.
5. Understand the concepts of software quality, testing and maintenance.

UNIT-I
The software Problem: Cost, Schedule and Quality, Scale and change, Software Processes: - Process and project, Component Software Processes, Software Development Process Models, Project management Process.

UNIT-II
Software Requirements Analysis and Specification: Value of a good SRS, Requirements Process, Requirements Specification, Functional Specification with Use Cases, Other approaches for analysis. Software Architecture: Role of Software Architecture Views, Component and connector view, Architectural styles for C & C view, Documenting Architecture Design, Evaluating Architectures.

UNIT-III
Planning a Software Project: Effort Estimation, Project Schedule and staffing, Quality Planning, Risk Management Planning, Project Monitoring Plan, Detailed Scheduling. Design: Design concepts, Function oriented Design, Object Oriented Design, Detailed Design, Verification, Metrics.

UNIT-IV
Coding and Unit Testing: Programming Principles and Guidelines, incrementally developing code, managing evolving code, unit testing, code inspection, Metrics. Testing: Testing Concepts, Testing Process, Black Box testing, White box testing, Metrics.

UNIT-V
Maintenance and Re-engineering: Software Maintenance, supportability, Reengineering, Business process Reengineering, Software reengineering, Reverse engineering; Restructuring, Forward engineering, Economics of Reengineering. Software Process Improvement: Introduction, SPI process, CMMI, PCMM, Other SPI Frameworks, SPI return on investment, SPI Trends.
Suggested Readings:

1. Pankaj Jalote, "Software Engineering- A Precise Approach", Wiley India, 2010.
2. Roger. S. Pressman, "Software Engineering - A Practitioner's Approach", 7th Edition, McGraw Hill Higher Education, 2010.
3. Deepak Jain, "Software Engineering", Oxford University Press, 2008.
4. Rajib Mall, "Fundamentals of Software Engineering", 4th Edition, PHI Learning, 2014.
5. Ian Sommerville, "Software Engineering", 10th Edition, Addison Wesley, 2015.

Course Code	Course Title						Core / Elective
OE 783 EC	**Principles of Electronic Communications**						**Open Elective-III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives
> ➢ Provide an introduction to fundamental concepts in the understanding of communications systems.
> ➢ Provide an introduction to network model and some of the network layers including physical layer, data link layer, network layer and transport layer.
> ➢ Provide an introduction to the evolution of wireless systems and current wireless technologies.

Course Outcomes
1. Understand the working of analog and digital communication systems
2. Understand the OSI network model and the working of data transmission
3. Understand the evolution of communication technologies from traditional telephony systems to modern wireless communication systems.

UNIT – I

Introduction to communication systems: Electromagnetic Frequency Spectrum, Signal and its representation, Elements of Electronic Communications System, Types of Communication Channels.
Signal Transmission Concepts: Baseband transmission and Broadband transmission,
Communication Parameters: Transmitted power, Channel bandwidth and Noise, Need for modulation
Signal Radiation and Propagation: Principle of electromagnetic radiation, Types of Antennas, Antenna Parameters and Mechanisms of Propagation.

UNIT – II

Analog and Digital Communications: Amplitude modulation and demodulation, FM modulation and demodulation, Digital converters, Digital modulation schemes – ASK, FSK, PSK, QPSK, Digital demodulation.

UNIT – III

Data Communication and Networking: Network Models, OSI Model, Data Link Layer – Media Access control, Ethernet, Network Layer – Internet Protocol (IPv4/IPv6), Transport Layer – TCP, UDP.

UNIT – IV

Telecommunication Systems: Telephones, Telephone system, Paging systems, Internet Telephony.
Optical Communications: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT – V

Wireless Communications: Evolution of Wireless Systems: AMPS, GSM, CDMA, WCDMA, OFDM. Current Wireless Technologies: Wireless LAN, Bluetooth, PAN and ZigBee, Infrared wireless, RFID communication, UWB, Wireless mesh networks, Vehicular adhoc networks.

Suggested Readings:
1. *Principles of Electronic Communication Systems*, Louis E. Frenzel, 3e, McGraw Hill, 2008.
2. *Data Communications and Networking,* Behrouz A. Forouzan, 5e TMH, 2012.
3. Kennady, Davis, *Electronic Communications systems*, 4e, McGraw Hill, 1999.

