



# **Jawaharlal Nehru Technological University Anantapur**

*(Established by Govt. of A.P., Act. No. 30 of 2008)*

**Ananthapuramu–515 002 (A.P) India**

## **III & IV year B.Tech Course Structures and Syllabi under R19 Regulations**

<b>JNTUA Curriculum</b>
<b>Civil Engineering B. Tech Course Structure</b>

### **3<sup>rd</sup> Year Course Structure**

<b>Semester - 5 (Theory - 6, Lab - 3)</b>					
<b>S.No</b>	<b>Course No</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P</b>	<b>Credits</b>
<b>1.</b>	19A01501	Design of Reinforced Concrete Structures	PC	2-1-0	3
<b>2.</b>	19A01502	Water Resources Engineering	PC	3-0-0	3
<b>3.</b>	19A01503T	Engineering Geology	PC	2-0-0	2
<b>4.</b>	19A01504	Structural Analysis-II	PC	2-1-0	3
<b>5.</b>	19A01505a 19A01505b 19A01505c 19A01505d 19A01505e	Professional Elective-I Building Construction Practice Subsurface Investigation and Instrumentation Environmental Pollution and Control Advanced Surveying Urban Hydrology	PE	3-0-0	3
<b>6.</b>	19A01506a 19A01506b 19A02506a 19A03506a 19A03506b 19A04506a 19A04506b 19A05506a 19A05506b 19A27506a 19A27506b 19A54506a 19A52506a	Open Elective-I Experimental stress analysis. Building Technology Electrical Engineering Materials Introduction to Hybrid and Electric Vehicles Rapid Prototyping Analog Electronics Digital Electronics Free and Open Sources Systems Computer Graphics and Multimedia Animation Brewing Technology Computer Applications in Food Technology Optimization Techniques Technical Communication and Presentation Skills	OE	3-0-0	3
<b>7.</b>	19A01507	Computer Aided Civil Engineering Drawing	PC	0-0-3	1.5
<b>8.</b>	19A01508	Environmental Engineering Lab	PC	0-0-3	1.5
<b>9.</b>	19A01503P	Engineering Geology Lab	PC	0-0-2	1.0
<b>10.</b>	19A01509	Socially Relevant Project	PR	-----	0.5
<b>11.</b>	19A99501	Mandatory course: Constitution of India	MC	3-0-0	0
<b>Total</b>					<b>21.5</b>

<b>Semester - 6 (Theory - 6, Lab - 2)</b>					
<b>S.No</b>	<b>Course No</b>	<b>Course Name</b>	<b>Cate gory</b>	<b>L-T-P</b>	<b>Credits</b>
<b>1.</b>	19A01601T	Geotechnical Engineering -I	PC	2-1-0	3
<b>2.</b>	19A01602	Design of Steel Structures	PC	2-1-0	3
<b>3.</b>	19A52601T	English Language Skills	HS	3-0-0	3
<b>4.</b>	19A01603a 19A01603b 19A01603c 19A01603d 19A01603e	Professional Elective-II Repair and Rehabilitation of Structures Ground Improvement Techniques Air Pollution Engineering Railway Engineering Hydropower Development	PE	3-0-0	3
<b>5.</b>	19A01604a  19A01604b 19A02604a 19A02604b 19A03604a 19A03604b 19A04604a 19A04604b 19A05604a 19A05604b 19A27604a 19A27604b 19A54604a 19A52604a	Open Elective-II Industrial waste and waste water management. Building Services & Maintenance Industrial Automation System Reliability Concepts Introduction to Mechatronics Optimization techniques through MATLAB Basics of VLSI Principles of Communication Systems Fundamentals of VR/AR/MR Data Science Food Toxicology Food Plant Equipment Design Wavelet Transforms & its applications Soft Skills	OE	3-0-0	3
<b>6.</b>	19A52602a 19A52602b  19A52602c 19A52602d 19A52602e	Humanities Elective-I Entrepreneurship & Incubation Managerial Economics And Financial Analysis Business Ethics And Corporate Governance Enterprise Resource Planning Supply Chain Management	HE	3-0-0	3
<b>7.</b>	19A01601P	Geotechnical Engineering lab	PC	0-0-3	1.5
<b>8.</b>	19A52601P	English Language Skills Lab	HS	0-0-3	1.5
<b>9.</b>	19A01605	Socially Relevant Project	PR	-----	0.5
<b>10.</b>	19A99601	Mandatory Course: Research Methodology	MC	3-0-0	0
<b>Total</b>					<b>21.5</b>

<b>Semester – 7 (Theory - 5, Labs -2 &amp; Project – 1)</b>					
<b>S.No</b>	<b>Course No</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P</b>	<b>Credits</b>
<b>1.</b>	19A01701	Geotechnical Engineering-II	PC	2-1-0	3
<b>2.</b>	19A01702	Estimation & costing	PC	2-1-0	3
<b>3.</b>	19A01703a1 19A01703a2 19A01703b1 19A01703b2 19A01703c1 19A01703c2 19A01703d1 19A01703d2 19A01703e1 19A01703e2	Professional Elective-III Bridge Engineering Prestressed concrete Expansive soils Rock Mechanics Industrial Waste & Waste Water Engineering Remote Sensing and GIS Traffic Engineering Urban Transportation Planning Water Resources System Analysis OR River Basin Management	PE	3-0-0	3
<b>4.</b>	19A01704a 19A01704b 19A02704a 19A02704b 19A03704a 19A03704b 19A04704a 19A04704b 19A05704a 19A05704b 19A27704a 19A27704b 19A54704a	Open Elective-III Air pollution and control. Basics of civil Engineering Renewable Energy Systems Electric Vehicle Engineering Finite element methods Product Marketing Introduction to Microcontrollers & Applications Principles of Digital Signal Processing Fundamentals of Game Development Cyber Security Corporate Governance in Food Industries Process Technology for Convenience & RTE Foods Numerical Methods for Engineers (ECE , CSE, IT &CE )	OE	3-0-0	3
<b>5.</b>	19A52701a 19A52701b 19A52701c 19A52701d 19A52701e	Humanities Elective-II Organizational Behavior Management Science Business Environment Strategic Management E-Business	HS	3-0-0	3
<b>6.</b>	19A01404P	Concrete technology Lab	PC	0-0-3	1.5
<b>7.</b>	19A01705	Computer Aided Design Lab	PC	0-0-3	1.5
<b>8.</b>	19A01706	Project*	PR	-----	2
<b>9.</b>	19A01707	Industrial Training/Skill Development/Research Project*	PR	-----	1.5
<b>Total</b>					<b>21.5</b>

<b>Semester – 8 (Theory - 2, Project – 1)</b>					
<b>S.No</b>	<b>Course No</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P</b>	<b>Credits</b>
<b>1.</b>	19A01801a1	Professional Elective-IV Finite Element Methods	PE	3-0-0	3
	19A01801a2	Advanced R.C.C Structural Design			
	19A01801a3	Advanced steel structures			
	19A01801b1	Advanced Foundation Engineering			
	19A01801b2	Soil structure interaction			
	19A01801c1	Environmental Impact Assessment			
	19A01801c2	Environmental Economics			
	19A01801d1	Docks and Harbor Engineering			
	19A01801d2	Traffic Analysis			
	19A01801e1	Design and Drawing of Irrigation Structures			
	19A01801e2	Water Shed Management			
	19A01801e3	Sustainable Water Resources Development			
<b>2.</b>	19A01802a	Open Elective-IV Disaster Management.	OE	3-0-0	3
	19A01802b	Global Warming and climate changes			
	19A02802a	IoT Applications in Electrical Engineering			
	19A02802b	Smart Electric Grid			
	19A03802a	Energy conservation and management			
	19A03802b	Non destructive testing			
	19A04802a	Introduction to Image Processing			
	19A04802b	Principles of Cellular and Mobile Communications			
	19A04802c	Industrial Electronics			
	19A04802d	Electronic Instrumentation			
	19A05802a	Block Chain Technology and Applications			
	19A05802b	MEAN Stack Technology			
	19A27802a	Food Plants Utilities & Services			
	19A27802b	Nutraceuticals & Functional Foods			
	19A54802a	Mathematical Modeling & Simulation			
<b>3.</b>	19A01803	Project	PR	-----	7
<b>Total</b>					<b>13</b>

### **Areas for Socially Relevant Project in 5th Semester**

- Water quality analysis in a village /town
- Survey camp

- c) Road safety Audit
- d) Environmental impact Audit

### **Areas for Socially Relevant Project in 6th Semester**

- a) Structural condition assessment of school buildings
- b) Water resources management -Audit
- c) Survey of waste management systems-Swachh Bharat
- d) Survey of modern building materials & properties
- e) Survey on Implementation of Government welfare schemes

### **MINOR DEGREE IN CIVIL ENGINEERING**

CORE SUBJECTS- 5 X 3 =15

Labs - 2 X 1.5 =3

Projects - 1 X 2 = 2

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20

Core courses

- 1) Strength of materials-I
- 2) Building materials and Construction
- 3) Surveying
- 4) Concrete technology
- 5) Estimation and costing
- 6) Surveying Lab
- 7) Concrete Technology lab
- 8) Project.

**(19A01501) DESIGN OF REINFORCED CONCRETE STRUCTURES**

**Course objectives:**

- To teach concepts of working stress and limit state methods.
- To impart design procedure of RC elements in flexure, shear and torsion.
- To teach design procedure for short and long RC columns.
- To explain design procedure of RC footings
- To demonstrate design of RC slab

**UNIT- I:**

**Introduction:**

Concepts of Reinforced concrete Design – Introduction to Working Stress Method - Limit State method – Material Stress- Strain Curves – Safety factors – Characteristic values. Stress Block parameters – IS – 456:2000. **Beams:** Limit state analysis and design of singly reinforced, doubly reinforced, T and L beam sections

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Familiarize with working stress and limit stress method of design.
- Understand stress block parameters in methods of analysis
- Design of beams of varying cross sections adopting IS Code

**UNIT -II:**

**Shear and torsion:**

Limit state analysis and design of section for shear and torsion – concept of bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing;

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand behavior of beams under shear and torsion
- Visualize importance of bond and anchorage
- Design and Detail RC beams under due to shear and torsion adopting IS Code.

### **UNIT -III:**

#### **Columns:**

Short and Long columns – under axial loads, uniaxial bending and biaxial bending – I S Code provisions.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand behavior of columns with different slenderness characteristics
- Contrast behavior of columns axial. And under uniaxial biaxial eccentricities
- Design and detail RC columns under different loads adopting IS Code.

### **UNIT -IV:**

#### **Footings:**

Different types of footings – Design of isolated, square, rectangular, circular footings and combined footings.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Classify footings based on shape and utility
- Examine the field conditions and suggest appropriate footings
- Design reinforced concrete footings.

### **UNIT- V:**

#### **Slabs & Stair Case:**

Design of one way slab, Two-way slabs and continuous slab using I.S. Coefficients Limit state design for serviceability for deflection, cracking and codal provision. Design of doglegged staircase.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Classify understand performance of slabs based on dimensions
- Design reinforced concrete slabs & Stair cases as per IS codal provisions.

**Codes/Tables:** IS 456-2000 and relevant sheets (Pertaining to columns) of SP 16 Code books to be permitted into the examinations Hall.



## **Course Outcome:**

After completing the course, the student will be able to,

- Understand the basic concepts of working stress and limit state design methods
- Design various RC elements like beams, columns, footings and slabs.
- Apply design concepts to complex structural systems in advanced courses.

## **TEXT BOOKS:**

1. B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, “Limit State Design”, Laxmi, Publications Pvt. Ltd., New Delhi
2. P. C. Varghese, Limit state “designed of reinforced concrete”, Prentice Hall of India, New Delhi

## **REFERENCES:**

1. N. Krishna Raju, “Structural Design and Drawing”, Universities Press Pvt Ltd, Hyderabad. 4<sup>th</sup> edition 2020.
2. N. C. Sinha and S. K Roy, “Fundamentals of reinforced concrete”, S. Chand publishers
3. N.Subramanian, “Design of Reinforced concrete structures”, Oxford university press.

## **IS CODE OF PRACTICE**

IS 456- 2000 Code of practice for Reinforced Concrete Structures.

## **NOTE: Assignment on preparation of drawing sheets showing detailing of various RC Elements**

All the designs to be taught in Limit State Method

Following plates should be prepared by the students.

- Reinforcement particulars of T-beams and L-beams.
- Reinforcement detailing of continuous beams.
- Reinforcement particulars of columns and footings.
- Detailing of One way, Two way and continuous slabs

**(19A01502) WATER RESOURCE ENGINEERING**

**Course Objectives:**

- To Illustrate hydrologic cycle and its relevance to Civil engineering
- To teach students understand physical processes in hydrology & components of the hydrologic cycle
- To demonstrate concepts and theory of physical processes and interactions
- To impart on measurement and estimation of the components hydrologic cycle.
- To provide an overview and understanding of Unit Hydrograph theory, flood frequency and its analysis

**UNIT -I**

**Introduction:**

Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data.

**Precipitation:** Types and forms, measurement, rain gauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, frequency of rainfall, Intensity-Duration-Frequency (IDF) curves, Depth-Area-Duration (DAD) curves, Probable Maximum Precipitation (PMP), design storm

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand basics of engineering hydrology and its applications.
- Demonstrate measurement techniques of precipitation.
- Learn curves related to frequency of rainfall..

**UNIT-II**

**Abstractions from Precipitation:**

Initial abstractions. Evaporation: factors affecting, measurement, reduction Evapo-transpiration: factors affecting, measurement, control - Infiltration: factors affecting, Infiltration capacity curve, measurement, infiltration indices.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Attain knowledge on factors influencing evaporation.

- Analyze factors influencing infiltration.

### **UNIT-III**

#### **Runoff and Hydrograph analysis:**

Catchment characteristics, Factors affecting runoff, components, computation- empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve. Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation of unit hydrograph, unit hydrographs of different durations, principle of superposition and S-hydrograph methods, limitations and applications of unit hydrograph, synthetic unit hydrograph – Floods: Causes and effects .

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Determine runoff characteristics and factors influencing runoff.
- Examine components of hydro graph.
- Develop knowledge on floods and its effects.

### **UNIT-IV**

**Groundwater:** Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, permeability, transmissivity and storage coefficient, types of wells, Darcy's law, Dupuit's equation- steady radial flow to wells in confined and unconfined aquifers, yield of a open well-recuperation test.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand basics about ground water.
- Learn and implement Darcy's law and Dupuit's equation.

### **UNIT-V**

#### **IRRIGATION:**

Introduction-necessity and impotence of irrigation-advantages and ill-effects of irrigation; types of irrigation; methods of application of water; quality for irrigation water; duty and delta; duty at various places; relation between duty and delta; factors affecting duty; methods of improving duty; soil-water-plant relationship; limiting soil moisture conditions, depth and frequency of irrigation.

#### **LIST OF DRAWINGS:**

**Draw the following irrigation structures.**

1. Sloping glacis weir
2. Surplus weir.
3. Tank sluice with tower head
4. Type III Syphon aqueduct.
5. Canal regulator.

**Course Outcomes**

At the end of the course the students are able to

- Understand of the theories and principles governing the hydrologic processes.
- Identify major hydrologic components and apply key concepts to several practical areas of engineering hydrology and related design aspects.
- Develop Intensity-Duration-Frequency and Depth-Area Duration curves to design hydraulic structures.
- Determine aquifer parameters, yield of wells and model hydrologic processes.
- Understand duty and delta.
- Understand soil, water, plant relationships.
- Design the Hydraulic structures.

**TEXT BOOKS:**

1. Jayarami Reddy P., “Engineering Hydrology”, Laxmi Publications Pvt. Ltd., (2013), New Delhi
2. B.C. Punmia, Pande B. B. Lal, Ashok Kumar Jain and Arun Kumar Jain, “Irrigation and Water Power Engineering”, Lakshmi Publications (P) Ltd.
3. C.Satyanarayana Murthy, “Design of minor irrigation and canal structures”, Wiley eastern Ltd

**REFERENCES:**

1. Subramanya K., “Engineering Hydrology”, Tata McGraw-Hill Education Pvt Ltd, (2013), New Delhi.
2. Santosh Kumar Garg,” Irrigation Engineering and Hydraulic Structure”, Khanna Publishers.
3. Chow V.T., D.R Maidment and L.W. Mays, “Applied hydrology”, Tata McGraw Hill Education Pvt Ltd, (2011), New Delhi.
4. Mays L.W, “Water Resources Engineering”, Wiley India Pvt. Ltd, (2013).

**(19A01503T) ENGINEERING GEOLOGY**

**Course Objectives:**

- To understand weathering process and mass movement
- To distinguish geological formations
- To identify geological structures and process of rock mass quality.
- To identify subsurface information and groundwater potential sites through geophysical investigations
- To apply geological principles of mitigation of natural hazards and select sites for dams and tunnels

**UNIT -I**

**Introduction:**

Application of Earth Science in Civil Engineering Practices, Understanding the earth, internal structure and composition. Weathering, erosion and denudations process on earth material and natural agencies, Geological work of wind, river underground water and glaciers Mineralogy: Mineral properties, composition and their use in the manufacture of construction materials – Quartz Group; Feldspar Group; Kaolin; Asbestos; Carbonate Group ; Gypsum; Mica Group; Ore minerals - Iron ores; pyrite; Chlorite

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the formation of earth and its internal structure
- Understand weathering and formation of natural minerals
- Explain composition of minerals and their utilization in construction industry.

**UNIT- II**

**Petrology & Structural Geology:**

Definition of rock - Rock forming processes - Geological classification of rocks - Dykes and sills, common structures and textures - Megascopic study, Chemical and Mineralogical Composition of rock (Granite, Gabbro, Dolerite, Basalt, Pegmatite, Laterite, Conglomerate, Sand Stone, Shale, Limestone, Tuff, Felsite, Gneiss, Schist, Quartzite, Breccia, Marble, Porphyries, Charnockite and Slate).

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand classification of rocks
- Demonstrate chemical composition
- Identify mineral composition of rock

**UNIT -III****Structural Geology:**

Out crop, strike and dip study of common geological structures associating with the rocks such as folds, faults unconformities, and joints – their important types. Their importance insitu and drift soils, common types of soils, their origin and occurrence in India

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain formation of folds strike and dip of geological structures
- Assess importance of soils and
- Locate origin of different types of rocks and soils and their origin India

**UNIT –IV****Geomorphology, hydrogeology and seismology:**

Ground water, Water table - ground water exploration. site selection for dams and tunnels – analysis of failures in dams and tunnels - Seismic zones of India - Earth quakes, their causes and effects. Seismic waves, Richter scale. Landslides - causes and effects; Tsunami –causes and effects.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand geomorphology
- Identify procedures for site selection of important structures
- Contrast seismic Zonation of India in stages
- Understand seismic scales and effects of major earthquakes earth quakes, landslides and Tsunami.

## **UNIT -V**

### **Geophysical Studies:**

Importance - Branches and necessity of Geophysical investigations - Gravity methods. Magnetic methods, Electrical methods. Seismic methods, Radio metric methods and Geothermal method. Electrical resistivity methods, and seismic refraction methods.

### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand importance of Geophysical investigations
- Carryout geo physical investigations using various methods.

### **Course Outcomes:**

At the end of the course student will be able to

- Gain basic knowledge on characteristics of rocks and minerals.
- Identify and differentiate rocks using geological classification.
- Carry out geo physical investigations for infrastructural projects.
- Apply concepts of structural geology for civil engineering structures.
- Understand the seismic zones of India.