Course Code	Course Title						Core / Elective
OE 784 EE	**Illumination and Electric Traction Systems**						**Open Elective-III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives
- ➢ To introduce the students and understand Utilization of electrical energy for various applications like industrial heating, welding etc.,
- ➢ To understand the concept of illumination, and know the applications of various lamps to factory lighting, street lighting etc.
- ➢ To understand the concept of electrification of traction system

Course Outcomes
On successful completion of course, students will be able to:
1. Design the resistive and inductive heating and calculate the requirements of heating power for an industrial need
2. Analyse the type of motor control required and select the type and rating of motor.
3. Understand and Design illumination for different application
4. Understand the traction and use of DC machines
5. Analyse the traction mechanics to arrive at a rating of drive.

UNIT-I
Industrial Heating: Advantages and methods of electric heating. Description, operation and performance of resistance ovens — Design of elements. Core type, Coreless type furnaces, High frequency eddy current heating, Dielectric heating. Arc furnace. Electric welding, Resistance welding, welding transformer and its rating, various types of Electric arc welding and electric resistance welding.

UNIT-II
Schematic Utilization and Connection Diagrams for Motor Control: Two supply sources for 3 phase Induction motors. Direct reversing, remote control operation, and jogging operating of Induction motor. Contactor control circuit. Push button control stations. Over load relays, limit switches, float switches. Interlocking methods for reversing control.

UNIT-III
Illumination: Introduction, nature and production of light, Sensitivity of the eye, Units of light. The inverse square law and cosine law, Solid angle, lighting calculations — Determination of M.S.C.P, Rousseau's construction, Discharge lamps, Sodium vapour lamps, Mercury vapour lamps — Fluorescent lamp, Starting and power factor corrections, Stroboscopic effects — Neon signs, Application to factory lighting, Street lighting and Flood lighting.

UNIT-IV
Electric Traction: System of Electric Traction — Transmission of drive — Systems of track electrification — Traction mechanics — Speed time curves — Tractive effort — Power of Traction motor — Specific energy consumption — Mechanics of train movement— Coefficient of adhesion.
Traction Motors: Desirable characteristics, DC series motors, AC series motors 3-phase induction motors, DC motor series & parallel control, Energy saving.

UNIT-V
Train Lighting: Systems of train lighting — Special requirements of train lighting — Methods of obtaining unidirectional polarity — Methods of obtaining constant output — Single battery system — Double battery parallel block system — Principal equipment of double battery system — Coach wiring — Dynamo.
Batteries: Lead acid batteries, SMF batteries, Construction and maintenance, Charging and rating of batteries.

Suggested Readings:
1. Partab H, Art and Science of Utilization of Electric Power, Dhanpat Rai & Sons, 1997.
2. K.B. Raina & S.K. Bhattacharya, Electrical Design, Estimating and Costing, Wiley Eastern Ltd., 1991.
3. Partab H, Modern Electric Traction, Dhanpat Rai & Sons, 2000.
4. B.L. Theraja, A Text Book of Electrical Technology, S. Chand & Company Ltd, Vol —I.

Course Code	Course Title						Core / Elective
OE 785 ME	**Mechatronics**						**Open Elective-III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

Student has to understand the

> How to identify, formulate, and solve engineering problems
> The design a system, component, or process to meet desired needs within realistic constraints
> The how to use the techniques, skills, and modern engineering tools necessary for engineering practice
> The use of drive mechanisms and fluid power systems
> The use of industrial electronic devices
> The demonstrate the design of modern CNC machines, and Mechatronics elements

Course Outcomes

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

1. Model and analyse electrical and mechanical systems and their interconnection
2. Integrate mechanical, electronics, control and computer engineering in the design of Mechatronics systems
3. Do the complete design, building, interfacing and actuation of a Mechatronics system for a set of specifications
4. Be proficient in the use of fluid power systems in various Mechatronics applications
5. Demonstrate the use of industrial electronic devices
6. Demonstrate the design of modern CNC machines, and Mechatronics elements

UNIT-I

Introduction to mechanization & automation: Need of interface of electrical & electronic devices with mechanical elements, the concept of Mechatronics, Flow chart of Mechatronics system, elements of Mechatronics system, drive mechanisms, actuators, feedback devices and control system, application in industries and systems development

UNIT-II

Drive mechanisms: Feeding and indexing, orientation, escapement and sorting devices, conveyor systems Introduction to electrical actuators: A.C. servomotors, D.C. servomotors, stepper motors

UNIT-III

Introduction to fluid power systems: Industrial Pneumatics and hydraulics, merits of fluid power, pneumatic & hydraulic elements symbols, study of hydraulic control valves, pumps & accessories, hydraulic circuits & mechanical servo control circuits, Electro-hydraulic and Hydro pneumatic circuits