### **TEXT BOOKS:**

1. D.Venkata Reddy, “Engineering Geology, Second edition”, Vikas Publishing house, Pvt, Ltd.
2. N. Chenna Kesavulu, “Text Book of Engineering Geology”, 2<sup>nd</sup> Edition (2009), Macmillan Publishers India.
3. Vasudev Kanithi, “Engineering Geology”, Universities Press Pvt Ltd, Hyderabad. 2012.

### **REFERENCES:**

1. Parbin Singh, “Engineering and General Geology”, 8<sup>th</sup> Edition (2010), S K Kataria & Sons.
2. J. C. Harvey, “Geology for Geotechnical Engineers”, Cambridge University Press (1982).
3. Richard E. Goodman, “Engineering Geology, Rock in Engineering Construction”, John Wiley & Sons, Inc. 1993.
4. Billings, M. P., “Structural Geology”, Prentice-Hall India, 1974, New Delhi
5. S.K.Duggal, H.K Pandey, N.Rawal, “Engineering Geology”, Mc.Graw Hill Education(India) Pvt. Ltd.

**(19A01504) STRUCTURAL ANALYSIS-II**

**Course objectives:**

- To impart knowledge of rotation contribution method of analysis.
- To enable the student to analyze the two hinged and three hinged arches
- To impart the student the knowledge of rolling loads and influence lines.
- To enable the student to undergo the analysis of matrix methods.
- To inculcate the knowledge of plastic analysis to the student.

**UNIT – I**

**Arches:** Introduction- hinges-transfer of load to arches-linear arch-hinges in the arch-arch action-Horizontal force – three hinged arches – circular arches – springs at different level-Two hinged arches- two hinged circular arches – fixed arches (only theory) - Temperature stresses in arches.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To Differentiate between two hinged and three arches.
- To analyze the arches by finding axial thrust and radial shear.
- To know the temperature effect in arches.

**UNIT – II**

**Rolling loads and influence line diagrams for determinate structures:** Introduction-simply supported beams – single concentrated load- UDL longer than the beam span – UDL shorter than the beam span- two wheel axles separated by a distance- multiple wheel axles (train of loads)- influence line diagram for shear force and bending moments – influence line diagrams for three hinged arches.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Know the effect of rolling loads on bridges
- Draw the influence lines of variable for a given moving load on bridges.



## UNIT – III

**Matrix method of structural analysis-flexibility method:** Introduction- Different approaches to matrix method- degree of static and kinematic indeterminacy-generalized coordinate system-flexibility matrix- application to beams.

### Learning Outcomes:

At the end of this unit, the student will be able to

- Introduce matrix methods in structural analysis.
- Develop flexibility matrix for the structural elements.

## UNIT – IV

**Stiffness matrix method:** Introduction- stiffness matrix-relationship between flexibility and stiffness matrices-flexibility matrix method- stiffness matrix method – application to simple beams.

### Learning Outcomes:

At the end of this unit, the student will be able to

- Develop stiffness matrix for the structural elements.
- Develop relationship between flexibility and stiffness matrices.

## UNIT – V

**Plastic analysis:** Introduction- definition of plastic hinge and plastic moment capacity – Assumptions- shape factor- shape factor for general sections – collapse load – basic theorems for finding collapse loads-methods of plastic analysis-static method-kinematic method- kinematic method applied to beams and simple frames- beam mechanism- sway mechanism-combined mechanism.

### Learning Outcomes:

At the end of this unit, the student will be able to

- To know plastic moment capacity of a structural member.
- To find the collapse load for a structural member.
- To find the collapse mechanism for a structural member.

**Course Outcomes:**

At the end of the course student will be able to

- Analyze the final moments at the ends of the members
- Analyze bending moment, normal thrust and radial shear in the arches
- Analyze the variation of shear force and bending moment in the members due to rolling loads
- Analyze the degree of indeterminacy of the structures, reactions and displacements
- Analyze the formation of plastic hinges in different mechanisms

**TEXT BOOKS:**

1. Ramamurtham S., “Theory of Structures”, Dhanpat Rai Publishing Company (p) Ltd,
2. C. S. Reddy, “Basic Structural Analysis”, Tata McGraw Hill
3. S.S. Bhavikatti, “Structural analysis”, Volume 1 and 2, Vikas publishing house pvt. Ltd.
4. Dr.Vaidyanathan, Dr.P.Perumal, “Comprehensive structural analysis”, Vol-II, Laxmi Publications (P) Ltd.

**REFERENCES**

1. Timoshenko & Young, “Theory of Structures”, Tata McGraw Hill
2. Junarkar S. B., “Structural Mechanics”, Vol I & II, Charotar Publishers
3. C. K. Wang, “Intermediate Structural Analysis”, McGraw Hill

**(19A01505a) BUILDING CONSTRUCTION PRACTICE  
PROFESSIONAL ELECTIVES-I**

**Course Objectives:**

- To Impart knowledge in investigation of soil condition, Deciding and design of suitable foundation for different structures
- To examine the good materials to be used for the construction work
- To teach to supervision of different types of masonry
- To illustrate the methodology in selection of materials, design and supervision of suitable type of floor and roof.
- To teach the methodology of constructing advances structures

**UNIT -I:**

**Structural Components:**

Foundations – classification of Foundations – consideration in selection of foundation types – Masonry – Brick and block walls – Cavity walls – Damp-proof courses and membranes – Mortars – Arches and openings – Windows – Glass and glazing –Doors – Stairs – Types and Applications – Cladding to external walls – Flat roofs – Dormer windows – Formwork & Scaffolding – Precast concrete frames – Portal frames – Types – components – Framed structures – Components – Construction Procedure – Panel walls – National Standards.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand components of structures and their performance
- Explain construction materials their importance
- Understand formwork and scaffolding

**UNIT -II:**

**Internal Construction and Finishes**

Internal elements – Internal walls – Construction joints – Internal walls, fire protection – separating walls – Partitions – Plasters and plastering – Domestic floors and finishes – Sound insulation – Timber, concrete and metal stairs–Internal doors – Door – Fire resisting doors – Plasterboard ceilings – Suspended ceilings –Paints and painting – Components of Paints – Types

of Paint – Considerations in Selecting Paints – Cement Paints – Oil Paints –Emulsion - Paints – Whitewash and Colour wash – Application of Paints –Distempers – Varnishes – Safety –Joinery production – Composite boarding – National Standards.

### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand internal components of structures and their performance
- Explain different features of interiors of a building and their importance
- Compare different types of construction materials
- Examine relative advantages and limitations

## **UNIT- III:**

### **Construction of high rise buildings:**

Construction methods and techniques using different materials, Minerals, Admixtures in-situ concrete, Precast Concrete & Structural Steel, finished concrete, tunnel form, fire Fighting, Safety & Hazards, Job Safety Analysis. Innovative methods of construction – Slip form technology, Jump form technology, Aluform & Tunnel Form Technology, Dry wall technology, Plastering Machines.

### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Develop knowledge on construction of high rise building
- Understand materials used for components of structures
- Explain safety requirements and provisions in high rise buildings

## **UNIT -IV:**

### **Concepts and components of bridges:**

Bridges, Steel Bridges, Arch Bridges, Cantilever Bridges Segmental construction & Box Girders. Construction of special type of bridges such as cable stayed bridge, suspension and Pre-stressed bridge, construction of foundation and Super structure. Construction of Metro Railway & Monorail - Underground and over ground structures, different methods and techniques of construction. Problems and solutions – during maintenance and upkeep of structures. Fire, Ventilation, Dewatering and power supply, Subsidence, Vibration etc., Concept of Mag-rail.

### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Classify types of bridges based on features materials and engineering

- Develop procedures for construction of different types of bridges
- Study advanced technologies in developing Metrorail facilities
- Appraise importance of maintenance of bridges

## **UNIT -V:**

### **Construction of Power Generating Structures**

Atomic Power stations, Thermal power stations- Generation Power Plants, Windmills, Transmission towers, Chimneys (single and multi-flue), cooling towers - Natural draft cooling towers (NDCT) & Induced draft cooling tower (IDCT), Ash handling system, Containment Structure, Electro Static Precipitator (ESP), Case study of Kaiga atomic power station, Madras atomic power station. Or Any other Case Study and Safety Hazards

### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand procedures for construction of power generating infrastructure
- Develop knowledge on existing important power plants and their role in development

### **Course outcomes:**

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

- Classify suitable materials for buildings and adopt suitable construction techniques.
- Adopt suitable internal finishes and maintenance work to enhance durability of buildings.
- Design of high rise buildings.
- Design of power generation structures.

### **TEXT BOOKS:**

1. Roy Chudley and Roger Greeno, “Construction Technology”, Prentice Hall, 2005.
2. Peurifoy, “Construction Planning, Equipment and methods”, Tata McGraw Hill Publication

### **REFERENCES**

1. Mahesh Varma, “Construction Equipment Planning and Applications”.
2. Kumar Niraj Jha, - “Formwork for Concrete Structures”, Mc Graw Hill Publication
3. Sushil Kumar “Building Materials and construction”, 20<sup>th</sup> edition, reprint 2015, Standard Publishers
4. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, “Building Construction”, Laxmi Publications (P) Ltd., New Delhi.

**(19A01505b) SUBSURFACE INVESTIGATION AND INSTRUMENTATION  
PROFESSIONAL ELECTIVES-I**

**Course Objectives:**

- To discuss the importance of site investigation,
- To narrate various exploration techniques
- To describe soil sampling techniques.
- To train with in-situ sub soil exploration methods
- To demonstrate instrumentation for sub soil exploration.

**UNIT -I**

**Exploration and geophysical methods:**

Exploration program planning -methods of exploration- preliminary and detailed design-spacing and depth of bores, data presentation. Geophysical exploration and interpretation, seismic and electrical methods, cross bore hole, single bore hole – up hole -down hole methods.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand exploration process
- Learn about different geophysical methods of exploration.

**UNIT –II**

**Exploration Techniques**

Methods of boring and drilling, non-displacement and displacement methods, drilling in difficult subsoil conditions, limitations of various drilling techniques, stabilization of boreholes, bore logs.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Learn various exploration techniques.
- Determine appropriate methods of exploration based on limitations

## **UNIT -III**

### **Soil Sampling**

Sampling Techniques – quality of samples – factors influencing sample quality - disturbed and undisturbed soil sampling advanced sampling techniques, offshore sampling, shallow penetration samplers, preservation and handling of samples.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand concepts of sampling
- Study different types of sampling techniques.

## **UNIT -IV**

### **Field Testing In Soil Exploration**

Field tests, penetration tests, Field vane shear, Insitu shear and bore hole shear test, pressure meter test, dilatometer test - plate load test–monotonic and cyclic; field permeability tests – block vibration test. Procedure, limitations, correction and data interpretation.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Develop in-situ soil exploration methods.
- Interpret data of soil exploration and documentation

## **UNIT -V**

### **Instrumentation**

Instrumentation in soil engineering, strain gauges, resistance and inductance type, load cells, earth pressure cells, settlement and heave gauges, pore pressure measurements - slope indicators, sensing units, case studies.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Choose appropriate instrumentation in sub soil exploration process.
- Soil Character measurement and case studies.

**Course Outcomes:**

At the end of the course student is able to

- Plan and execute sub soil investigation programme.
- Handle both laboratory and in-situ testing techniques.
- Carry out collection, handling and preservation of samples.
- Handle instruments during sub soil exploration process

**TEXT BOOKS:**

1. Alam Singh and Chowdhary G. R., "Soil Engineering in Theory and Practice, Volume-2, Geotechnical testing and instrumentation", CBS Publishers and Distributors, New Delhi, 2006.
2. Dunnicliff J., and Green, G. E., "Geotechnical Instrumentation for Monitoring Field Performance", John Wiley, 1993.

**REFERENCES:**

1. Bowles J. E., "Foundation Analysis and Design", 5<sup>th</sup> Edition, The McGraw-Hill companies, Inc., New York, 1995.
2. C. Venkataramiah, "Geotechnical Engineering", New age International Pvt . Ltd, (2002).
3. Hanna T. H., "Field Instrumentation in Geotechnical Engineering", Trans Tech., 1985.
4. Hunt R. E., "Geotechnical Engineering Investigation Manual", McGraw Hill, 1984.



**(19A01505c) ENVIRONMENTAL POLLUTION AND CONTROL  
PROFESSIONAL ELECTIVE-I**

**Course Objectives:**

- Impart knowledge on aspects of air pollution & control and noise pollution
- Impart concepts of treatment of waste water from industrial source.
- Differentiate the solid and hazardous waste based on characterization
- Introduce sanitation methods essential for protection of community health.
- Provide basic knowledge on sustainable development.

**UNIT – I:**

**Air Pollution:**

Air pollution Control Methods–Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards. Noise Pollution: Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO:14000.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand control mechanism of air pollutants
- Design noise reduction techniques.

**UNIT –II:**

**Industrial waste water Management:**

Strategies for pollution control – Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants – Recirculation of industrial wastes – Effluent standards.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the importance of treatment process of industrial effluents.
- Design treatment plants

### **UNIT – III:**

**Solid Waste Management:** solid waste characteristics – basics of on-site handling and collection – separation and processing – Incineration- Composting-Solid waste disposal methods – fundamentals of Land filling. **Hazardous Waste:** Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Classification of solid waste and separation and procession solid waste
- Identification of Hazardous wastes
- Plan and execute solid waste and hazardous waste management.

**UNIT – IV: Environmental Sanitation:** Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low cost waste disposal methods.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand importance of hygienic environment
- Suggest appropriate rural sanitation methods to keep surrounding clean.

### **UNIT – V:**

**Sustainable Development:** Definition- elements of sustainable developments-Indicators of sustainable development- Sustainability Strategies- Barriers to Sustainability–Industrialization and sustainable development – Cleaner production in achieving sustainability- sustainable development.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Execute sustainable development strategies.

#### **Course Outcomes:**

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

- Understand the fundamentals of solid waste management, practices adopted in his town/village and its importance in keeping the health of the city.

- Identify the air pollutant control devices and have knowledge on the NAAQ standards and air emission standards.
- Differentiate the treatment techniques used for sewage and industrial wastewater treatment.
- Inventing the methods of environmental sanitation and the management of community facilities without spread of epidemics.
- Appreciate the importance of sustainable development while planning a project or executing an activity.

## **TEXT BOOKS**

1. Peavy, H. S., Rowe, D.R, Tchobanoglous, “Environmental Engineering”, G.Mc-Graw Hill International Editions, New York 1985.
2. J. G. Henry and G.W. Heinke, “Environmental Science and Engineering”, Pearson Education.

## **REFERENCES:**

1. G. L. Karia and R.A. Christian, “Waste water treatment- concepts and design approach”, Prentice Hall of India
2. M. N. Rao and H. V. N. Rao, “Air pollution”, Tata Mc.Graw Hill Company.
3. Ruth F. “Weiner and Robin Matthews Environmental Engineering”, 4<sup>th</sup> Edition Elsevier, 2003.
4. K. V. S. G. Murali Krishna, “Air Pollution and Control” by, Kousal & Co. Publications, New Delhi.

(19A01505d) **ADVANCED SURVEYING**  
**PROFESSIONAL ELECTIVE-I**

**Course Objectives:**

- To make the student to get well conversant with the fundamentals of triangulation surveying.
- To introduce to the students the methods of hydrographic surveying
- To make the student to use photogrammetry in surveying
- To enable the student to set simple horizontal curves.
- To introduce the knowledge construction surveys and usage of modern instrument such as total station.

**UNIT – I**

**Triangulation:** Geodetic surveying-classification of triangulation system-triangulation figures-strength of figure-reconnaissance- signals and towers.

**Base line measurement-** calculation of length of base line-Selecting a base line site- apparatus for baseline measurement-fieldwork for base measurement-corrections to the observed length of a base line-the base net-auxiliary operations in base line work.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To impart basic concepts of triangulation surveying.
- To impart the essentiality of the base line measurement in a triangulation system.

**UNIT - II**

**Hydrographic surveying** – Introduction-tides-equilibrium theory-spring tides and neap tides-priming and lagging-primary and derivative tide waves – lunar tidal interval- tide prediction-tide gauges-mean sea level-shoreline surveys-sounding equipment and methods-locating the soundings –reduction and plotting the soundings-three point problem-tidal current surveys-capacity of a reservoir –river surveying –area velocity method-weir method-chemical method .

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To impart basic principles in hydrographic surveying.
- To know practical applications of soundings in hydrographic surveying.

### **UNIT - III**

**Photogrammetric Surveying:** Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand photogrammetry adopting various techniques.
- Map areas using triangulation
- Distinguish different types of plotting instruments

### **UNIT -IV Typical Curve Setting:**

Compound and reverse curves- elements of compound curve-relationship between the parts of a compound curve-setting out compound curve-elements of a reverse curve-relationships between various parts of a reverse curve.

Transition curves-general requirements-length of transition curve- the ideal transition curve: clothoid-characteristics of a transition curve-computations and setting out – spiraling compound curves – spiraling of reverse curves – Bernoulli's lemniscates curve.

Vertical curves: Introduction to vertical curves – Types of vertical curves.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- To understand about necessity of compound and reverse curves.
- To understand the essentiality condition for transition curves
- To understand the different vertical curves.

### **UNIT -V**

**Remote Sensing:** Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing.

**GPS:** Segments, GPS measurements, errors and biases, co-ordinate transformation, accuracy considerations.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand principles of remote sensing.

- Carryout data acquisition and interpretation
- Understand the principles of GPS

### **Course Outcomes:**

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

- Apply triangulation in surveying
- Correlate knowledge to frontiers like Hydrography, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing.
- Identify data collection methods and prepare field notes

### **TEXT BOOKS:**

1. R. Subramanian, "Surveying and leveling", Oxford university press, New Delhi.
2. Chandra A M, "Higher Surveying", New age International Pvt. Ltd., Publishers, New Delhi, 2002.
3. Hoffman. B, H. Lichtenegga and J. Collins, "Global Positioning System" - Theory and Practice, Springer -Verlag Publishers, 2001.
4. C.Venkatramaiah, "Text book of surveying", 2<sup>nd</sup> edition, Universities press, 2018

### **REFERENCES:**

1. Arthur R Benton and Philip J Taety, "Elements of Plane Surveying", McGraw Hill – 2000.
2. Arora K R "Surveying Vol 1, 2 & 3), Standard Book House, Delhi, 2004.
3. B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain – "Surveying" (Vol – 1, 2 & 3), Laxmi Publications (P) ltd., New Delhi.
4. Chandra A M, "Plane Surveying", New Age International Pvt. Ltd., New Delhi, 2002.
5. Bhavikatti; "Surveying", Vikas publishing house ltd.
6. Duggal S K, "Surveying (Vol – 1 & 2)", Tata McGraw Hill Publishing Co. Ltd. New Delhi, 2004.
7. R. Agor Khanna "Surveying and leveling", Publishers 2015.

**(19A01505e) URBAN HYDROLOGY**  
**PROFESSIONAL ELECTIVE-I**

**Course Objectives**

- To impart impact of urbanization on catchment hydrology.
- To narrate the importance of rainfall runoff data for urban hydrology.
- To teach techniques for peak flow estimation for storm water drainage system design.
- To explain the design concepts of components in urban drainage systems.
- To Train for preparation of master urban drainage system.

**UNIT -I:**

**Introduction:**

Urbanization and its effect on water cycle – urban hydrologic cycle – Effect of urbanization on hydrology. **Precipitation Analysis:** Importance of short duration of rainfall and runoff data, methods of estimation of time of concentration and design of urban drainage systems, Intensity-Duration -Frequency (IDF) curves, design storms for urban drainage systems.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Define Urbanization and its effects
- Understand basic concepts of hydrological cycle.