UNIT-IV

Introduction to industrial electronic devices: Diodes, Transistors, Silicon Controlled Rectifiers (SCR), Integrated Circuits (IC), Digital Circuits, Measurement systems & Data acquisition systems: sensors, digital to analog and analog-to-digital conversion, signal processing using operational amplifiers, introduction to microprocessor & micro controller, Temperature measurement interface and LVDT interface, Systems response

UNIT-V

Design of modern CNC machines and Mechatronics elements: machine structures, guide ways, spindles, tool monitoring systems, adaptive control systems, Flexible manufacturing systems, Multipurpose control machines, PLC programming

Suggested Readings:

1. William Bolton, Mechatronics: Electronic control systems in mechanical and electrical engineering, 6th edition, Pearson Education
2. HMT Ltd, Mechatronics, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1998
3. Michaels Histand & David G, Alciatore, Introduction to Mechatronics and Measurement Systems, Tata McGraw-Hill International Edition
4. Devdas Shetty, Richard A. Kolk, Mechatronics System Design, Cengage Learning
5. S.R. Majumdar, Oil Hydraulic Systems – Principles & Maintenance, McGraw-Hill Publishing Company Limited, New Delhi
6. Godfrey Onwubolu, Mechatronics: Principles and Applications, Butterworth-Heinemann

Course Code	Course Title						Core / Elective
PC 751 CE	**Computer Application Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	25	50	1

Course Objectives
  ➢ Understand the application of softwares in civil engineering.
  ➢ Analysis and design of structural members using software techniques.
  ➢ Use of software knowledge for solving fluid mechanics related problems.
  ➢ Solving geotechnical problems using software.

Course Outcomes
After completing this course, the student will be able to
  1. To use software skills to solve civil engineering related analysis and design.
  2. To analyse and design of RCC beam using limit state design.
  3. To analyse and solve problems related to hydraulic structures using software.
  4. To compute bearing capacity and other geotechnical related problems using software.

List of Experiments to be performed:

  1. Calculation of shear force *I* bending moment at any section for a simply supported beam carrying a u.d.l., shorter than span.
  2. Structural design of an RCC beam section using limit state method, given are the grade of concrete, grade or steel, BM and SF.
  3. A rectangular cross section is subjected to a non-central force parallel to axis of member. Determine the stresses at any location of the section. Direct and bending stresses.
  4. Calculation of normal depth and critical depth in a trapezoidal channel
  5. Computation of discharge over a rectangular notch using velocity of approach
  6. Determination of pre and post jump depths from known specific energy values
  7. Calculation of Φ-index
  8. Estimation of specific capacity and maximum pumping rate of a well
  9. Analysis of pipe network in water distribution systems
  10. Flood routing using Muskigham's method
  11. Design of an irrigation channel using Kennedy's theory
  12. Design of trapezoidal notch canal fall
  13. Compute distribution of increment in vertical stress due to applied point load on a
      (a) Horizontal Plane
      (b) Vertical plane. Using the computed values, plot the distribution utilizing VC as front end tool.
  14. Compute the values of a pressure bulb and using the values plot pressure bulb utilizing VC as front end tool.
  15. Compute the consolidation settlement duly dividing the strata in to infinitesimally small layers to fulfil the Terzaghi's assumption.
  16. Compute earth pressure on to a retaining wall and check its stability.
  17. Compute bearing capacity of a shallow foundation as per IS: 6403 -1980
  18. Develop a code in C to design a single vertical pile, pile group to suit various ground conditions.

Course Code	Course Title						Core / Elective
PW 761 CE	**Project Work - I**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	4	50	-	2

Course Objectives
  ➢ To enhance practical and professional skills.
  ➢ To familiarize tools and techniques of systematic literature survey and documentation
  ➢ To expose the students to industry practices and team work.
  ➢ To encourage students to work with innovative and entrepreneurial ideas

Course Outcomes
  1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.
  2. Evaluate different solutions based on economic and technical feasibility
  3. Effectively plan a project and confidently perform all aspects of project management
  4. Demonstrate effective written and oral communication skills

The department can initiate the project allotment procedure at the end of VI semester and finalize it in the first two weeks of VII semester.

The department will appoint a project coordinator who will coordinate the following:
  ➢ Collection of project topics/ descriptions from faculty members (Problems can also be invited from the industries)
  ➢ Grouping of students (max 3 in a group)
  ➢ Allotment of project guides

The aim of project work is to develop solutions to realistic problems applying the knowledge and skills obtained in different courses, new technologies and current industry practices. This requires students to understand current problems in their domain and methodologies to solve these problems. To get awareness on current problems and solution techniques, the first 4 weeks of VII semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R&D institutions. After completion of these seminars each group has to formalize the project proposal based on their own ideas or as suggested by the project guide.

Seminar schedule will be prepared by the coordinator for all the students from the 5th week to the last week of the semester which should be strictly adhered to.

Each group will be required to:
  1. Submit a one-page synopsis before the seminar for display on notice board.
  2. Give a 30 minutes' presentation followed by 10 minutes' discussion.
  3. Submit a technical write-up on the talk.

At least two teachers will be associated with the Project Seminar to evaluate students for the award of sessional marks which will be on the basis of performance in all the 3 items stated above.

The seminar presentation should include the following components of the project:
  ➢ Problem definition and specification
  ➢ Literature survey
  ➢ Broad knowledge of available techniques to solve a particular problem.
  ➢ Planning of the work, preparation of bar (activity) charts
  ➢ Presentation- oral and written.

Course Code	Course Title						Core / Elective
SI 762 CE	**Summer Internship**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Knowledge of Civil Engineering	-	-	-	-	50	-	2

Course Objectives
- ➢ To identify the topic and make a visit to the industry.
- ➢ To observe the salient features of the activity.
- ➢ To interact with the plant team and get clarity about the operations.
- ➢ To present a comprehensive report on the visit.

Course Outcomes
After completing this course, the student will be able to
1. Learn how to approach an industry and get permission.
2. Make technical visit to that plant/site.
3. Learn the Civil Engineering aspects of that plant/site.
4. Prepare a report on the visit covering all salient features of that plant/site/activity.

Summer Internship is introduced as part of the curricula of encouraging students to work on problems of interest to industries. A batch of three students will be attached to a person from the Government or Private Organisations/Computer Industry/Software Companies/R&D Organization for a period of 4-6 weeks. This will be during the summer vacation following the completion of the III-year Course. One faculty coordinator will also be attached to the group of 3 students to monitor the progress and to interact with the industry co-ordinate (person from industry).

The course schedule will depend on the specific internship/training experience. The typical time per topic will vary depending on the internship
- Overview of company/project
- Safety training
- Discussions with project teams
- Background research, review of documents, white papers, and scientific papers
- Planning, designing, and reviewing the planned work
- Executing the plans
- Documenting progress, experiments, and other technical documentation
- Further team discussions to discuss results
- Final report writing and presentation

After the completion of the project, each student will be required to:
1. Submit a brief technical report on the project executed and
2. Present the work through a seminar talk (to be organized by the Department)

Award of sessionals are to be based on the performance of the students at the workplace and awarded by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will co-ordinate the overall activity of Industry Attachment Program.

Note: Students have to undergo summer internship of 4-6 weeks at the end of semester VI and credits will be awarded after evaluation in VII semester.

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

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	Credits
Theory Courses										
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	-
Practical/ Laboratory Courses										
6	**PW 961 CE**	Project Work – II	-	-	16	16	50	100	-	8
7		Mandatory Course	-	-	3	3	50	-	3	-
			15	-	19	34	250	450		20

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
PC 801 CE	**Construction Management & Technology**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Engineering Mathematics & Estimation and Costing	3	-	-	-	30	70	3

Course Objectives
- ➢ Describe different techniques of construction management projects.
- ➢ Illustrate economics of construction management projects.
- ➢ Study the Safety Engineering practices of construction management projects.

Course Outcomes
After completing this course, the student will be able to
1. Understand and apply various techniques involved in planning and construction stages.
2. Analyse and optimize the materials used in construction.
3. Assess and prevent the conflicts and accidents that may occur during various stages of construction.

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
PE 821 CE	**Retrofitting and Rehabilitation of Structures**					**Elective**
Prerequisites	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Concrete Technology	3	-	-	-	30	70	3

Course Code	Course Title	Core / Elective
PE 821 CE	**Retrofitting and Rehabilitation of Structures**	**Elective**

Prerequisites	L	T	D	P	CIE	SEE	Credits
Concrete Technology	3	-	-	-	30	70	3

Course Objectives
- ➢ Understand the basic concepts of building maintenance.
- ➢ Understand the causes, mechanisms and prevention of deterioration of structures.
- ➢ Understand the methods of condition assessment of structures.
- ➢ Learning the materials, methodology and techniques of repair.
- ➢ Learning the methods and strategies of retrofitting of structures.

Course Outcomes
After completing this course, the student will be able to
1. Distinguish between various definitions related to building repair and maintenance.
2. Differentiate the types of defects, damage and explain the various deterioration mechanisms in structures.
3. Classify and explain the various non-destructive tests and condition assessment procedures.
4. Describe various repair materials and techniques.
5. Explain the various retrofitting and rehabilitation procedures.