**UNIT -II:**

**Methods of Urban Drainage:**

Time of concentration, peak flow estimation approaches, rational method, NRCS curve number approach, runoff quantity and quality, wastewater and storm water reuse , major and minor systems. Drainage systems: Open channel, underground drains, appurtenances, pumping, source control.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Acquire skills for rainfall data acquisition
- Design of drainage system.

### **UNIT -III:**

#### **Analysis and Management:**

Storm water drainage structures, design of storm water network- Best Management Practices—detention and retention facilities, swales, constructed wetlands, models available for storm water management.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Design drainage network scheme.

### **UNIT -IV:**

#### **Master drainage plans:**

Issues – typical urban drainage master plan, interrelation between water resources investigation and urban planning processes, planning objectives, comprehensive planning , use of models in planning.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Prepare proper plan for storm water drainage system

### **UNIT –V:**

#### **Hydrological models:**

General principles of hydrological modelling - The Rational Method - The time-area method - The unit hydrograph method - Physically based distributed models - Physically based partially distributed models - Hydraulic modelling - Model calibration and validation - Probabilistic models - Expert systems

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Develop hydraulic models.

### **Course Outcomes**

At the end of the course the student will be able to

- Develop intensity duration frequency curves for urban drainage systems.
- Develop design storms to size the various components of drainage systems.
- Apply best management practices to manage urban flooding.



- Develop master drainage plan for an urbanized area.

### **TEXT BOOKS:**

1. Akan A.O and R.L. Houghtalen, “Urban Hydrology, Hydraulics and Stormwater Quality: Engineering Applications and Computer Modelling (2006)”, Wiley International.
2. Hall M. J., Urban Hydrology (1984), Elsevier Applied Science Publisher.

### **REFERENCES BOOKS:**

1. Geiger W. F., J Marsalek, W. J. Rawls and F. C. Zuidema, “Manual on Drainage in Urbanised area’ (1987 – 2 volumes)”, Unesco,
2. Wanielista M. P. and Eaglin, Hydrology, “Quantity and Quality Analysis (1997)”, Wiley and Sons.
3. Stahre P. and Urbonas B., “Stormwater Detention for Drainage (1990)”, Water Quality and CSO Management, Prentice Hall.
4. Maksimovic C. and J. A. Tejada-Guibert, “Frontiers in Urban Water Management”, Deadlock or Hope (2001), IWA Publishing.

**(19A01506a) EXPERIMENTAL STRESS ANALYSIS  
OPEN ELECTIVE-I**

**Course Objective:**

To bring awareness on experimental method of finding the response of the structure to different types of load.

- Demonstrates principles of experimental approach.
- Teaches regarding the working principles of various strain gauges.
- Throws knowledge on strain rosettes and principles of non destructive testing of concrete.
- Gives an insight into the principles of photo elasticity.

**UNIT-I**

**PRINCIPLES OF EXPERIMENTAL APPROACH:** - Merits of Experimental Analysis  
Introduction, uses of experimental stress analysis advantages of experimental stress analysis,  
Different methods –Simplification of problems.

**Learning outcomes:**

At the end of the unit, students will be able to:

- Demonstrate the merits and principles of experimental approach
- Give an insight into the uses and advantages of experimental stress analysis

**UNIT-II**

**STRAIN MEASUREMENT USING STRAIN GAUGES:** - Definition of strain and its relation of experimental Determinations Properties of Strain Gauge Systems-Types of Strain Gauges – Mechanical, Acoustic and Optical Strain Gauges. Introduction to Electrical strain gauges - Inductance strain gauges – LVDT – Resistance strain gauges – various types –Gauge factor – Materials of adhesion base.

**Learning outcomes:**

At the end of the unit, students will be able to:

- Introduce various strain gauge systems and their properties
- Give information regarding the gauge factor and materials of adhesion bases

### **UNIT-III**

**STRAIN ROSSETTES AND NON – DESTRUCTIVE TESTING OF CONCRETE:-**  
Introduction – the three elements Rectangular Rosette – The Delta Rosette Corrections for Transverse Strain Gauge. Ultrasonic Pulse Velocity method –Application to Concrete. Hammer Test – Application to Concrete.

#### **Learning outcomes:**

At the end of the unit, students will be able to:

- Introduces various strain rosettes and corrections for strain gauges
- Gives an insight into the destructive and non destructive testing of concrete

### **UNIT-IV**

**THEORY OF PHOTOELASTICITY: -** Introduction –Temporary Double refraction – The stress Optic Law –Effects of stressed model in a polariscope for various arrangements – Fringe Sharpening. Brewster’s Stress Optic law.

#### **Learning outcomes:**

At the end of the unit, students will be able to:

- Introduces stress optic laws.
- Gives the arrangements and working principles of polariscope.

### **UNIT-V**

**TWO DIMENSIONAL PHOTOELASTICITY: -** Introduction – Iso-chromatic Fringe patterns- Isoclinic Fringe patterns passage of light through plane Polariscope and Circular polariscope Isoclinic Fringe patterns – Compensation techniques – Calibration methods – Separation methods – Scaling Model to prototype Stresses – Materials for photo – Elasticity Properties of Photoelastic Materials.

#### **Learning outcomes:**

At the end of the unit, students will be able to:

- Introduces the understanding of different fringe patterns.
- Introduces model analysis and properties of photo elastic materials.

#### **Course Outcomes:**

After completion of the course

- The student will be able to understand different methods of experimental stress analysis
- The student will be able to understand the use of strain gauges for measurement of strain
- The student will be exposed to different Non destructive methods of concrete
- The student will be able to understand the theory of photo elasticity and its applications in analysis of structures

**TEXT BOOKS:-**

1. J.W.Dally and W.F.Riley, "Experimental stress analysis College House Enterprises"
2. Dr.Sadhu Singh, "Experimental stress analysis", khanna Publishers

**REFERENCE BOOKS:**

1. U.C.Jindal, "Experimental Stress analysis", Pearson Publications.
2. L.S.Srinath, "Experimental Stress Analysis", MC.Graw Hill Company Publishers.

**(19A01506b) BUILDING TECHNOLOGY**

**OPEN ELECTIVE-I**

**Course Objectives:**

- To impart to know different types of buildings, principles and planning of the buildings.
- To identify the termite control measure in buildings, and importance of grouping circulation, lighting and ventilation aspects in buildings.
- To know the different modes of vertical transportation in buildings.
- To know the utilization of prefabricated structural elements in buildings.
- To know the importance of acoustics in planning and designing of buildings.

**UNIT-I**

Overview of the course, basic definitions, buildings-types-components- economy and design-principles of planning of buildings and their importance. Definitions and importance of grouping and circulation-lighting and ventilation-consideration of the above aspects during planning of building.

**Learning outcomes:**

At the end of the unit, students will be able to:

- To be able to plan the building with economy and according to functional requirement.

**UNIT-II**

Termite proofing: Inspection-control measures and precautions- lighting protection of buildings-general principles of design of openings-various types of fire protection measures to be considered while planning a building.

**Learning outcomes:**

At the end of the unit, students will be able to:

- Able to know the termite proofing technique to the building and protection from lightening effects.
- To be able to know the fire protection measure that are to be adopted while planning a building.

### **UNIT-III**

Vertical transportation in a building: Types of vertical transportation-stairs-different forms of stairs- planning of stairs- other modes of vertical transportation – lifts-ramps-escalators.

#### **Learning outcomes:**

At the end of the unit, students will be able to:

- To be able to know the different modes of vertical transportation and their suitability

### **UNIT-IV**

Prefabrication systems in residential buildings- walls-openings-cupboards-shelves etc., planning and modules and sizes of components in prefabrication. Planning and designing of residential buildings against the earthquake forces, principles, seismic forces and their effect on buildings.

#### **Learning outcomes:**

At the end of the unit, students will be able to:

- Identify the adoption of prefabricated elements in the building.
- Know the effect of seismic forces on buildings

### **UNIT-V**

Acoustics – effect of noise – properties of noise and its measurements, principles of acoustics of building. Sound insulation- importance and measures.

#### **Learning outcomes:**

At the end of the unit, students will be able to:

- To know the effect of noise, its measurement and its insulation in planning the buildings

#### **Course Outcomes:**

After completion of the course the student will be able to

- Understand the principles in planning and design the buildings.
- Know the different methods of termite proofing in buildings.
- Know the different methods of vertical transportation in buildings.
- Know the implementation of prefabricated units in buildings and effect of earthquake on buildings.
- Know the importance of acoustics in planning and designing of buildings.

**TEXT BOOKS :**

1. Varghese, “Building construction”, PHI Learning Private Limited.
2. Punmia.B.C, “Building construction”, Jain.A.K and Jain.A.K Laxmi Publications.
3. S.P.Arora and S.P.Brndra “Building construction”, Dhanpat Rai and Sons Publications,  
New Delhi
4. “Building construction-Technical teachers training institute”, Madras, Tata McGraw Hill.

**REFERENCE BOOKS:**

1. National Building Code of India, Bureau of Indian Standards

**(19A02506a) ELECTRICAL ENGINEERING MATERIALS  
(OPEN ELECTIVE-I)**

**Course Objectives:**

To make the students learn about

- Classification of materials.
- Properties of materials and its applications.
- Domestic wiring and earthing

**UNIT-I Conducting Materials**

Introduction – classification of materials – Metals and Non metals, physical, thermal, mechanical and electrical properties of materials – classification of electrical materials – concept of atom – electron configuration of atom, conductors, general properties of conductors, factors effecting resistivity of electrical materials –electrical/mechanical/thermal properties of copper, aluminum, iron, steel, lead, tin and their alloys – applications.

**Learning outcomes:**

At the end of the unit, students will be able to:

- Understand the classification of conducting materials.
- Analyze the properties of different conducting materials
- Apply the materials where it is applicable
- Know about electron configuration of atom

**UNIT-II Dielectric and High Resistivity Materials**

Introduction – solid, liquid and gaseous dielectrics, leakage current, permittivity, dielectric constant, dielectric loss – loss angle – loss constant, Breakdown voltage and dielectric strength of – solid, liquid and gaseous dielectrics, effect of break down– electrical and thermal effects, Polarization – electric, ionic and dipolar polarization. Effect of temperature and Frequency on dielectric constant of polar dielectrics. High Resistivity materials – electrical / thermal / mechanical properties of Manganin, Constantan, Nichrome, Tungsten, Carbon and Graphite and their applications in electrical equipment.

**Learning outcomes:**

At the end of the unit, students will be able to:

- Understand the classification of dielectric and high resistivity materials.
- Analyze the properties of dielectric and high resistivity materials
- Understand about concept of polarization and dipolar polarization
- Apply the materials where it is applicable



### **UNIT-III Solid Insulating Materials**

Introduction – characteristics of a good electrical insulating materials – classification of insulating materials – electrical, thermal, chemical and mechanical properties of solid insulating materials - Asbestos, Bakelite, rubber, plastics, thermo plastics. Resins, polystyrene, PVC, porcelain, glass, cotton and paper.

#### **Learning outcomes:**

At the end of the unit, students will be able to:

- Understand about various characteristics of solid insulating materials
- Understand the classification of solid insulating materials.
- Analyze the properties of solid insulating materials
- Apply the materials where it is applicable

### **UNIT-IV Liquid & Gas Insulating Materials**

Liquid insulating materials – Mineral oils, synthetic liquids, fluorinated liquids – Electrical, thermal and chemical properties – transformer oil – properties – effect of moisture on insulation properties Gaseous insulators – classification based on dielectric strength – dielectric loss, chemical stability properties and their applications.

#### **Unit Outcomes:**

At the end of the unit, the student will be able to

- Understand the classification of liquid insulating materials.
- Analyze the properties of liquid insulating materials
- Apply the materials where it is applicable
- Understand about properties and classification of gaseous insulators

### **UNIT-V Domestic Wiring**

Wiring materials and accessories – Types of wiring – Types of Switches - Specification of Wiring – Stair case wiring - Fluorescent lamp wiring- Godown wiring – Basics of Earthing – single phase wiring layout for a residential building.

#### **Learning Outcomes:**

At the end of the unit, the student will be able to

- Understand about wiring materials and accessories
- Understand about earthing and wiring layout of domestic buildings
- Design and develop Residential wiring
- Know about godown wiring

**Course Outcomes:**

After completing the course, the student should be able to:

- Understand the classification of materials, domestic wiring materials and earthing.
- Analyze the properties of different electrical materials
- Apply where the materials are applicable based on properties of materials
- Design and develop Residential wiring, godown wiring and earthing.

**Text Books:**

1. G.K. Mithal, “Electrical Engineering Materials”, Khanna publishers, 2<sup>nd</sup> edition, 1991.
2. R.K. Rajput, A course in “Electrical Engineering Materials”, Laxmi publications, 2009.

**Reference Books:**

1. C.S. Indulkar and S. Thiruvengadam, “An Introduction to Electrical Engineering Materials” S Chand & Company, 2008.
2. Technical Teachers Training Institute, “Electrical engineering Materials”, 1<sup>st</sup> Edition, Madras, McGraw Hill Education, 2004.
3. by S.P. Seth, “A course in Electrical Engineering Materials Physics Properties & Applications”, Dhanapat Rai & Sons Publications, 2018.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (CE)– III-I**  

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**(19A03506a) INTRODUCTION TO HYBRID AND ELECTRIC VEHICLES**  
**OPEN ELECTIVE-I**

**Course Objectives:**

- Provide good foundation on hybrid and electrical vehicles.
- To address the underlying concepts and methods behind power transmission in hybrid and electrical vehicles.
- Familiarize energy storage systems for electrical and hybrid transportation.
- To design and develop basic schemes of electric vehicles and hybrid electric vehicles.

**UNIT I: Electric Vehicle Propulsion and Energy Sources**

Introduction to electric vehicles, vehicle mechanics - kinetics and dynamics, roadway fundamentals propulsion system design - force velocity characteristics, calculation of tractive power and energy required, electric vehicle power source - battery capacity, state of charge and discharge, specific energy, specific power, Ragone plot. battery modeling - run time battery model, first principle model, battery management system- soc measurement, battery cell balancing. Traction batteries - nickel metal hydride battery, Li-Ion, Lipolymer battery.

**Learning Outcomes:**

After successful completion of this unit, the students will be able to

- Summaries the concepts of electrical vehicle propulsion and energy sources. (I2)
- Identify the types of power sources for electrical vehicles.(I3)
- Demonstrate the design considerations for propulsion system. (I2)
- Solve the problems on tractive power and energy required. (I3)

**UNIT II: Electric Vehicle Power Plant And Drives**

Introduction electric vehicle power plants. Induction machines, permanent magnet machines, switch reluctance machines. Power electronic converters-DC/DC converters - buck boost converter, isolated DC/DC converter. Two quadrant chopper and switching modes. AC drives- PWM, current control method. Switch reluctance machine drives - voltage control, current control.

**Learning Outcomes:**

After successful completion of this unit, the students will be able to

- Choose a suitable drive scheme for developing an electric vehicles depending on resources.(11)
- List the various power electronic converters. (11)
- Describe the working principle dc/dc converters and buck boost convertor. (12)
- Explain about ac drives. (12)

### **UNIT III: Hybrid And Electric Drive Trains**

Introduction hybrid electric vehicles, history and social importance, impact of modern drive trains in energy supplies. Hybrid traction and electric traction. Hybrid and electric drive train topologies. Power flow control and energy efficiency analysis, configuration and control of DC motor drives and induction motor drives, permanent magnet motor drives, switch reluctance motor drives, drive system efficiency.

#### **Learning Outcomes:**

After successful completion of this unit, the students will be able to

- Identify the social importance of hybrid vehicles. (13)
- Discuss impact of modern drive trains in energy supplies. (16)
- Compare hybrid and electric drive trains.(12)
- Analyze the power flow control and energy efficiency. (16)

### **UNIT IV: Electric and Hybrid Vehicles - Case Studies**

Parallel hybrid, series hybrid -charge sustaining, charge depleting. Hybrid vehicle case study – Toyota Prius, Honda Insight, Chevrolet Volt. 42 V system for traction applications. Lightly hybridized vehicles and low voltage systems. Electric vehicle case study - GM EV1, Nissan Leaf, Mitsubishi Miev. Hybrid electric heavy duty vehicles, fuel cell heavy duty vehicles.

#### **Learning Outcomes:**

After successful completion of this unit, the students will be able to

- List the various electric and hybrid vehicles in the present market. (11)
- Discuss lightly hybridized vehicle and low voltage systems.(16)
- Explain about hybrid electric heavy duty vehicles and fuel cell heavy duty vehicles. (12)

## **UNIT V: Electric And Hybrid Vehicle Design :**

Introduction to hybrid vehicle design. Matching the electric machine and the internal combustion engine. Sizing of propulsion motor, power electronics, drive system. Selection of energy storage technology, communications, supporting subsystem. Energy management strategies in hybrid and electric vehicles - energy management strategies- classification, comparison, implementation.

### **Learning Outcomes:**

After successful completion of this unit, the students will be able to

- Illustrate matching the electric machine and the internal combustion engine. (I2)
- Select the energy storage technology. (I3)
- Select the size of propulsion motor. (I3)
- Design and develop basic schemes of electric and hybrid electric vehicles. (I3)

### **Course outcomes:**

After learning the course the students will be able to:

- Explain the working of hybrid and electric vehicles. (I2)
- Choose a suitable drive scheme for developing an hybrid and electric vehicles depending on resources. (I3)
- Develop the electric propulsion unit and its control for application of electric vehicles.(I3)
- Choose proper energy storage systems for vehicle applications. (I3)
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles.(I3)

### **Text Books :**

1. Iqbal Hussein, “Electric and Hybrid Vehicles: Design Fundamentals”, 2<sup>nd</sup> edition, CRC Press, 2003.
2. [Amir Khajepour](#), [M. Saber Fallah](#), [Avesta Goodarzi](#), “Electric and Hybrid Vehicles: Technologies, Modeling and Control - A Mechatronic Approach”, illustrated edition, John Wiley & Sons, 2014.
3. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2004.

### **References:**

1. James Larminie, John Lowry, “Electric Vehicle Technology”, Explained, Wiley, 2003.
2. John G. Hayes, [G. Abas Goodarzi](#), “Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles”, 1<sup>st</sup> edition, Wiley-Blackwell, 2018.

**(19A03506b) RAPID PROTOTYPING  
OPEN ELECTIVE-I**

**Course Objectives:**

- Familiarize techniques for processing of CAD models for rapid prototyping.
- Explain fundamentals of rapid prototyping techniques.
- Demonstrate appropriate tooling for rapid prototyping process.
- Focus Rapid prototyping techniques for reverse engineering.
- Train Various Pre – Processing, Processing and Post Processing errors in RP Processes.

**UNIT – I**

**10 Hours**

**Introduction:** Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

**RP Software:** Need for RP software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, SolidView, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP.

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Explain prototyping process. (12)
- Classify different rapid prototyping processes. (12)
- Summarize rp software's and represent a 3d model in stl format, other rp data formats. (12)

**UNIT – II**

**8 Hours**

**Solid and Liquid Based RP Systems:** Stereolithography (SLA): Principle, Process, Materials, Advantages, Limitations and Applications. Solid Ground Curing (SGC): Principle, Process, Materials, Advantages, Limitations, Applications.

**Fusion Deposition Modeling (FDM):** Principle, Process, Materials, Advantages, Limitations, Applications. **Laminated Object Manufacturing (LOM):** Principle, Process, Materials, Advantages, Limitations, Applications.

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Explain the principles, advantages, limitations and applications of Solid and Liquid based AM systems. (L2)
- Identify the materials for Solid and Liquid based AM systems. (L2)

### UNIT – III

**8 Hours**

**Powder Based RP Systems:** Principle and Process of Selective Laser Sintering (SLS), Advantages, Limitations and Applications of SLS, Principle and Process of Laser Engineered Net Shaping (LENS), Advantages, Limitations and Applications of LENS, Principle and Process of Electron Beam Melting (EBM), Advantages, Limitations and Applications of EBM.

**Other RP Systems:** Three Dimensional Printing (3DP): Principle, Process, Advantages, Limitations and Applications. Ballistic Particle Manufacturing (BPM): Principle, Process, Advantages, Limitations, Applications. Shape Deposition Manufacturing (SDM): Principle, Process, Advantages, Limitations, Applications.

#### Learning Outcomes:

At the end of the unit, the student will be able to

- Explain the principles, advantages, limitations and applications of powder based AM systems. (L2)
- Understand the principles, advantages, limitations and applications of other Additive Manufacturing Systems such as 3D Printing, Ballistic Particle Manufacturing and Shape Deposition Modeling. (L2)

### UNIT – IV

**8 Hours**

**Rapid Tooling:** Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.

**Reverse Engineering (RE):** Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development.

#### Learning Outcomes:

At the end of the unit, the student will be able to

- Classify Rapid Tooling methods. (L2)
- Explain the concepts of reverse engineering and scanning tools. (L2)

## UNIT – V

8 Hours

**Errors in RP Processes:** Pre-processing, processing, post-processing errors, Part building errors in SLA, SLS, etc.

**RP Applications:** Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

### Learning Outcomes:

At the end of the unit, the student will be able to

- Identify various Pre – Processing, Processing and Post – Processing errors in RP processes. (L2)
- Apply of RP in engineering design analysis and medical applications. (L3)

### Course Outcomes:

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

- Use techniques for processing of CAD models for rapid prototyping. (L3)
- Understand and apply fundamentals of rapid prototyping techniques. ((L3)
- Use appropriate tooling for rapid prototyping process. (L3)
- Use rapid prototyping techniques for reverse engineering. (L3)
- Identify Various Pre – Processing, Processing and Post Processing errors in RP processes. (L3)

### Text Books:

1. Chua C.K., Leong K.F. and Lim C.S., “Rapid Prototyping: Principles and Applications”, 2<sup>nd</sup> edition, World Scientific Publishers, 2003.
2. Ian Gibson, David W. Rosen, Brent Stucker, “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, 1<sup>st</sup> Edition, Springer, 2010.
3. Rafiq Noorani, “Rapid Prototyping: Principles and Applications in Manufacturing”, John Wiley & Sons, 2006.

### Reference Books:

1. Liou W. Liou, Frank W., Liou, “Rapid Prototyping and Engineering Applications: A Tool Box for Prototype Development”, CRC Press, 2007.
2. Pham D.T. and Dimov S.S., “Rapid Manufacturing; The Technologies and Application of RPT and Rapid tooling”, Springer, London 2001.
3. Gebhardt A., “Rapid prototyping”, Hanser Gardener Publications, 2003.
4. Hilton P.D. and Jacobs P.F., “Rapid Tooling: Technologies and Industrial Applications”, CRC Press, 2005.



**Course Objectives:**

- To understand the characteristics of various types of electronic devices and circuits (L1).
- To apply various principles of electronic devices and circuits to solve complex Engineering problems (L2).
- To analyze the functions of various types of electronic devices and circuits (L3).
- To evaluate the functions of various types of electronic devices and circuits in real time applications (L3).
- To design various types of electronic circuits for use in real time applications (L4).

**UNIT-I:**

**Diodes and Applications**

Properties of intrinsic and extrinsic semiconductor materials. Characteristics of PN junction diode and Zener diode. Applications of PN diode as a switch, rectifier and Zener diode as regulator. Special purpose diodes: Schottky diode, Tunnel diode, Varactor diode, photodiode and LED.

**Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the characteristics of various types of diodes (L1).
- Apply the principles of diodes to solve complex Engineering problems (L2).
- Analyze the functions of diodes in forward and reverse bias conditions (L3).
- Evaluate the functions of diodes in real time applications (L3).
- Design rectifiers and switches using diodes (L4).

**UNIT-II:**

**BJT and its Applications**

Construction, Operation, and Characteristics in CE, CB and CC configurations. Fixed-Bias and Voltage Divider-Bias. Applications as switch and amplifier.

### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the characteristics and biasing of BJT (L1).
- Apply the principles of BJT to solve complex Engineering problems (L2).
- Analyse the functions of BJT in various configurations (L3).
- Evaluate the functions of BJT in real time applications (L3).
- Design amplifiers and switches using BJT (L4).

### **UNIT-III:**

#### **FETs and Applications**

**JFETs:**Construction, Operation, and Characteristics in CS configurations. Fixed-Bias and Voltage Divider -Bias. Applications as switch and amplifier.

**MOSFETs:**Construction, Operation, and Characteristics of Enhancement and Depletion modes in CS configurations. Biasing in Enhancement and Depletion modes. Applications as switch.

### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the characteristics and biasing of FETs (L1).
- Apply the principles of FETs to solve complex Engineering problems (L2).
- Analyze the functions of FETs in CS configuration (L3).
- Evaluate the functions of FETs in real time applications (L3).
- Design amplifiers and switches using FETs (L4).

### **UNIT-IV:**

#### **Feedback Amplifiers and Oscillators**

**Feedback Amplifiers:** Concept of feedback, General characteristics of negative feedback amplifiers, Voltage-series, Current-series, Voltage-shunt, and Current-shunt feedback amplifiers.

**Oscillators:**Conditions for oscillations, Hartley and Colpitts oscillators, RC phase-shift and Wien-bridge oscillators.

### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concept of negative & positive feedback and characteristics feedback amplifiers (L1).
- Apply the principles of feedback amplifiers and oscillators to solve complex Engineering problems (L2).
- Analyze the functions of feedback amplifiers and oscillators (L3).

- Evaluate the functions of feedback amplifiers and oscillators in real time applications (L3).
- Design feedback amplifiers and oscillators for specific applications (L4).

#### **UNIT-V:**

##### **Wave-Shaping & Multivibrator Circuits and Linear Integrated Circuits**

**Wave-Shaping & Multivibrator Circuits:** Introduction, Waveform Shaping Circuits –RC and RL Circuits. Clippers, Comparator and Clampers. Bistable, Schmitt Trigger, Monostable and Astable Multivibrators.

**Linear Integrated Circuits:** Operational Amplifier: Introduction, Block diagram, Basic applications – Inverting, Non-inverting, Summing amplifier, Subtractor, Voltage Follower. IC 555 Timer and IC 7805 Regulator.

#### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the operation of Wave-Shaping & Multivibrator Circuits and Linear Integrated Circuits (L1).
- Apply the principles of Wave-Shaping & Multivibrator Circuits and Linear Integrated Circuits to complex Engineering solve problems (L2).
- Analyse the functions of Wave-Shaping & Multivibrator Circuits and Linear Integrated Circuits (L3).
- Evaluate the functions of Wave-Shaping & Multivibrator Circuits and Linear Integrated Circuits in real time applications (L3).
- Design Wave-Shaping & Multivibrator Circuits and Linear Integrated Circuits for specific applications (L4).

Note: In all the units, only qualitative treatment is required.

#### **Course Outcomes:**

At the end of the course, the student should be able to

- Understand the characteristics of various types of electronic devices and circuits
- Apply various principles of electronic devices and circuits to solve complex Engineering problems
- Analyse the functions of various types of electronic devices and circuits, Evaluate the functions of various types of electronic devices and circuits in real time applications
- Design various types of electronic circuits for use in real time applications.

**TEXT BOOKS:**

1. S. Salivahanan and N. Suresh Kumar, “Electronic Devices and Circuits”, 4<sup>th</sup> Edition, McGraw Hill Education (India) Pvt Ltd., 2017.

**REFERENCES:**

1. J. Milliman, Christos C Halkias, and Satyabrata Jit, “Electronics Devices and Circuits”, 4<sup>th</sup> Edition, McGraw Hill Education (India) Pvt Ltd., 2015.
  2. David A. Bell “Electronics Devices and Circuits”, 5<sup>th</sup> Edition, Oxford University Press, 2008.
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**Blooms’ learning levels:**

L1: Remembering and Understanding

L2: Applying

L3: Analyzing/Derive

L4: Evaluating/Design

L5: Creating

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (CE)– III-I**  
**(19A04506b) DIGITAL ELECTRONICS**  
**OPEN ELECTIVE-I**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

- To introduce different methods for simplifying Boolean expressions
- To analyze logic processes and implement logical operations using combinational logic circuits
- To understand characteristics of memory and their classification.
- To understand concepts of sequential circuits and to analyze sequential systems in terms of state machines
- To understand concept of Programmable Devices

**UNIT- I**

Minimization Techniques and Logic Gates Minimization Techniques: Boolean postulates and laws – De-Morgan’s Theorem - Principle of Duality - Boolean expression - Minimization of Boolean expressions — Minterm – Maxterm - Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization – Don’t care conditions – Quine - McCluskey method of minimization. Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive–NOR Implementations of Logic Functions using gates, NAND– NOR implementations – Multi level gate implementations- Multi output gate implementations. TTL and CMOS Logic and their characteristics – Tristate gates.

**Learning Outcomes:**

At the end of the unit, the student should be able to:

- Learn Boolean algebra and logical operations in Boolean algebra. (L1)
- Apply different logic gates to functions and simplify them. (L2)
- Analyze the redundant terms and minimize the expression using Kmaps and tabulation methods (L3)

**UNIT- II**

Combinational Circuits -Design procedure – Half adder – Full Adder – Half subtractor – Full subtractor – Parallel binary adder, parallel binary Subtractor – Fast Adder - Carry Look Ahead adder – Serial Adder/Subtractor - BCD adder – Binary Multiplier – Binary Divider - Multiplexer/ Demultiplexer – decoder - encoder – parity checker – parity generators – code converters - Magnitude Comparator.

**Learning Outcomes:**

At the end of the unit, the student should be able to:

- Apply the logic gates and design of combinational circuits(L2)
- Design of different combinational logic circuits(L4)

**UNIT -III**

Sequential Circuits-Latches, Flip-flops - SR, JK, D, T, and Master-Slave – Characteristic table and equation –Application table – Edge triggering – Level Triggering – Realization of one flip flop using other flip flops – serial adder/subtractor- Asynchronous Ripple or serial counter – Asynchronous Up/Down counter - Synchronous counters – Synchronous Up/Down counters – Programmable counters – Design of Synchronous counters: state diagram- State table –State minimization –State assignment - Excitation table and maps-Circuit implementation - Modulo-n counter, Registers – shift registers - Universal shift registers – Shift register counters – Ring counter – Shift counters - Sequence generators.

**Learning Outcomes:**

At the end of the unit, the student should be able to:

- Understand the clock dependent circuits (L1)
- Identify the differences between clocked and clock less circuits, apply clock dependent circuits(L2)
- Design clock dependent circuits(L4)

**UNIT -IV**

Memory Devices Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM –EAPROM, RAM – RAM organization – Write operation – Read operation – Memory cycle - Timing wave forms – Memory decoding – memory expansion – Static RAM Cell- Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell –Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using ROM, PLA, PAL

**Learning Outcomes:**

At the end of the unit, the student should be able to:

- Understand the principle of operation of basic memory devices, and programmable logic devices. (L1)

- Implement combinational logic circuits using memory and programmable logic devices (L2)

## **UNIT -V**

Synchronous and Asynchronous Sequential Circuits Synchronous Sequential Circuits: General Model – Classification – Design – Use of Algorithmic State Machine – Analysis of Synchronous Sequential Circuits Asynchronous Sequential Circuits: Design of fundamental mode and pulse mode circuits – Incompletely specified State Machines – Problems in Asynchronous Circuits – Design of Hazard Free Switching circuits.

### **Learning Outcomes:**

At the end of the unit, the student should be able to:

- Understand how synchronous and asynchronous sequential circuit works (L1)
- Understand the FSM and its design principles. (L1)
- Analyze the procedure to reduce the internal states in sequential circuits (L3)
- Illustrate minimization of complete and incomplete state machines and to write a minimal cover table(L2)

### **Course Outcomes:**

- Explain switching algebra theorems and apply them for logic functions, discuss about digital logic gates and their properties, Identify the importance of SOP and POS canonical forms in the minimization of digital circuits.
- Evaluate functions using various types of minimizing algorithms like Boolean algebra, Karnaugh map or tabulation method.
- Analyze the design procedures of Combinational & sequential logic circuits.
- Design of different combinational logic circuits, and compare different semiconductor memories.

### **Text Books:**

1. M. Morris Mano, “Digital Design”, 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
2. Zvi Kohavi, “Switching and Finite Automata Theory”, 3<sup>rd</sup> Edition, South Asian Edition, 2010,

### **References:**

1. John F.Wakerly, “Digital Design”, Fourth Edition, Pearson/PHI, 2008
2. John.M Yarbrough, “Digital Logic Applications and Design”, Thomson Learning, 2006.

3. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.
4. Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 6th Edition, TMH, 2006.
5. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011
6. Donald D.Givone, "Digital Principles and Design", TMH, 2003.



**(19A05506a) FREE AND OPEN SOURCES SYSTEMS**

**(Open Elective –I)  
(Common to CSE & IT)**

**Course Objectives:**

This course is designed to:

- Understand the context and operation of free and open source software (FOSS) communities and associated software projects.
- Motivate the students to contribute in FOSS projects
- Familiarize with programming languages like Python, Perl, Ruby
- Elucidate the important FOSS tools and techniques

**UNIT I PHILOSOPHY**

Notion of Community--Guidelines for effectively working with FOSS community--, Benefits of Community based Software Development --Requirements for being open, free software, open source software --Four degrees of freedom - FOSS Licensing Models - FOSS Licenses – GPL-AGPL-LGPL - FDL - Implications – FOSS examples.

**Learning outcomes:**

At the end of the unit, students will be able to:

- Analyze the benefits of Community based Software Development. (L4)
- Explain the degrees of Freedom. (L2)

**UNIT II LINUX**

Linux Installation and Hardware Configuration – Boot Process-The Linux Loader (LILO) - The Grand Unified Bootloader (GRUB) - Dual-Booting Linux and other Operating System - Boot-Time Kernel Options- X Windows System Configuration-System Administration – Backup and Restore Procedures- Strategies for keeping a Secure Server.

**Learning outcomes:**

At the end of the unit, students will be able to:

- Demonstrate Linux Installation and hardware configuration. (L2)
- Compare Linux and Windows System Configurations. (L4)

**UNIT III PROGRAMMING LANGUAGES**

Programming using languages like Python, Perl, Ruby

**Learning outcomes:**

At the end of the unit, students will be able to:

- Explain the syntax of programming Languages Python, Perl and Ruby. (L2)
- Develop applications in the Open source programming Languages. (L6)

**UNIT IV PROGRAMMING TOOLS AND TECHNIQUES**

Usage of design Tools like Argo UML or equivalent, Version Control Systems like Git or equivalent, – Bug Tracking Systems- Package Management Systems

**Learning outcomes:**

At the end of the unit, students will be able to:

- List various programming tools and explain their uses (L1)
- Make use of the various tools while building applications (L3)

**UNIT V FOSS CASE STUDIES**

Open Source Software Development - Case Study – Libre office -Samba

**Learning outcomes:**

At the end of the unit, students will be able to:

- Elaborate the open Source Software Development(L6)
- Compare Libre office with its proprietary equivalent (L5)

**Course Outcomes:**

Upon completion of the course, the students should be able to:

- Demonstrate Installation and running of open-source operating systems.(L2)
- Justify the importance of Free and Open Source Software projects. (L5)
- Build and adapt one or more Free and Open Source Software packages. (L6)
- Utilize a version control system. (L3)
- Develop software to and interact with Free and Open Source Software development projects.(L3)

**TEXT BOOK:**

Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, “Linux in a Nutshell”, Sixth Edition, OReilly Media, 2009.

**REFERENCES:**

1. Philosophy of GNU URL: <http://www.gnu.org/philosophy/>.
2. Linux Administration URL: <http://www.tldp.org/LDP/lame/LAME/linux-admin-made-easy/>.
3. The Python Tutorial available at <http://docs.python.org/2/tutorial/>.
4. Perl Programming book at <http://www.perl.org/books/beginning-perl/>.
5. Ruby programming book at <http://ruby-doc.com/docs/ProgrammingRuby/>.
6. Version control system URL: <http://git-scm.com/>.
7. Samba: URL : <http://www.samba.org/>.
8. Libre office: <http://www.libreoffice.org/>.

**(19A05506b) COMPUTER GRAPHICS and MULTIMEDIA ANIMATION**  
**(Open Elective –I)**  
**(Common to CSE & IT)**

**Course Objectives:**

This course is designed to:

- Introduce the use of the components of a graphics system and become familiar with the building approach of graphics system components and related algorithms.
- Understand the basic principles of 3- 3-dimensional computer graphics.
- Provide insites on how to scan, convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition.
- Provide an understanding of mapping from world coordinates to device coordinates, clipping, and projections.
- Discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications.

**UNIT I OVERVIEW OF COMPUTER GRAPHICS SYSTEM**

OverView of Computer Graphics System – Video display devices – Raster Scan and random scan system – Input devices – Hard copy devices.

**Learning outcomes:**

At the end of the unit, students will be able to:

- Explain the overview of computer graphics with visualization. (L2)
- Classify the Input devices. (L2)
- Distinguish raster scan and random scan systems. (L4)

**UNIT II OUTPUT PRIMITIVES AND ATTRIBUTES**

Drawing line, circle and ellipse generating algorithms – Scan line algorithm – Character Generation – attributes of lines, curves and characters – Antialiasing.

**Learning outcomes:**

At the end of the unit, students will be able to:

- Analyse output primitives and attributes. (L4)
- Design algorithms based on output. (L6)

### **UNIT III TWO DIMENSIONAL GRAPHICS TRANSFORMATIONS AND VIEWING:**

Two-dimensional Geometric Transformations – Windowing and Clipping – Clipping of lines and clipping of polygons.

#### **Learning outcomes:**

At the end of the unit, students will be able to:

- Create two-dimensional graphics. (L6)
- Examine the clipping of polygon. (L4)
- Compare different forms of variations. (L2)

### **UNIT IV THREE DIMENSIONAL GRAPHICS AND VIEWING**

Three-dimensional concepts – Object representations- Polygon table, Quadric surfaces, Splines, Bezier curves and surfaces – Geometric and Modelling transformations – Viewing - Parallel and perspective projections.

#### **Learning outcomes:**

At the end of the unit, students will be able to:

- Create three-dimensional graphics. (L6)
- Explain the Quadric surfaces and polygon table. (L2)
- Define modelling transformations. (L1)

### **UNIT V REMOVAL OF HIDDEN SURFACES**

Visible Surface Detection Methods – Computer Animation.

#### **Learning outcomes:**

At the end of the unit, students will be able to:

- List the different types of detection methods. (L1)
- Compare various computer animations. (L2)

#### **Course outcomes:**

Upon completion of the course, the students should be able to:

- Explain the basic concepts used in computer graphics. (L2)
- Inspect various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping. (L4)
- Assess the importance of viewing and projections. (L5)
- Define the fundamentals of animation, virtual reality and its related technologies. (L3)
- Analyze the typical graphics pipeline (L4)

## **TEXTBOOK**

1. Hearn, D. and Pauline Baker,M., Computer Graphics (C-Version), 2nd Edition, Pearson Education, 2002.

## **REFERENCES**

1. Neuman, W.M., and Sproull, R.F., Principles of Interactive Computer Graphics, Mc Graw Hill Book Co., 1979.
2. Roger, D.F., Procedural elements for Computer Graphics, Mc Graw Hill Book Co., 1985.
3. Asthana, R.G.S and Sinha, N.K., Computer Graphics, New Age Int. Pub. (P) Ltd., 1996.
4. Floey, J.D., Van Dam, A, Feiner, S.K. and Hughes, J.F, Computer Graphics, Pearson Education, 2001.