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
PE 822 CE	**Computer Aided Analysis and Design**						**Elective**
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
PE 823 CE	**Applied Hydrology**						**Elective**
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, Correlogaram 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
PE 824 CE	**Introduction to Climate Change**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Environmental Science	3	-	-	-	30	70	3

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
PE 831 CE	**Structural Dynamics**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Engineering Mechanics, Solid Mechanics & Theory of Structures	3	-	-	-	30	70	3

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 dicretization: Lumped mass Procedure / Consistent mass procedure/generalized displacements – Single Degree Freedom Systems – Formulation of Equation of Motion: D'Alembert's Principle e – 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 / Accelero Meters / 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 detrimental 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) – Undammed 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
PE 832 CE	**Design with Geosynthetics**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Theory of Structures-I	3	-	-	-	30	70	3

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
PE 833 CE	**Groundwater Management**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Water Resources Engineering-I	3	-	-	-	30	70	3

Course Objectives

To make the student familiar with the concepts of
- ➢ The importance of hydrologic cycle in improving groundwater.
- ➢ The characteristics of groundwater flow, storage parameters and geophysical methods in groundwater exploration.
- ➢ The socio-economic aspects of groundwater hydrology.
- ➢ Developing numerical solutions for groundwater flow models.

Course Outcomes

After completing this course, the student will be able to
1. Describe the socio-economic aspects of groundwater hydrology.
2. Perform geophysical methods for groundwater exploration.
3. Compute flow from a groundwater aquifer.
4. Identify groundwater contamination sources.
5. Analyse various models in ground water.

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
PE 834 CE	**Intelligent Transportation Systems**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Transportation Engineering	3	-	-	-	30	70	3

Course Objectives
- ➢ To introduce the concept of intelligent transportation systems.
- ➢ To understand the functional area of ITS.
- ➢ To study the ITS architecture and its applications.

Course Outcomes
1. Able to plan and specification requirements using ITS
2. Able to plan and management aspects for ITS
3. Able to prepare architecture and application for ITS

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
PE 841 CE	**Prefabrication Engineering**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Project Management, Building Materials & Design of Concrete and Steel Structures	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, singe span single storied simple frames, single storied buildings, slabs, beams and columns.

Suggested Readings:
1. Mokk. 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
PE 842 CE	**Principles of Green Building Practices**						**Elective**
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
PE 843 CE	**Advanced Reinforced Concrete Design**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Reinforced Cement Concrete	3	-	-	-	30	70	3

Course Objectives
- ➢ Understand the design of curved beams in plan.
- ➢ Understand the analysis and design of portal frames.
- ➢ Learn the analysis and design of an interior panel of substitute frame.
- ➢ Design flat slabs and raft slabs.

Course Outcomes

After completing this course, the student will be able to
1. Design curved and deep beams.
2. Design portal frames.
3. Design flat slabs and raft foundations.

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
PE 844 CE	**Traffic Engineering & Infrastructure Design**						**Elective**
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
MC 901 CE	**Gender Sensitization**					**Mandatory**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	0	0	30	70	3

Course Objectives

- ➢ To develop students' sensibility with regard to issues of gender in contemporary India.
- ➢ To provide a critical perspective on the socialization of men and women.
- ➢ Information about some key biological aspects of genders.
- ➢ Reflect critically on gender violence.
- ➢ Exposure on egalitarian interactions between men and women.

Course Outcomes

After completing this course, the student will be able to

1. Develop a better understanding of important issues related to gender in contemporary India.
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.
3. Get a finer grasp of how gender discrimination works in our society and how to counter it.
4. Better equipped to work and live together as equals.
5. Develop a sense of appreciation of women in all walks of life.

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 Bhrugubanda, 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
PW 961 CE	**Project Work – II**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	16	50	100	8

Course Objectives
- ➢ To enhance practical and professional skills.
- ➢ To familiarize tools and techniques of systematic literature survey and documentation
- ➢ To expose the students to industry practices and team work.
- ➢ To encourage students to work with innovative and entrepreneurial ideas

Course Outcomes
1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.
2. Evaluate different solutions based on economic and technical feasibility
3. Effectively plan a project and confidently perform all aspects of project management
4. Demonstrate effective written and oral communication skills

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 1st 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 for25 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
MP 951 SP	**Yoga Practice**						**Mandatory**
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
MC 952 SP	**National Service Scheme (NSS)**						**Mandatory**
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
MC 953 SP	**Sports**						**Mandatory**
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