**(19A27506a) BREWING TECHNOLOGY**  
**OPEN ELECTIVE - I**

**PREAMBLE**

This course covers the origin of brewing and ingredients used, methods and equipment used and innovations in this field.

**Course Objectives**

- To understand the Beer manufacturing, ingredients and their roles.
- To understand overall view of a brewing industry

**UNIT – I**

Introduction of brewing, history of brewing; Raw materials: barley, hops, water, yeast; Adjuncts for beer production: Maize, rice, millet, wheat, sugar etc. Malt production, role of enzymes for malting; Barley storage, steeping, germination, kilning, cooling, storage;

**Learning Outcomes:**

At the end of the unit, the student should be able to:

- Introduction of brewing, history of brewing
- Raw materials like barley, hops, water, yeast
- Adjuncts for beer production: Maize, rice, millet, wheat, sugar etc
- Malt production, role of enzymes for malting
- Barley storage, steeping, germination, kilning, cooling, storage

**UNIT – II**

Malt from other cereals, caramel malt, roasted malt, smoked malt, malt extract; Malt quality evaluation, Wort production, malt milling, Mashing, Mashing vessels; Wort boiling, clarification, cooling and aeration Enzyme properties, starch degradation, b-glucan degradation; Conversion of fatty matter, Biological acidification

### **Learning Outcomes:**

At the end of the unit, the student should be able to:

- Malt from other cereals, caramel malt, roasted malt, smoked malt, malt extract
- Malt quality evaluation, Wort production, malt milling, Mashing, Mashing vessels
- Wort boiling, clarification, cooling and aeration Enzyme properties, starch degradation, b-glucan degradation
- Conversion of fatty matter, Biological acidification

### **UNIT – III**

Beer production methods, fermentation technology, changes during fermentation; Filtration procedure and equipment, beer stabilization conditions and durations, beer carbonation process; Packaging equipment and packaging materials, storage conditions and distribution process

### **Learning Outcomes:**

At the end of the unit, the student should be able to:

- Beer production methods, fermentation technology, changes during fermentation
- Filtration procedure and equipment, beer stabilization conditions and durations, beer carbonation process
- Packaging equipment and packaging materials, storage conditions and distribution process

### **UNIT – IV**

Brewing Equipment. Grain mill, kettles, siphons, carboys, fermentation equipment, wort chillers, pumps beer bottles, cans, labels, bottle caps, sanitation equipments Preventive Production of beer against technology, ling phenomenon of beer, possible measures against staling reactions, oxidation

### **Learning Outcomes:**

At the end of the unit, the student should be able to:

- Brewing Equipments like Grain mill, kettles, siphons, carboys, fermentation equipment, wort chillers
- pumps beer bottles, cans, labels, bottle caps, sanitation equipments
- Preventive Production of beer against technology, ling phenomenon of beer, possible measures against staling reactions, oxidation



## **UNIT – V**

Recent advances: Immobilized Cell Technology in Beer Production, immobilized yeast cell technology Energy management in the brewery and maltings; waste water treatment Automation and plant planning

### **Learning Outcomes:**

At the end of the unit, the student should be able to:

- Immobilized Cell Technology in Beer Production, immobilized yeast cell technology
- Energy management in the brewery and maltings
- waste water treatment Automation and plant planning

### **Course Outcomes:**

By the end of this course, students will attain the:

- Knowledge of beer making, chemistry of ingredients used for brewing,
- Knowledge on brewing industry, Unit operations and equipments involved.

### **TEXT BOOKS**

1. Brewing: “Science and Practice, Brookes and Roger Stevens”, Dennis E. Briggs, Chris A. Boulton, Peter A. 2004, Woodhead publishing limited.
2. Die Deutsche “Bibliothek Technology: “Brewing and Malting”, Wolfgang Kunze. 2010, Bibliographic information published

### **REFERENCES**

1. “Handbook of Brewing”: Process, Technology, Markets, Hans Michael Eblinger. 2009, Wiley-VCH Verlag GmbH & Co.
2. Brewing: “New Technologies”, Charles W. Bamforth. 2006, Woodhead Pub.

**(19A27506b) COMPUTER APPLICATIONS IN FOOD INDUSTRY**  
**(OPEN ELECTIVE – I)**

**PREAMBLE**

This course covers all facets of computerization and various software's used and their usage.

**Course Objectives**

- Able to know about “The necessity of Software & their applications in Food Industries”
- Able to Implement the Programs in ‘C’ to perform various operations that are related to Food Industries.

**UNIT – I**

Computerization, Importance of Computerization in food industry and IT applications in food industries. Computer operating environments and information system for various types of food industries. Introduction to Bar charts and Pie charts & the procedure to develop bar charts and pie charts on given Data.

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Computerization, Importance of Computerization in food industry and IT applications in food industries.
- Computer operating environments and information system for various types of food industries.
- Introduction to Barcharts and Piecharts & the procedure to develop barcharts and piecharts on given Data.

**UNIT – II**

Introduction to Software & Programming Languages, Properties, Differences of an Algorithm and Flowcharts, Advantages and disadvantages of Flowcharts & Algorithms. Introduction, Fundamentals & advantages of ‘C’. Steps in learning ‘C’ (Character set, Identifiers, Keywords) Steps in learning ‘C’ (Data types, Constants, Variables, Escape sequences).

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Introduction to Software & Programming Languages, Properties, Differences of an Algorithm and Flowcharts
- Advantages and disadvantages of Flowcharts & Algorithms. Introduction, Fundamentals & advantages of 'C'.
- Steps in learning 'C' (Character set, Identifiers, Keywords)
- Steps in learning 'C' (Data types, Constants, Variables, Escape sequences).

### **UNIT – III**

Steps in learning 'C' (Operators, Statements) Steps in learning 'C' (Header Files, Input & Output functions: Formatted I/O functions, Unformatted I/O functions). Basic Structure of a simple 'C' program. Decision Making/Control Statements. Branching, Concept of Looping & Looping statements.

#### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Steps in learning 'C' (Operators, Statements)
- Steps in learning 'C' (Header Files, Input & Output functions: Formatted I/O functions, Unformatted I/O functions).
- Basic Structure of a simple 'C' program. Decision Making/Control Statements.
- Branching, Concept of Looping & Looping statements.

### **UNIT – IV**

Concept of Functions (Defining a function & Function Prototypes, Types of functions: Library functions & User defined functions. Concept of various types of User Defined Functions (i.e., About 4 types). Concept of Arrays & Types of Arrays (Single, Double and Multi-Dimensional Arrays). Concept of a String Library Functions.

#### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Concept of Functions (Defining a function & Function Prototypes, Types of functions: Library functions & User defined functions.
- Concept of various types of User Defined Functions (i.e., About 4 types).
- Concept of Arrays & Types of Arrays (Single, Double and Multi-Dimensional Arrays).
- Concept of a String Library Functions.

## **UNIT – V**

Concept of Pointers, Structures & Unions. Introduction to Data Structures, Types of Data Structures (Primary & Secondary Data Structures) Concept of Linked Lists, Types of Linked Lists & Basic operations on linked Lists. Concept of Stacks & Operations on Stacks (PUSH & POP Operations) Concept of Queues and types of Queues Operations on a Queue (ENQUEUE & DEQUEUE Operations)

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Concept of Pointers, Structures & Unions. Introduction to Data Structures, Types of Data Structures (Primary & Secondary Data Structures)
- Concept of Linked Lists, Types of Linked Lists & Basic operations on linked Lists.
- Concept of Stacks & Operations on Stacks (PUSH & POP Operations)
- Concept of Queues and types of Queues Operations on a Queue (ENQUEUE & Dequeue Operations)

### **Course Outcomes**

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

- know about the various steps which are related to computer and Software and their application in Food Industries
- know about the various steps which are necessary to implement the programs in ‘C’

### **TEXT BOOKS**

1. Yeswanth Kanethkar, Let us ‘C’
2. Balaguruswamy E., “Computer Programming in ‘C’”
3. Mark Allen Waise , “Data Structures”

### **REFERENCES**

1. M. S Excel 2000, Microsoft Corporation
2. M. S. Office – Microsoft Corporation
3. Verton M.V. “Computer concepts for Agri Business”, AVI Pub. Corp., West Port, USA.

**(19A54506a) OPTIMIZATION TECHNIQUES  
(OPEN ELECTIVE-I)**

**Course Objectives:**

The student will be able to learn:

- The basic concepts of Optimization
- The emphasis of this course is on different classical Optimization techniques linear programming and simplex algorithms.
- About optimality of balanced transportation Problems
- About Constrained and unconstrained nonlinear programming.
- About principle of optimality and dynamic programming

**UNIT – I Introduction and Classical Optimization Techniques:**

Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems. Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – multivariable Optimization with inequality constraints – Kuhn – Tucker conditions – Numerical examples.

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- To know how to formulate statement of optimization problem with or without constraints
- To know about classification of single and multivariable optimization problems
- To know about necessary and sufficient conditions in defining the optimization problems
- To understand how to formulate Kuhn-Tucker conditions and to solve numerical problems

**UNIT – II Linear Programming**

Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm – Numerical examples.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- To know about formulation of LPP
- To know about formulations of GPP
- To understand various theorems in solving simultaneous equations
- To understand about necessity of Simplex method and to solve numerical problems

### **UNIT – III Nonlinear Programming – One Dimensional Minimization methods**

Introduction, Unimodal function, Elimination methods- Unrestricted Search, Exhaustive Search, Dichotomous Search, Fibonacci Method, Golden Section Method and their comparison; Interpolation methods - Quadratic Interpolation Method, Cubic Interpolation Method and Direct Root Methods – Numerical examples.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- To know about NLP in one dimensional optimization problems
- To understand about various search methods
- To learn about various interpolation methods
- To distinguish and compare the various elimination methods with numerical examples

### **UNIT – IV Unconstrained & Constrained Nonlinear Programming**

**Unconstrained Optimization Techniques:** Introduction- Classification of Unconstrained Minimization Methods, General Approach, Rate of Convergence, Scaling of Design Variables; Direct Search methods- Random Search Methods, Grid Search Method, Pattern Directions, Powell's Method and Simplex Method

**Constrained Optimization Techniques:** Introduction, Characteristics of a Constrained Problem, Direct Search Methods - Random Search Methods, Basic Approach in the Methods of Feasible Directions, Rosen's Gradient Projection Method, Generalized Reduced Gradient Method and Sequential Quadratic Programming.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- To distinguish between unconstrained and constrained optimization problems
- To learn about direct search methods in unconstrained NLP problems and comparison
- To understand about direct search methods in constrained NLP problems and comparison
- To do exercises for solving numerical examples of various methods

## **UNIT – V Dynamic Programming**

Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution – Numerical examples.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- To know what is DP problem?
- To know about computational procedure in solving DPP
- To know Calculus and Tabular methods of solving with numerical examples of various methods

### **Course Outcomes:**

The student gets thorough knowledge on:

- Basic methods, principles in optimization
- Formulation of optimization models, solution methods in optimization
- Finding initial basic feasible solutions.
- Methods of linear and non-linear (constrained and unconstrained) programming.
- Applications to engineering problems.

### **TEXT BOOKS:**

1. S. S. Rao, “Engineering optimization”: Theory and practice 3rd edition, New Age International (P) Limited, 1998.
2. H.S. Kasana & K.D. Kumar, “Introductory Operations Research Springer (India)”, 2004.

### **REFERENCES:**

1. R Fletcher, “Practical Methods of Optimization” , 2<sup>nd</sup> Edition, Wiley Publishers, 2000.
2. Jorge Nocedal and Wright S, “Numerical Optimization Springer”, 1<sup>st</sup> Edition, 1999.
3. by K.V. Mital and C. Mohan, “Optimization Methods in Operations Research and systems Analysis” 3<sup>rd</sup> Edition, New Age International (P) Limited, 1996.
4. by S.D. Sharma, “Operations Research”, Kedar Nath, 2012.
5. by H.A. Taha, “Operations Research”, 9<sup>th</sup> Edition, An Introduction Pearson, 2010.
6. G. Hadley, “Linear Programming”, Narosa, 2002.

**(19A52506a) TECHNICAL COMMUNICATION AND PRESENTATION SKILLS**  
**(OPEN ELECTIVE)**

**Course Objectives:**

- To develop awareness in students of the relevance and importance of technical communication and presentation skills.
- To prepare the students for placements
- To sensitize the students to the appropriate use of non-verbal communication
- To train students to use language appropriately for presentations and interviews
- To enhance the documentation skills of the students with emphasis on formal and informal writing

**SYLLABUS**

**UNIT -1:**

**Basics of Technical Communication** – Introduction – Objectives & Characteristics of Technical Communication – Importance and need for Technical communication - LSRW Skills – Barriers to effective communication

**Learning Outcomes:**

At the end of the module, the learners will be able to

- Understand the importance of LSRW skills
- Identify and overcome the barriers to effective communication
- Realize the need and importance of technical communication

**UNIT -II**

**Informal and Formal Conversation** - Verbal and Non-verbal communication –Kinesics, Proxemics, Chronemics, Haptics, Paralanguage

**Learning Outcomes:**

At the end of the module, the learners will be able to

- State the difference between formal and informal conversation.
- Apply the knowledge of the difference between the verbal and non-verbal communication
- Evaluate the different aspects of non-verbal communication.



### **UNIT -III**

**Written communication** – Differences between spoken and written communication – Features of effective writing –Advantages and disadvantages of spoken and written communication- Art of condensation- summarizing and paraphrasing

#### **Learning Outcomes:**

At the end of the module, the learners will be able to

- Know the difference between written and spoken communication
- Apply the awareness of features of effective writing.
- Implement the understanding of summarizing and paraphrasing.

### **UNIT -IV**

**Presentation Skills** – Nature and importance of oral presentation – Defining the purpose – Analyzing the audience - Planning and preparing the presentation, organizing and rehearsing the presentation –Individual and group presentations - Handling stage fright

#### **Learning Outcomes:**

At the end of the module, the learners will be able to

- State the importance of presentation skills in corporate climate.
- Analyze the demography of the audience.
- Plan, prepare and present individual and group presentations.

### **UNIT -V**

**Interview Skills** – The Interview process –Characteristics of the job interview – Pre-interview preparation techniques – Projecting the positive image – Answering Strategies

#### **Learning Outcomes:**

At the end of the module, the learners will be able to

- Identify the characteristics of the job interview.
- Understand the process of Interviews.
- Develop a positive image using strategies in answering FAQs in interviews

## **Course Outcomes**

- Understand the importance of effective technical communication
- Apply the knowledge of basic skills to become good orators
- Analyze non-verbal language suitable to different situations in professional life
- Evaluate different kinds of methods used for effective presentations
- Create trust among people and develop employability skills

## **TEXT BOOKS:**

1. Ashrif Rizvi, “Effective Technical Communication”, TataMcGrahill, 2011
2. Meenakshi Raman &Sangeeta Sharma, “Technical Communication”, 3<sup>rd</sup> Edition, O U Press 2015

## **REFERENCES:**

1. Pushpalatha & Sanjay Kumar, “Communication Skills”, Oxford Univsesity Press
2. Barron’s/Books on TOEFL/GRE/GMAT/CAT/IELTS DELTA/Cambridge University Press.2012.
3. Butterfield Jeff, “Soft Skills for Everyone”, Cengage Publications, 2011.
4. Universities Press (India) Pvt Ltd., “Management Shapers Series”, Himayatnagar, Hyderabad 2008.
5. John Hughes & Andrew Mallett, “Successful Presentations” Oxford.
6. Edgar Thorpe and Showick Thorpe, “Winning at Interviews” Pearson
7. Munish Bhargava, “Winning Resumes and Successful Interviews”, McGraw Hill

**(19A01507) COMPUTER AIDED CIVIL ENGINEERING DRAWING**

**Course Objectives:**

- To make the student prepare engineering drawings conventionally involving various design parameters.
- To introduce fundamentals of computer aided drawing in Civil Engineering.
- To enable the student develop drawing of building components
- To train the student in Producing 2D & 3D drawings
- To enable the students Communicate designs graphically
- To teach methodologies for understanding and verification of CAD

**UNIT -I**

**Introduction to drawing:**

Introduction to Civil Engineering drawings, Interpretation of typical drawings, Scales – Elements of a building drawing – Plan, Section and Elevation from the given line drawing/Site plan/floor plan of residential and public buildings. Introduction to computer aided drawing, co-ordinate systems, and reference planes. Commands: Initial settings, Drawing commands, Modify commands

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand basic terms plan section and elevation in drawing
- Introduce computer applications in developing drawing skills

**UNIT –II**

**Sign conventions and symbols:**

Layers and Annotations in AUTOCAD, Conventional signs – Materials, Architecture, Structure, Electrical and Plumbing, Rebar drawings, Brick Bonds – Header, Stretcher, English and Flemish, one and half, two and two and half brick walls. Doors and Windows

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Acquaint with AUTOCAD software

- Identify sign conventions and symbols used in civil engineering drawing.

### **UNIT –III**

#### **Introduction to Building Planning**

Development of 2D wireframe models in AUTOCAD

Introduction, terminology, Objectives of building bye-laws, Principles under laying building bye laws. Classification of buildings, Open space requirements. Floor area ratio, Floor space index, built up area limitations. Lighting and ventilation requirements.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand building bye-laws
- Understand planning the components of building and standard dimensions.

### **UNIT –IV**

#### **Basics of a building drawing:**

Elements of planning building drawing, Methods of line and detailed drawing. Site plan, floor plan, elevation and section, drawing of residential buildings. Foundation details.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Draw various views of building.
- Develop floor plan, elevation and section

### **UNIT –V**

**Pictorial View:** Principles of isometrics and perspective view of building.

Fundamentals of Building Information Modeling (BIM) using Revit Architecture. Introduction to Revit architecture software tools; Detailed planning of structural components, walls, floors, ceiling, roof, stairs; modify tools; structural modelling, column and beam system, foundations.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand basic principles of BIM
- Draw the detailed structural elements and visualize.

### **List of Drawing Experiments:**

1. Sign conventions and symbols
2. Masonry bonds
3. Doors and windows
4. Buildings with load bearing walls including details of doors and windows.
5. Taking standard drawings of a typical two storied building including all MEP.
6. Joinery, re-bars, finishing and other details and writing out a description of the RCC framed structures
7. Reinforcement drawings for typical slabs,
8. Reinforcement drawings for typical beams,
9. Reinforcement drawings for typical columns
10. Reinforcement drawings for typical spread footings.
11. Industrial buildings - North light roof structures - Trusses
12. Perspective view of one and two storey buildings

### **Course Outcomes:**

At The end of the course the student will be able to

- Develop drawing skills for effective demonstration of building details.
- Draw building plans using Computer Aided Design and Drafting software's.
- Develop engineering project drawings incorporating details and design parameters in 2D & 3D.
- Examine efficacy of CAD design.

### **TEXT BOOKS:**

1. Subhash C Sharma & Gurucharan Singh (2005), "Civil Engineering Drawing", Standard Publishers
2. Ajeet Singh (2002), "Working with AUTOCAD 2000 with updates on AUTOCAD 2001", Tata- Mc Graw-Hill Company Limited, New Delhi
3. N. Kumara Swamy, A. Kameswara Rao "Building Planning and Drawing"

### **REFERENCES:**

1. Balagopal and Prabhu (1987), "Building Drawing and Detailing", Spades publishing KDR building, Calicut, (Corresponding set of) CAD Software Theory and User Manuals.
2. Sikka, V.B. (2013), "A Course in Civil Engineering Drawing", S. K. Kataria & Sons,
3. Sham Tickoo Swapna D (2009), "AUTOCAD for Engineers and Designers", Pearson Education,

4. Venugopal (2007), “Engineering Drawing and Graphics + AUTOCAD”, New Age International Pvt. Ltd.,
5. Nawari & Kuenstle, Building “Information Modeling (BIM): A framework for Structural Design”, CRC press ISBN-13: 978-1482240436, ISBN-10: 1482240432, CRC Press, Taylor and Francis Group. <http://www.crcpress.com/>; spring 2015. By N. Nawari & M. Kuenstle.
6. Eastman BIM Handbook: “A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors”.

**(19A01508) ENVIRONMENTAL ENGINEERING LAB**

**OBJECTIVE:** The object of the course is to enable the students to identify the characteristics of water sample.

**LABORATORY EXPERIMENTS**

1. Determination of pH and Electrical Conductivity (Salinity) of Water and Soil.
2. Determination and estimation of Total Hardness–Calcium & Magnesium.
3. Determination of Alkalinity/Acidity
4. Determination of Chlorides in water and soil
5. Determination and Estimation of total solids, organic solids and inorganic solids and settleable solids by Imhoff Cone.
6. Determination of Iron.
7. Determination of Dissolved Oxygen with D.O. Meter & Wrinklers Method and B.O.D.
8. Determination of N, P, K values in solid waste
9. Physical parameters – Temperature, Colour, Odour, Turbidity, Taste.
10. Determination of C.O.D.
11. Determination of Optimum coagulant dose.
12. Determination of Chlorine demand.
13. Presumptive Coliform test.

**Course Outcomes:**

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

- Understand about quality of water and purification process
- Select appropriate technique for treatment of waste water.
- Assess the impact of air pollution
- Understand consequences of solid waste and its management.
- Design domestic plumbing systems.

**TEXT BOOKS:**

1. G. S. Birdi “Water supply and sanitary Engineering”, Dhanpat Rai & Sons Publishers.
2. Peavy, H.S, Rowe, D. R. Tchobanoglous, “Environmental Engineering”, Mc-Graw –Hill International Editions, New York 1985.

## **REFERENCES:**

1. B.C. Punmia, Ashok Jain & Arun Jain, “Water Supply Engineering, Vol. 1, Waste water Engineering, Vol. II”, Laxmi Publications Pvt. Ltd, New Delhi.
2. MetCalf and Eddy. “Wastewater Engineering, Treatment, Disposal and Reuse”, Tata McGraw- Hill, New Delhi.
3. S. M. Patil, “Plumbing Engineering. Theory, Design and Practice”,1999.
4. K. N. Duggal, “Elements of environmental engineering”, S. Chand Publishers.



**(19A01503P) ENGINEERING GEOLOGY LAB**

**OBJECTIVE:** The object of the course is to enable the students to identify the physical characteristics various rocks .

**LABORATORY EXPERIMENTS**

1. Physical properties of minerals: Mega-scopic identification of Rock forming minerals – Quartz group, Feldspar group,
2. Identification of Rock forming minerals Garnet group, Mica group
3. Physical properties of minerals: Mega-scopic identification of Talc, Chlorite, Olivine, Kyanite, Asbestos, Tourmelene, Calcite, Gypsum, etc...
4. Physical properties of minerals: Mega-scopic identification of Ore forming minerals – Magnetite, Hematite, Pyrite, Pyralusite, Graphite, Chromite, etc...
5. Megascopic description and identification of Igneous rocks – Types of Granite, Pegmatite, Gabbro, Dolerite, Syenite, Granite Poryphery, Basalt, etc...
6. Megascopic description and identification of Sedimentary rocks – Sand stone, Ferruginous sand stone, Lime stone, Shale, Laterite, Conglamorate, etc...
7. Megascopic description and identification of Metamorphic rocks – Biotite – Granite Gneiss, Slate, Muscovite & Biotiteschist, Marble, Khondalite, etc...
8. Interpretation and drawing of sections for geological maps showing tilted beds
9. Interpretation and drawing of sections for geological maps showing faults,
10. Interpretation and drawing of sections for geological maps showing unconformities etc.
11. Simple Structural Geology problems.
12. Strength of the rock using laboratory tests.

**Course Outcomes:** At the end of the course the students will be able to classify various types of rocks, their properties and they will be familiar with interpretation of geological maps.

**19A01509 SOCIALLY RELEVANT PROJECT**

**Areas for Socially Relevant Project in 5th Semester**

- a) Water quality analysis in a village /town
- b) Survey camp
- c) Road safety Audit
- d) Environmental impact Audit

**(19A99501) MANDATORY COURSE: CONSTITUTION OF INDIA**

**Course Objectives :**

The objective of this course is

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and Election Commission of India.
- To understand the central-state relation in financial and administrative control

**Syllabus**

**UNIT-I**

Introduction to Indian Constitution – Constitution -Meaning of the term - Indian Constitution- Sources and constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.

**Learning Outcomes:-**

After completion of this unit student will

- Understand the concept of Indian constitution
- Apply the knowledge on directive principle of state policy
- Analyze the History and features of Indian constitution
- Learn about Preamble, Fundamental Rights and Duties

**UNIT-II**

Union Government and its Administration Structure of the Indian Union - Federalism - Centre-State relationship – President’s Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat –Lok Sabha - Rajya Sabha - The Supreme Court and High Court - Powers and Functions

### **Learning Outcomes:-**

After completion of this unit student will

- Understand the structure of Indian government
- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High court

### **UNIT-III**

State Government and its Administration - Governor - Role and Position -CM and Council of ministers - State Secretariat-Organization Structure and Functions

### **Learning Outcomes:-**

After completion of this unit student will

- Understand the structure of state government
- Analyze the role of Governor and Chief Minister
- Explain the role of State Secretariat
- Differentiate between structure and functions of state secretariat

### **UNIT-IV**

Local Administration - District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation Panchayati Raj - Functions- PRI -Zilla Parishath - Elected officials and their roles - CEO,Zilla Parishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

### **Learning Outcomes:-**

After completion of this unit student will

- Understand the local Administration
- Compare and contrast district administration's role and importance
- Analyze the role of Mayor and elected representatives of Municipalities
- Learn about the role of Zilla Parishath block level organization

## **UNIT-V**

Election Commission - Election Commission- Role of Chief Election Commissioner and Election Commissionerate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women

### **Learning Outcomes:-**

After completion of this unit student will

- Know the role of Election Commission
- Contrast and compare the role of Chief Election commissioner and Commissionerate
- Analyze the role of state election commission
- Evaluate various commissions viz SC/ST/OBC and women

### **Course Outcomes:**

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

- Understand historical background of the constitution making and its importance for building a democratic India.
- Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
- Understand the value of the fundamental rights and duties for becoming good citizen of India.
- Analyze the decentralization of power between central, state and local self-government
- Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

## **TEXT BOOKS**

1. Durga Das Basu, “Introduction to the Constitution of India”, Prentice – Hall of India Pvt. Ltd.. New Delhi
2. Subash Kashyap, “Indian Constitution”, National Book Trust

## **REFERENCES:**

1. J.A. Siwach, “Dynamics of Indian Government & Politics”.
2. H.M.Sreevai, “Constitutional Law of India”, 4<sup>th</sup> edition in 3 volumes (Universal Law Publication)
3. J.C. Johari, “Indian Government and Politics”, Hans India
4. M.V. Pylee, “Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice”, Hall of India Pvt. Ltd.. New Delhi

**E-RESOURCES:**

- 1.[nptel.ac.in/courses/109104074/8](https://nptel.ac.in/courses/109104074/8) 2.[nptel.ac.in/courses/109104045/](https://nptel.ac.in/courses/109104045/)
- 3.[nptel.ac.in/courses/101104065/](https://nptel.ac.in/courses/101104065/)
- 4.[www.hss.iitb.ac.in/en/lecture-details](http://www.hss.iitb.ac.in/en/lecture-details)
- 5.[www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution](http://www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution)

**(19A01601T) GEOTECHNICAL ENGINEERING -I**

**Course Objectives:**

The objective of this course is:

- To enable the student to find out the index properties of the soil and classify it.
- To enable the student to determine permeability of soils using various methods.
- To impart the concept of seepage of water through soils and determine the seepage discharge.
- To enable the students to differentiate between compaction and consolidation of soils and to determine the consolidation settlement.
- To impart knowledge on soil exploration.
- To teach slope stability and safety assessment of earth retaining structures.
- To impart knowledge on bearing capacity and settlement of shallow foundations.
- To throw light on pile and well foundation designs.

**UNIT I:**

INTRODUCTION: Soil formation – soil structure – Adsorbed water – Mass- volume relationship – Relative density. Index Properties Of Soils: Moisture Content, Specific Gravity, In-situ density, Grain size analysis – Sieve and Hydrometer methods – consistency limits and indices – I.S. Classification of soils.

**Learning Outcomes:-**

After completion of this unit student will

- Understand the characteristics of soils
- Assess relationships between different parameters
- Determine soil properties
- Determine Liquid, Shrinkage and Plasticity Limits
- Characterize and classify soils based on different limits.

**UNIT II:**

PERMEABILITY: Soil water – capillary rise – flow of water through soils – Darcy's law- permeability – Factors affecting – laboratory determination of coefficient of permeability – Permeability of layered systems.

SEEPAGE THROUGH SOILS: Total, neutral and effective stresses –quick sand condition – Seepage through soils – Flow nets : Characteristics and Uses.

### **Learning Outcomes:-**

After completion of this unit student will

- Determine the permeability of soils and stratified soils.
- Explain factors effecting permeability
- Estimate the rate of seepage using flow net

## **UNIT III**

STRESS DISTRIBUTION IN SOILS: Boussinesq's and Westergaard's theories for point loads and areas of different shapes – Newmark's influence chart . Compaction: Mechanism of compaction – factors affecting – effects of compaction on soil properties. – Field compaction Equipment – compaction control.

### **Learning Outcomes:-**

After completion of this unit student will

- Compute stresses in soils under various loading conditions.
- Explain compaction of soils
- Compaction control can be understand.

## **UNIT IV:**

CONSOLIDATION : Types of compressibility – Immediate Settlement, primary consolidation and secondary consolidation - stress history of clay; e-p and e-log p curves – normally consolidated soil, over consolidated soil and under consolidated soil – pre-consolidation pressure and its determination – Terzaghi's 1-D consolidation theory – coefficient of consolidation: square root time and logarithm of time fitting methods.

### **Learning Outcomes:-**

After completion of this unit student will

- Understand the consolidations and settlement of soils.
- Differentiate compaction and consolidation
- Assessment of final settlements of soil
- Differentiate primary and secondary consolidation



## **UNIT V:**

**SHEAR STRENGTH OF SOILS :** Importance of shear strength – Mohr's– Coulomb Failure theories – Types of laboratory tests for strength parameters – strength tests based on drainage conditions – strength envelopes.

### **Learning Outcomes:-**

After completion of this unit student will

- Can able to determine the shear strength of the soil.
- To understand the various shear tests based on drainage conditions.

### **Course Outcomes**

On completion of the course, the students will be able to:

- Classify various types of soils using USCS and IS classification methods
- Understand the behavior of coarse grained and fine grained soils.
- Design earth dams using different methods.
- Calculate the stress distribution in foundations.
- Know the field Compaction control.
- Determination of settlement of foundations.
- Calculate the shear strength of soil under different drainage conditions.

### **TEXT BOOKS:**

1. Alam Singh and Chowdhary G. R., "Soil Engineering in Theory and Practice, Volume-2, Geotechnical testing and instrumentation", CBS Publishers and Distributors, New Delhi, 2006.
2. Dunnicliff J., and Green, G. E., "Geotechnical Instrumentation for Monitoring Field Performance", John Wiley, 1993.
3. Purushotham Raj -2013-"Soil Mechanics and foundation engineering" – 2<sup>nd</sup> edition, Pearson Publishers.

### **REFERENCES:**

1. Bowles J. E., "Foundation Analysis and Design", 5th Edition, The McGraw-Hill companies, Inc., New York, 1995.
2. C. Venkataramiah, "Geotechnical Engineering", New age International Pvt . Ltd, (2002).
3. Hanna T. H., "Field Instrumentation in Geotechnical Engineering", Trans Tech., 1985.
4. Hunt R. E., "Geotechnical Engineering Investigation Manual", McGraw Hill, 1984.

**(19A01602) DESIGN OF STEEL STRUCTURES**

**Course Objectives**

- To teach different types of Connections and relevant IS code provision.
- To impart with design procedures of beams and columns.
- To enable Design of truss elements
- To enable design of column bases
- To teach design and Plate and Gantry Girders with curtailment of flanges.

**UNIT -I:**

**Connections:**

Bolted connections – Bolt value, Welded connections: Advantages and disadvantages of welding- Strength of welds-Butt and fillet welds: Permissible stresses – IS Code requirements. Design of fillet weld subjected to in plane and out of plane.

**Learning Outcomes:-**

After completion of this unit student will

- Understand bolted and welded connections
- Estimate strength of welds
- Design Welded and Bolted connections as per IS Codal provisions

**UNIT -II:**

**Tension Members and Compression members:**

Design of members in direct tension and bending –effective length of columns. Slenderness ratio – permissible stresses. Design of compression members. Roof Trusses: types of trusses – Design loads – Load combinations as per IS Code, detailing –Design of simple roof trusses elements (purlins, members and joints) – tubular trusses.

**Learning Outcomes:-**

After completion of this unit student will

- Understand behavior of tension members
- Understand behavior of compression members

- Design and detail of Tension and compression members under different conditions adopting IS Code.
- Design simple roof trusses and elements

### **UNIT -III:**

#### **Beams:**

Allowable stresses, design of simple and compound beams-Curtailment of flange plates - IS Code-provision - Beam - to - beam connection, shear, buckling, check for deflection and bearing, laterally unsupported beams.

#### **Learning Outcomes:-**

After completion of this unit student will

- Understand behavior of simple and compound beams
- Visualize importance of curtailment of flange plates
- Design and detail of steel beams under different conditions adopting IS Code.

### **UNIT -IV:**

#### **Design of built-up columns and column bases:**

Built-up columns with lacing and/or battening system. Design of Eccentrically loaded columns, Splicing of columns. **Design of Column bases:** slab base and gusseted base under axial load and moment.

#### **Learning Outcomes:-**

After completion of this unit student will

- Understand behavior of builtup columns
- Understand behavior of column bases
- Design and detail of built-up columns and column bases adopting IS Code.

### **UNIT -V:**

#### **Plate Girders:**

Design of plate girder – IS code Provisions – Welded – Curtailment of flange plates, Design of stiffeners – splicing and connections.

#### **Learning Outcomes:-**

After completion of this unit student will

- Identify different components of plate girder
- Design and detail of components of plate girder confirming to IS Code
- Understand the functioning of gantry girder for different types of loads

**NOTE :Assignment on preparation of drawing sheets showing detailing of various Steel Elements**

The students should prepare the following plates.

- Plate 1 Detailing of simple beams
- Plate 2 Detailing of Compound beams including curtailment of flanges
- Plate 3 Detailing of Column including lacing and battens.
- Plate 4 Detailing of Column bases – slab base and gusseted base
- Plate 5 Detailing of steel roof trusses including joint details.
- Plate 6 Detailing of Plate girder including curtailment, splicing

**Codes/Tables:** IS-800 code books and Structural Steel Tables are to be permitted into the examination Hall.

**IS Codes:**

- 1) Indian Standard Code for General Construction in Steel, 3<sup>rd</sup> revision, Indian Standards Institution, New Delhi, 2008.
- 2) IS – 875, Code of practice for design loads (other than earth quake) for buildings and structures (Part-1-Part 5), Bureau of Indian standards.
- 3) Steel Tables.

**Course Outcomes:**

At the end of this course the student will be able to

- Explain relevant IS codes
- Analysis and design of flexural members and detailing
- Design compression members of different types with connection detailing
- Design Plate Girder and Gantry Girder with connection detailing
- Develop drawings pertaining to different components of steel structures

**TEXT BOOKS**

1. N. Subramanian, “Design of Steel Structures Limit state method”, (IS:800-2007) Oxford University Press.
2. S. K. Duggal, “Design of steel structures”, Tata Mc Graw Hill, New Delhi.
3. N. Krishna Raju; “Structural Design and Drawing”, 4<sup>th</sup> edition, (IS:800-2007) University Press

## **REFERENCES**

1. Sarwar Alam Raz, “Structural Design in Steel”, New Age International Publishers, New Delhi
2. M. Raghupathi, “Design of Steel Structures”, Tata Mc. Graw-Hill.
3. L.S.Jayagopal and D.Tensing, “Design of steel structures”, Vikas publishers

**19A52601T ENGLISH LANGUAGE SKILLS**

**Introduction**

The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners' ability to effectively use English language skills in academic/ workplace contexts. The shift is from *learning about the language* to *using the language*. They should be able to express themselves clearly in speech and competently handle the writing tasks and verbal ability component of campus placement tests. Activity based teaching-learning methods would be adopted to ensure that learners would engage in actual use of language both in the classroom and laboratory sessions.

**Course Objectives**

- Facilitate active listening to enable inferential learning through expert lectures and talks
- Impart critical reading strategies for comprehension of complex texts
- Provide training and opportunities to develop fluency in English through participation in formal group discussions and presentations using audio-visual aids
- Demonstrate good writing skills for effective paraphrasing, argumentative essays and formal correspondence
- Encourage use of a wide range of grammatical structures and vocabulary in speech and writing

**UNIT - I**

**Text:**

1. **Lines Composed a Few Miles above Tintern Abbey - William Wordsworth**
2. **The Lotos-Eaters - Alfred Tennyson**

**Listening:** Listening to famous speeches for structure and style

**Speaking:** Oral presentations on general topics of interest.

**Reading:** Reading for meaning and pleasure – reading between the lines.

**Writing:** Appreciating and analyzing a poem –Paraphrasing, note-taking.

**Grammar and Vocabulary: Tenses (Advanced Level)** Correcting errors in punctuation -Word roots and affixes.

## Learning Outcomes

At the end of the module, the learners will be able to

- Understand the purpose of rhythm and rhyme and the use of figures of speech in making the presentation lively and attractive
- Apply the knowledge of structure and style in a presentation, identify the audience and make note of key points
- Make formal structured presentations on general topics using grammatical understanding
- Prioritize information from reading texts after selecting relevant and useful points
- Paraphrase short academic texts using suitable strategies and conventions

## UNIT-II

**Text: The Model Millionaire – Oscar Wilde**

**Listening:** Following the development of theme; answering questions on key concepts after listening to stories online.

**Speaking:** Narrating personal experiences and opinions.

**Reading:** Reading for summarizing and paraphrasing; recognizing the difference between facts and opinions.

**Writing:** Summarizing, précis writing, letter and note-making

Grammar and Vocabulary: Subject-verb agreement, noun-pronoun agreement, collocations.

## Learning Outcomes

At the end of the module, the learners will be able to

- Comprehend academic lectures, take notes and answer questions
- Make formal structured presentations on academic topics
- Distinguish facts from opinions while reading
- Summarize and make a précis of reports
- Use correct English avoiding common errors in formal speech and writing

## UNIT – III

**Text: Speech at IIM Calcutta – Azim Premji**

**Listening:** Identifying views and opinions expressed by different speakers while listening to speeches.

**Speaking:** Small talks on general topics; agreeing and disagreeing, using claims and examples/evidences for presenting views, opinions and position.

**Reading:** Identifying claims, evidences, views, opinions and stance/position.

**Writing:** Writing structured persuasive/argumentative essays on topics of general interest using suitable claims, examples and evidences.

**Grammar and Vocabulary:** The use of Active and passive Voice, vocabulary for academic texts

### **Learning Outcomes**

At the end of the module, the learners will be able to

- Critically follow and participate in a discussion
- Participate in group discussions using appropriate conventions and language strategies
- Comprehend complex texts and identify the author's purpose
- Produce logically coherent argumentative essays
- Use appropriate vocabulary to express ideas and opinions

### **UNIT -IV**

**Text: A Biography of Steve Jobs**

**Listening:** Listening to identify important moments - Understanding inferences; processing of information using specific context clues from the audio.

**Speaking:** Group discussion; reaching consensus in group work (academic context).

**Reading:** Reading for inferential comprehension.

**Writing:** Applying for internship/ job - Writing one's CV/Resume and cover letter.

**Grammar and Vocabulary: Phrasal verbs, phrasal prepositions and technical vocabulary.**

### **Learning Outcomes**

At the end of the module, the learners will be able to

- Draw inferences and conclusions using prior knowledge and verbal cues
- Express thoughts and ideas with acceptable accuracy and fluency
- Develop advanced reading skills for deeper understanding of texts
- Prepare a cv and write a cover letter to seek internship/ job
- Understand the use of technical vocabulary in academic writing

### **UNIT -V**

**Text: How I Became a Public Speaker - George Bernard Shaw**

**Listening:** Understanding inferences - processing of explicit information presented in the text and implicit information inferable from the text or from previous/background knowledge.

**Speaking:** Formal team presentations on academic/ general topics.

**Reading:** Intensive and extensive reading.

**Writing:** Structure and contents of a Report – Abstract – Project report features.



**Grammar and Vocabulary:** Correcting common errors, improving vocabulary and avoiding clichés and jargons.

### **Learning Outcomes:**

At the end of the module, the learners will be able to

- Develop advanced listening skills for in-depth understanding of academic texts
- Collaborate with a partner to make effective presentations
- Understand and apply the structure of project reports
- Demonstrate ability to use grammatically correct structures and a wide range of vocabulary

### **Course Outcomes**

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

- Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English
- Apply grammatical structures to formulate sentences and correct word forms
- Analyze discourse markers to speak clearly on a specific topic in informal discussions
- Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.
- Create a coherent paragraph interpreting a figure/graph/chart/table

### **Prescribed Book**

1. Forging Ahead: A Course Book for B.Tech Students. Orient BlackSwan, 2020.

### **Reference Books**

1. Bailey, Stephen. "Academic writing: A handbook for international students". Routledge, 2014.
2. Chase, Becky Tarver. Pathways: "Listening, Speaking and Critical Thinking", Heinley ELT; 2<sup>nd</sup> Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. "Cambridge Academic English (B2)". CUP, 2012. (Student Book, Teacher Resource Book, CD & DVD)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
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**(19A01603a) REPAIR AND REHABILITATION OF STRUCTURES**  
**PROFESSIONAL ELECTIVE-II**

**Course Objective**

- To describe causes of distress in concrete structures and plan repair strategies.
- To explain issues on serviceability and durability of concrete.
- To throw light on various repair materials and their characteristics.
- To demonstrate repair techniques and protection measures.
- To illustrate suitable retrofitting schemes.

**UNIT- I**

**Maintenance and repair strategies:**

Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration.

**Learning Outcomes:-**

After completion of this unit student will

- Understand importance and requirement of maintenance
- Gain knowledge on quantification of repairs and documentation

**UNIT -II**

**Serviceability and Durability of Concrete**

Quality assurance for concrete – Strength, Durability and Thermal properties, of concrete Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion - Effects of cover thickness and cracking.

**Learning Outcomes:-**

After completion of this unit student will

- Understand serviceability and durability issues in concrete structures.
- Explain effect due to natural elements on structures

## **UNIT -III**

### **Materials for Repair**

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete.

### **Learning Outcomes:-**

After completion of this unit student will

- List characteristics of materials used for repair.
- Understand suitability of certain materials for a specific type of repair

## **UNIT- IV**

### **Techniques for Repair and Protection Methods**

Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and drypack, vacuum concrete, Guniting and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection. Engineered demolition techniques for dilapidated structures – case studies

### **Learning Outcomes:-**

After completion of this unit student will

- Explain techniques for repair and rehabilitation.
- Understand methods of corrosion protection and inhibition

## **UNIT -V**

### **Retrofitting of Structures**

Repairs to overcome low member strength. Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure.

### **Learning Outcomes:-**

After completion of this unit student will

- Develop effective strategies for retrofitting.

**Course outcomes:**

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

- Understand evaluation procedure and plan for repair.
- Design suitable rehabilitation scheme for serviceability and durability.
- Choose suitable repair material for different magnitudes of distress.
- Apply efficient repair and retrofitting schemes.

**TEXT BOOKS:**

1. Dension Campbell, Allen and Harold Roper, “Concrete Structures”, Materials,
2. “Maintenance and Repair”, Longman Scientific and Technical, U.K.

**REFERENCES:**

1. R T. Allen and S.C. Edwards, “Repair of concrete Structures”, Blakie and sons, UK.
2. Santhakumar, A. R. “Training Course notes on damage assessment and Repair in Structures”
3. Raikar, R. N. Learning from failures – “deficiencies in Design, construction and service” R&D centre (SDCPL), Raikar Bhavan, Bombay.
4. N. Palaniappan, “Estate Management, Anna Institute of Management”, Madras.
5. F. K. Garas, J. L. Clarke, G.S.T. Armer, “Structural Assessment”, Butterworths, UK.
6. A.R. Santhakumar, “Concrete chemicals – Theory and applications, Indian society for construction Engineering and Technology”, Madras.

**(19A01603b) GROUND IMPROVEMENT TECHNIQUES**  
**PROFESSIONAL ELECTIVE-II**

**Course Objectives:**

The objective of this course is:

- To understand need for different ground improvement methods adopted for improving the properties of re-moulded and in-situ soils by adopting different techniques
- To make the student understand how the reinforced earth technology and soil nailing can obviate the problems posed by the conventional retaining walls.
- To know geo-textiles and geo-synthetics can to improve the performance of soils.
- To learn the concepts, purpose and effects of grouting.

**SYLLABUS:**

**UNIT- I**

In situ densification methods- in situ densification of granular soils- vibration at ground surface and at depth, impact at ground and at depth – in situ densification of cohesive soils – pre loading – vertical drains – sand drains and geo drains – stone columns.

**Learning Outcomes:-**

After completion of this unit student will

- Understand methods of in-situ densification
- Study different types of drains for soil densification

**UNIT –II**

Dewatering – sumps and interceptor ditches – single and multi stage well points – vacuum well points – horizontal wells – criteria for choice of filler material around drains – electro osmosis

**Learning Outcomes:-**

After completion of this unit student will

- Understand methods of dewatering
- Study different types of dewatering and working criteria

### **UNIT- III**

Stabilization of soils – methods of soil stabilization – mechanical – cement – lime – bitumen and polymer stabilization – use of industrial wastes like fly ash and granulated blast furnace slag.

#### **Learning Outcomes:-**

After completion of this unit student will

- Study different methods of stabilization of soils
- Study utilization of industrial wastes to stabilize soils

### **UNIT- IV**

Reinforce earth – principles – components of reinforced earth – design principles of reinforced earth walls – stability checks – soil nailing

#### **Learning Outcomes:-**

After completion of this unit student will

- Understand principles of reinforced earth in ground improvement
- Study procedures for verification of stability of slopes.

### **UNIT- V**

Geo-synthetics – Geo-textiles – types – functions, properties and applications – Geo-grids, Geo-membranes and gabions - properties and applications.

Grouting – objectives of grouting – grouts and their applications – methods of grouting – stage of grouting – hydraulic fracturing in soils and rocks – post grout tests

#### **Learning Outcomes:-**

After completion of this unit student will

- Utilization of advanced materials for ground improvement
- Compare different types of synthetic based soil stabilization material and understand performance
- Understand methods of grouting
- Assess efficiency of grouting adopting different tests

**Course Outcomes:**

By the end of the course, the student should be able to

- Perceive the knowledge of various methods of ground improvement and their suitability to different field situations.
- Design a reinforced earth embankment and check its stability.
- Understand the functions of Geo-synthetics and their applications in Civil Engineering practice.
- Understand the concepts and applications of grouting.

**TEXT BOOKS:**

1. Manfred R. Haussmann, "Engineering Principles of Ground Modification", McGraw Hill Pub. Co., New York, 1990
2. Purushotham Raj, "Ground Improvement Techniques", Laxmi Publications, New Delhi.

**REFERENCES:**

1. G. L. Siva Kumar Babu, "An introduction to Soil Reinforcement and Geosynthetics", Universities Press.
2. M. P. Moseley, "Ground Improvement, Blackie Academic and Professional", USA.
3. Nihar Ranjan Patro, "Ground Improvement Techniques", Vikas Publishing House (p) Limited, New Delhi.
4. R. M. Koerner, "Designing with Geo-synthetics", Prentice Hall

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**(19A01603c) AIR POLLUTION ENGINEERING**  
**PROFESSIONAL ELECTIVE-II**

**Course Objectives:**

- To teach the basics of air pollution
- To impart the behavior of air due to metrological influence
- To throw light on air quality management
- To teach the design of air pollution control methods

**UNIT –I**

**Air Pollution:**

Sampling and analysis of air pollutants, conversion of ppm into  $\mu\text{g}/\text{m}^3$ . Definition of terms related to air pollution and control - secondary pollutants - Indoor air pollution – Ozone holes and Climate Change and its impact - Carbon Trade.

**Learning Outcomes:-**

After completion of this unit student will

- Learn the basics of air pollutants.
- Estimate the impact of air pollution

**UNIT-II**

**Thermodynamics and Kinetics of Air-pollution:**

Applications in the removal of gases like  $\text{SO}_x$ ,  $\text{NO}_x$ , CO and HC - Air-fuel ratio- Computation and Control of products of combustion, Automobile pollution. Odour pollution control, Flares.

**Learning Outcomes:-**

After completion of this unit student will

- Analyse and compute the parameters of air pollutants
- Evaluate procedures for control of pollution



## **UNIT –III**

### **Meteorology and Air Pollution:**

Properties of atmosphere: Heat, Pressure, Wind forces, Moisture and relative Humidity, Lapse Rates - Influence of Terrain and Meteorological phenomena on plume behavior and Air Quality - Wind rose diagrams and Isopleths- Plume Rise Models

### **Learning Outcomes:-**

After completion of this unit student will

- Study properties of atmosphere
- Learn plume behavior in different environmental conditions

## **UNIT-IV**

### **Ambient Air Quality Management:**

Monitoring of SPM - RPM SO<sub>2</sub>; NO<sub>x</sub> and CO - Stack Monitoring for flue gases - Micro-meteorological monitoring – Noise Monitoring - Weather Station. Emission Standards- Gaussian Model for Plume Dispersion.

### **Learning Outcomes:-**

After completion of this unit student will

- Study the air quality management.
- Visualize emissions and their permissible standards

## **UNIT-V**

### **Air Pollution Control Methods:**

Control of particulates – Control at Sources, Process Changes, Equipment modifications, Design and operation of Control Equipments –Control of NO<sub>x</sub> and SO<sub>x</sub> emissions – Environmental friendly fuels - In-plant Control Measures, process changes, methods of removal and recycling. Environmental criteria for setting industries and green belts.

### **Learning Outcomes:-**

After completion of this unit student will

- Learn the design principles of particulate and gaseous control.
- Develop environmental friendly fuels and study their properties.

**Course Outcomes:**

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

- Evaluating the ambient air quality based on the analysis of air pollutants
- Design particulate and gaseous control measures for an industry
- Judge the plume behavior in a prevailing environmental condition
- Estimate carbon credits for various day to day activities

**TEXT BOOKS:**

1. M. N. Rao and H. V. N. Rao, “Air Pollution”, Tata McGraw Hill Company.
2. K. V. S. G. Murali Krishna, “Air Pollution and Control”, Laxmi Publications, New Delhi, 2015.

**REFERENCE:**

1. R. K. Trivedy and P. K. Goel, “An Introduction to Air pollution”, B.S. Publications.
2. Wark and Warner, Air Pollution, Harper & Row, New York.
3. Garg, S. K, “Environmental Engineering Vol. II (Sewage Disposal and Air Pollution Engineering)”, Khanna Publishers.
4. Arya, S. P., “Air Pollution Meteorology and Dispersion”, Oxford University Press.

**(19A01603d) RAILWAY ENGINEERING  
PROFESSIONAL ELECTIVE-II**

**Course Objectives:**

The objective of this course is to:

- Comprehend different parts of railway track and their functions.
- Teach track construction and engineering applications
- Explain different essential features and requirements of different types of crossings
- Demonstrate signaling system and maintenance of tracks

**SYLLABUS:**

**UNIT –I**

**Introduction to Indian Railways:**

History and Importance of Indian Railways Construction and Maintenance- Permanent Way - Components-Rails, sleepers, ballast-functions and requirements- Gauges, Types, Uniformity of Gauge- Different Gauges in Indian Railways- Associated problems- Ideal Alignment- Standard Rail Sections- Causes and Effects of Creep- Measurement to Reduce Creep- Fixtures and Fastenings.

**Learning Outcomes:-**

After completion of this unit student will

- Understand the basics of railway components.
- Acquaint with gauges, alignment and standard rail sections.
- Understand different types of fixtures and fastenings

**UNIT –II**

**Geometric Design of Railway Track:**

Geometric design of railway track- Horizontal curves-radius and degree of curve-Cant-Cant Deficiency – Negative Cant – Permissible speed on railway tracks – Gradients- Grade Compensation On Curves.

### **Learning Outcomes:-**

After completion of this unit student will

- Understand the geometric elements of railway track.
- Design the geometrics of railway track.

### **UNIT –III**

#### **Rail way signals**

Classification of Railway Signals – Semaphore Signals- Working Philosophy Of Semaphore Signal – Other Types Of Signals – Their Functions .

### **Learning Outcomes:-**

After completion of this unit student will

- Study the types and classification of signals.
- Understand the functions of various types of signals.

### **UNIT –IV**

**Railway Stations and Yards:** Purposes- Facilities Required At Railway Stations- Classification Of Stations - Requirements Of Station Yard- Classification Of Yards – Terminals – Junctions – Layouts.

### **Learning Outcomes:-**

After completion of this unit student will

- Study the different types of Stations and Yards.
- Understand the functions associated with stations and yards.

### **UNIT –V**

#### **Railway Control Systems:**

Introduction – Different Types Of Control Systems – Absolute Block System – Automatic Block System – Operational Philosophy of these systems.

### **Learning Outcomes:-**

After completion of this unit student will

- Study the types of control systems.

- Understand the operational philosophy of control systems.

### **Course Outcomes:**

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

- Explain components of Railway track, different Gauges.
- Design Track Gradients as per given requirements.
- Designing various types of Track Turnouts.
- Understand purposes and facilities at railway stations.
- Explain interlocking and modern signal systems.
- Identify surface defects on Railway Track and their remedial measures.

### **TEXT BOOKS:**

1. S. C. Saxena and S. P. Arora, “A Text book of Railway Engineering”, Dhanpatrai & Sons, Delhi.
2. C.Venkataramaiah., “Transportation Engineering (Vol – II)”, Universities Press Pvt Ltd, Hyderabad.

### **REFERENCES:**

1. Satish Chandra and M. M. Agarwal, “Railway Engineering”, Oxford University Press, New Delhi
2. R. Srinivasa Kumar, “Transportation Engineering”, Railways, Airports, Docks and Harbors Universities Press Pvt Ltd, Hyderabad. 2014.
3. Vazirani & Chandola, “Transportation Engineering Vol I & II”
4. K. P. Subramanian, “Highway, Railway, Airport and Harbor Engineering”, Sci.Tech publishers.

**(19A01603e) HYDROPOWER DEVELOPMENT  
PROFESSIONAL ELECTIVE-II**

**Course Objectives:**

- To teach concepts of Power potential in the world and India
- To impart with different types of Hydropower Plants and Classification
- To demonstrate different Water Conveyance systems
- To teach about different turbine draft tubes and water hammer effect
- To throw light on Planning and Design of Power house

**UNIT -1**

Introduction: Sources of power - Status of Power potential in the world and India. Transmission voltages and Hydropower - Estimation of water power potential. Source of Hydropower - Runoff and Stream flow. Stream flow analysis - Hydrograph, Mass curve and Flow duration curve.

**Learning Outcomes:-**

After completion of this unit student will

- Understand the basics of hydro power system.

**UNIT -II**

Hydropower Plants - Classification - Low and High head plants, Pumped storage plants Run - of - river plants - General arrangement of Run - of - river plants, Valley dam plants, High head diversion plants. Pumped storage plants - Advantages - Types of Pumped storage plants, Two and three unit arrangements.

**Learning Outcomes:-**

After completion of this unit student will

- Classify and components of hydro power plants.

**UNIT -III**

a. Water Conveyance systems.

Penstocks, Anchor blocks - Design criteria for Penstocks - Economical diameter of Penstock. Anchor blocks - Design principles of Anchor blocks. Valves, Bends and Manifolds

b. Intakes, canals and tunnels - Types of Intakes, Losses in Intakes, Air entrainment at Intakes - Inlet Aeration. Trash racks.

### **Learning Outcomes:-**

After completion of this unit student will

- Acquire Knowledge on external components of hydro power plants.

## **UNIT- IV**

Turbines - Main types - Hydraulic features - Turbine site, Constructional features - Lay out and arrangement. Draft tubes - Cavitation in Turbines - Governing of Turbines. Turbine Characteristics - Model testing - Water Hammer - Resonance in Penstocks. Surge tanks - Types and design principles of Simple Surge Tank.

### **Learning Outcomes:-**

After completion of this unit student will

- Classify the turbine categories
- Design different types of turbines.

## **UNIT -V**

Power house planning - Surface Power stations - Power house structure - Power house dimensions - Lighting and ventilations in Power house. Underground power stations - Location of Underground Power station - Components of Underground Power station. Features of some Typical Hydro - Power projects in India.

### **Learning Outcomes:-**

After completion of this unit student will

- Study the concepts related to planning of hydro power plants.

### **Course Outcomes:**

At the end of this course the student will be able to

- Understand the different sources of hydropower and estimation of potential.
- Hypothesizing the relevant procedures for planning hydro power plants.
- Design effective water conveyance systems and design.
- Design power house and features.

**TEXT BOOKS:**

1. S. K. Garg, "Irrigation engineering and Hydraulic structures", Standard Book House.
2. Punmia & Lal, "Irrigation and water power engineering" Laxmi publications Pvt. Ltd., New Delhi.

**REFERENCES:**

1. S K Sharma, "A Textbook Of Irrigation Engineering and Hydraulic Structures", S. Chand and Company Limited, New Delhi
2. P. N. Modi, "Irrigation and Water Resources & Water Power", Standard Book House.
3. G. L. Asawa, "Irrigation and water resources engineering", New Age International Publishers
4. Dilip Kumar Majumdar, "Irrigation water management", Principles and Practice, PHI Pvt. Ltd. NewDelhi.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (CE) – III-II** **L T P C**  
**3 0 0 3**  
**(19A01604a) INDUSTRIAL WASTE AND WASTE WATER MANAGEMENT**  
**OPEN ELECTIVE-II**

**Course Objectives:**

- To teach Health and Environment Concerns in waste water management
- To teach material balance and design aspects of the reactors used in waste water treatment.
- To impart knowledge on selection of treatment methods for industrial waste water
- To teach common methods of treatment in different industries
- To provide knowledge on operational problems of common effluent treatment plant

**UNIT –I**

**Industrial water Quantity and Quality requirements:**

Boiler and cooling waters–Process water for Textiles, Food processing, Brewery Industries, power plants, fertilizers, sugar mills Selection of source based on quality, quantity and economics. Use of Municipal wastewater in Industries – Adsorption, Reverse Osmosis, Ion Exchange, Ultra filtration, Freezing, Elutriation, Removal of Colour, Odour and Taste.

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Learn the procedures for assessment of quality of Industrial water
- Suggest different processes of handling waste water

**UNIT –II**

**Basic theories of Industrial Wastewater Management:** Industrial waste survey - Measurement of industrial wastewater Flow-generation rates – Industrial wastewater sampling and preservation of samples for analysis -Wastewater characterization-Toxicity of industrial effluents-Treatment of wastewater-unit operations and processes-Volume and Strength reduction – Neutralization and Equalization, Segregation and proportioning- recycling, reuse and resources recovery

### **Learning Outcomes:**

At the end of the unit, students will be able to:

- Measure industrial waste water flow
- Characterize waste water
- Suggest techniques for treatment of waste water.

### **UNIT –III**

**Industrial wastewater disposal management:** Discharges into Streams, Lakes and oceans and associated problems, Land treatment - Common Effluent Treatment Plants: advantages and suitability, Limitations and challenges- Recirculation of Industrial Wastes- Effluent Disposal Method

### **Learning Outcomes:**

At the end of the unit, students will be able to:

- Understand options for waste water disposal.
- Explain functioning of common effluent treatment plants

### **UNIT – IV**

**Process and Treatment of specific Industries-1:** Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Steel plants, Fertilizers, Textiles, Paper and Pulp industries, Oil Refineries, Coal and Gas based Power Plants

### **Learning Outcomes:**

At the end of the unit, students will be able to:

- Understand the character of waste water from Steel plants and refineries
- Suggest suitable waste water treatment techniques

### **UNIT – V**

**Process and Treatment of specific Industries-2:** Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Tanneries, Sugar Mills, Distillers, Dairy and Food Processing industries, Pharmaceutical Plants

## **Learning Outcomes:**

At the end of the unit, students will be able to:

- Understand the character of waste water from tanneries and distilleries
- Suggest suitable waste water treatment techniques

## **Course Outcomes:**

Upon the successful completion of this course, the students will be able to:

- Design treatment methods for any industrial wastewater.
- Examine the manufacturing process of various industries.
- Assess need for common effluent treatment plant for an industry
- Test and analyze BOD, COD, TSS and MPN in waste water.

## **TEXT BOOK**

1. M. N. Rao and A. K. Dutta, “Wastewater Treatment”, Oxford & IBH, New Delhi.
2. K.V. S. G. Murali Krishna, “Industrial Water and Wastewater Management”.

## **REFERENCES**

1. A. D. Patwardhan, “Industrial Wastewater treatment”, PHI Learning, Delhi
2. Metcalf and Eddy Inc., “Wastewater Engineering”, Tata McGraw Hill co., New Delhi.
3. G. L. Karia & R.A. “Christian Wastewater Treatment- Concepts and Design Approach”, Prentice Hall of India.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (CE)– III-II** **L T P C**  
**3 0 0 3**  
**(19A01604b) BUILDING SERVICES AND MAINTAINANCE**  
**OPEN ELECTIVE-II**

**Course Objectives:**

- To impart knowledge in concepts of building maintenance
- To insist the student to observe various practices of good building maintenance
- To teach the importance safety in buildings
- To demonstrate the use of ventilation in buildings.
- To give the list of different types of machineries in buildings

**UNIT – I**

**PLUMBING SERVICES:** Water supply system- fixing of pipes in buildings – maintenance of buildings- water meters-sanitary fittings-design of building drainage- gas supply systems

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Understand water supply system
- Understand the building drainage system.

**UNIT – II**

**VENTILATION:** Necessity of ventilation – functional requirements – systems of ventilation-natural ventilation-artificial ventilation-air conditioning-systems of air conditioning-essentials of air conditioning-protection against fire caused by air conditioning systems.

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Understand concepts of ventilation
- Understand concepts of air conditioning

### **UNIT – III**

**THERMAL INSULATION:** Heat transfer system-thermal insulating materials-methods of thermal insulation-economics of thermal insulation-thermal insulation of exposed walls, doors, windows and roofs.

#### **Learning Outcomes:**

At the end of the unit, students will be able to:

- Understand methods of insulation
- Understand materials of insulation

### **UNIT – IV**

**FIRE SAFETY:** Causes of fire in buildings-fire safety regulations-characteristics of fire resisting materials- fire resistant construction-heat and smoke detectors-fire alarms-fire fighting pump and water storage.

#### **Learning Outcomes:**

At the end of the unit, students will be able to:

- Understand safety regulations of fire system
- Know about the implementation and usage of various fire resistant materials in building construction

### **UNIT – V**

**MACHINERIES IN BUILDINGS:** Lifts-essential requirements-design considerations-escalators-essential requirements-electrical installations in buildings-lighting in buildings-methods of electrical wiring-earthing

#### **Learning Outcomes:**

At the end of the unit, students will be able to:

- Understanding of different machineries of buildings
- Understanding of electrical installation of buildings

**Course Outcomes:**

Student will be able to understand

- Concepts of plumbing, drainage system and gas supply system
- Concepts of ventilation and air conditioning
- Concepts of thermal insulation and economics of thermal insulation
- Concepts of fire safety in buildings and fire resistant construction
- Concepts of different machineries of buildings

**TEXT BOOKS:**

1. B.C.Punmia, Er. Ashok K Jain, Arun K Jain “Building construction”, Laxmi publications pvt.ltd. New Delhi.
2. Janardhan Jah, S.K Sinha, “Building construction”, Khanna publishers
3. Rangwala, “Building construction”, Charohtar publishing house.

**REFERENCE BOOKS:**

1. David V Chaddrton, “Building services engineering”, Outledge
2. P.C Varghees “Building construction”, Printice hall india

**(19A02604a) INDUSTRIAL AUTOMATION  
OPEN ELECTIVE-II**

**Course Objectives:**

- To understand the basic concepts of Automation
- To understand the concepts of automation cycle and hardware components
- To gain knowledge about pneumatic and hydraulic devices
- To understand the concepts of sensors and actuators
- To know the use of Robotics used in industries automation

**UNIT -I:**

**Introduction to Automation**

Definition and fundamentals of automation, reasons for Automating, basic elements of an automated system: Power, Program and control system, safety, maintenance & repair diagnosis, error detection and recovery, Automation principles and strategies: USA principle, strategies of automation and production system, automation migration strategy

**Learning Outcomes:**

At the end of the unit, students will be able to:

- To understand the fundamental concepts of automation and its basic elements
- To understand system safety requirements
- To understand about maintenance and repair strategies
- To know about production system automation

**UNIT- II:**

**Mechanization and Automation**

Basic principles of Mechanization and automation, product cycle, hard Vs flexible automation, Capital- intensive Vs low cost automation. Types of systems-mechanical, electrical, hydraulic, pneumatic and hybrid systems, Automation using CAMS, Geneva mechanisms, gears etc. Assembly line Automation: automated assembly systems, transfer systems, vibratory bowl feeders, non-vibratory feeders, part orienting, feed track, part placing & part escapement systems. Introduction to Material storage/ handling and transport systems, and its automation using AS/RS, AGVS and conveyors etc.

### **Learning Outcomes:**

At the end of the unit, students will be able to:

- To know about how to analyse the various automation methods
- To know about assembling and placing of various parts
- To distinguish between mechanization and automation of systems
- To know about material storage, handling and automation using various approaches

### **UNIT -III:**

#### **Pneumatics and hydraulics**

Hydraulic and pneumatic devices-Different types of valves, Actuators and auxiliary elements in Pneumatics & hydraulics , their applications and use of their ISO symbols. Synthesis and design of circuits (up to 3 cylinders)–pneumatic, electro pneumatics and hydraulics. Design of Electro-Pneumatic Circuits using single solenoid and double solenoid valves; with and without grouping.

### **Learning Outcomes:**

At the end of the unit, students will be able to:

- To know design of various pneumatic and hydraulic components
- To understand about synthesis and design of Pneumatic circuits
- To understand about electro pneumatic circuits
- To design using various solenoid valves with and without grouping

### **UNIT -IV:**

#### **Sensors & Actuators**

Selection of sensors (Displacement, temperature, acceleration, force /pressure) based on static and dynamic characteristics. Interfacing: Concept of interfacing, bit accuracy and sampling speed, amplifying electronics, and microcontroller. Actuators: Principle and selection of electro mechanical actuators (1) DC motors (2) Stepper Motors (3) Solenoid Actuators (4) Servo Motors (5) BLDC

### **Learning Outcomes:**

At the end of the unit, students will be able to:

- To know about selection of sensors and actuators based on dynamic characteristics
- To understand about necessity of interfacing sensors with Microcontroller
- To understand principle and selection of actuators
- To apply various electro mechanical actuators to certain machines



## **UNIT- V:**

### **Robots and their applications**

Introduction to robots, Types, Classifications, Selection of robots, Robot Degrees of freedom, Robot configuration, Accuracy and repeatability, Specification of a robot, Robot feedback controls: Point to point control and Continuous path control, Control system for robot joint, Adaptive control, Drives and transmission systems, End effectors, Industrial robot applications of robots

### **Learning Outcomes:**

At the end of the unit, students will be able to:

- To know about Robots, classification, selection and specifications
- To understand the use of robotics in industrial applications
- To know about various feedback controls of Robot
- To understand how adaptive control strategies can be used in Robots

### **Course Outcomes:**

1. Understand the basic concepts of Industrial automation
2. Design and analysis of automation methods, placing and assembling of various parts
3. Design of various processing and control circuits using pneumatic and hydraulic elements
4. Selection of sensors based on the industrial application
5. Role of robotics in industrial applications

### **TEXT BOOKS:**

1. Stamatios Manesis and George Nikolakopoulos, “Introduction to Industrial Automation”, CRC Press, 2018.
2. Frank Lamb, “Industrial Automation”, Hands on, Mc Graw Hill Education, 2013.

### **REFERENCES:**

1. Richerd L. Shell and Ernest L. Hall, “Hand Book of Industrial Automation”, CRC Press, 2000.

**(19A02604b) SYSTEM RELIABILITY CONCEPTS  
(OPEN ELECTIVE-II)**

**Course Objectives:**

To make the students learn about:

- The Basic concepts, rules for combining probabilities of events, failure density and distribution functions.
- Evaluation of network Reliability / Unreliability and types of redundancies.
- Evaluation of network Reliability / Unreliability using conditional probability method.
- Expected value and standard deviation of Exponential distribution and Measures of reliability.
- Evaluation of Limiting State Probabilities of one, two component repairable models.

**UNIT-I:**

**Basic Probability Theory**

Basic concepts – Rules for combining Probabilities of events – Failure Density and Distribution functions – Bernoulli's trials – Binomial distribution – Expected value and standard deviation for binomial distribution – Examples

**Learning Outcomes:**

At the end of the unit, students will be able to:

- To know about basic rules for probabilities of events
- To distinguish between pdf and cdf
- Get detailed information about Probability of failure density and distribution functions
- Obtain the expected value and standard deviation for binomial distribution.

**UNIT-II:**

**Network Modeling and Reliability Evaluation**

Basic concepts – Evaluation of network Reliability / Unreliability – Series systems, Parallel systems, Series - Parallel systems, partially redundant systems – Types of redundancies - Evaluation of network Reliability / Unreliability using conditional probability method – Paths based and Cutset based approach – complete event tree and reduced event tree methods - Examples.

## **Learning Outcomes:**

At the end of the unit, students will be able to:

- How to find the Probability of success and failures of network using different approaches for series-parallel configurations.
- Classification of redundancies.
- To find reliability / unreliability of complex systems using different methods
- Comparison of approaches to solve probability index of SISO system

## **UNIT-III:**

### **Time Dependent Probability**

Basic concepts – Reliability functions  $f(t)$ ,  $Q(t)$ ,  $R(t)$ ,  $h(t)$  – Relationship between these functions – Bath tub curve – Exponential failure density and distribution functions - Expected value and standard deviation of Exponential distribution – Measures of reliability – MTTF, MTTR, MTBF – Evaluation of network reliability / Unreliability of simple Series, Parallel, Series-Parallel systems - Partially redundant systems - Evaluation of reliability measure – MTTF for series and parallel systems – Examples.

## **Learning Outcomes:**

At the end of the unit, the student will be able to

- Understand the concepts of time domain functions and relationship between them.
- Obtain the expected value and standard deviation for exponential distribution.
- Obtain the values of probabilistic measures for series and parallel configurations.
- To obtain probabilistic measures for fully redundant and partially redundant configurations

## **UNIT-IV:**

### **Discrete Markov Chains & Continuous Markov Processes**

**Markov Chains:** Basic concepts – Stochastic transitional Probability matrix – time dependent probability evaluation – Limiting State Probability evaluation – Absorbing states.

**Markov Processes:** Modeling concepts – State space diagrams – time dependent reliability evaluation of single component repairable model – Evaluation of Limiting State Probabilities of one, two component repairable models – Frequency and duration concepts – Frequency balance approach - Examples.

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Understand the concepts of Stochastic Transitional Probability Matrix, Limiting State Probability
- To know about evaluation for one and two component repairable models.
- Understand the concept of Frequency balance approach.
- To distinguish between Markov chains and Markov processes

**UNIT-V:****Multi Component & Approximate System Reliability Evaluation**

Recursive relation for evaluation of equivalent transitional rates– cumulative probability and cumulative frequency and ‘n’ component repairable model – Series systems, Parallel systems, Basic probability indices – Series, Parallel systems – Complex Systems– Cutset approach – Examples.

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Understand the concepts of recursive relation for evaluation of equivalent transitional rates.
- Obtain the cumulative probability and cumulative frequency for different systems
- To know about computation of basic probability indices for series, parallel configurations
- To know how to evaluate basic probability indices using cut set approach

**Course Outcomes:**

After completing the course, the student should be able to do the following:

- Understand the concepts for combining Probabilities of events, Bernoulli’s trial, and Binomial distribution.
- Network Reliability/Unreliability using conditional probability, path and cutset based approach, complete event tree and reduced event tree methods.
- Understanding Reliability functions and to develop relationship between these functions, expected value and standard deviation of Exponential distribution and measures of reliabilities.
- Analyze the time dependent reliability evaluation of single component repairable model, frequency and duration concepts, Frequency balance approach.
- Recursive relation for evaluation of equivalent transitional rates, cumulative probability and cumulative frequency and ‘n’ component repairable model.

**Text Books:**

1. Roy Billinton and Ronald N. Allan, “Reliability Evaluation of Engineering Systems”, Reprinted in India B. S. Publications, 2007.
2. E. Balagurusamy, “Reliability Engineering”, Tata McGraw Hill, 2003.

**Reference Books:**

1. E. E. Lewis , “Introduction to Reliability Engineering” Wiley Publications.
2. Charles E. Ebeling, “Reliability and Maintainability Engineering”, Tata McGraw Hill, 2000.
3. by Ajit Kumar Verma, Srividya Ajit and Durga Rao Karanki, Springer, “Reliability and Safety Engineering” 2<sup>nd</sup> edition, 2016.
4. Rausand and Arnljot Hoyland, “System Reliability Theory Marvin”, Wiley Publications.

**(19A03604a) INTRODUCTION TO MECHATRONICS  
OPEN ELECTIVE**

**Course Objectives:**

- Familiarize the technologies behind modern mechatronic systems.
- Explain fundamentals for the development of fully automated system.
- Develop a robotic or automated systems focusing on the hardware and software integration.
- Demonstrate the development and design of mechatronic system and MEMS.

**UNIT – I**

**Introduction:** Definition of Mechatronics, Need for Mechatronics in Industry, Objectives of mechatronics, mechatronics design process, Mechatronics key elements, mechatronics applications – Computer numerical control (CNC) machines, Tool monitoring systems, Flexible manufacturing system (FMS), Industrial Robots, Automatic packaging systems, Automatic inspection systems.

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Explain the role of mechatronics in industry.(I2)
- Identify the application of mechatronics in automation industry.(I3)

**UNIT – II**

**Sensors:** Static characteristics of sensors, Displacement, Position and Proximity sensors, Force and torque sensors, Pressure sensors, Flow sensors, Temperature sensors, Acceleration sensors, Level sensors, Light sensors, Smart material sensors, Micro and Nano sensors, Selection criteria for sensors.

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Classify various types of sensors. (I2)
- Choose sensors for particular application. (I3)
- Measure different quantity's using sensors. (I4)

**UNIT – III**

**Actuators:** Mechanical, Electrical, Hydraulic and Pneumatic Actuation systems, Characteristics and their limitations, Design of Hydraulic and Pneumatic circuits, Piezoelectric actuators, Shape memory alloys, Selection criteria for actuators.

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Classify various actuation systems. (I2)
- Choose the criterion for different actuators. (I1)

**UNIT – IV**

**Microprocessors, Microcontrollers and Programmable Logic Controllers:** Architecture of of Microprocessor, Microcontroller and Programmable Logic Controller, PLC Programming using ladder diagrams, logics, latching, sequencing, timers relays and counters, data handling, Analog input/output, selection of controllers.

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Understand the architecture of microprocessors, microcontrollers and PLC. (L2)
- Formulate various programs using PLC. (L6)

**UNIT – V**

Design of mechatronics systems, Mechatronics design elements, Traditional mechatronics systems, Embedded systems, Procedure for designing a mechatronic systems.

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Understanding design of mechatronics . (L2)
- Various Mechatronics systems. (L4)
- Design Aspects of Mechatronic systems. (L2)

## **Course Outcomes**

Upon successful completion of this unit, the student will be able to:

- Explain mechatronics systems in industry. (I2)
- Identify mechatronic systems encountered in practice. (I3)
- Examine the components of a typical mechatronic system. (I4)
- Compare the various techniques used for development of mecs. (I4)
- Develop programs using plc. (I6)

## **Text books:**

1. Er R. Rajput, “A Text book of Mechatronics”, S.Chand, 2<sup>nd</sup> edition-2016.
2. James J Allen, “Micro Electro Mechanical Systems Design”, CRC Press Taylor & Francis group, 2005.

## **Reference Text books:**

1. WBolton, “Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering”, 3<sup>rd</sup> edition, Pearson Education Press, 2005.
2. Devadas Shetty and Richard A Kolk, “Mechatronic System Design”, 2<sup>nd</sup> edition, Cengage learning, 2010.
3. Clarence W. de Silva, “Mechatronics an Integrated Approach”, CRC Press, 2004.
4. Ganesh S Hedge, “Mechatronics”, Jones & Bartlett Learning, 2010.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (CE)– III-II Sem**  

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**(19A03604b) OPTIMIZATION TECHNIQUES THROUGH MATLAB**  
**OPEN ELECTIVE-II**

**Course Objectives**

- Introduce basics of MATLAB
- Familiarize the fundamentals of optimization
- Explain single variable optimization using various methods
- Implement multi variable optimization using various methods
- Train various evolutionary algorithms.

**UNIT -I**

**Introduction to MAT LAB:** Overview, MATLAB Preliminaries, Basics of MATLAB, Beyond the Basics of MATLAB, Popular Functions and Commands, Plotting using MATLAB, Optimization with MATLAB.

**Learning Outcomes:**

After completion of this unit, students will be able to

- Write simple codes in MATLAB. (L3)
- Plot the data using MATLAB. (L3)
- Implement optimization models in MATLAB. (L3)

**UNIT -II**

**Introduction to Optimization:** Statement of an optimization problem, Classifications of optimization Problems: Single variable optimization, Multi variable optimization with no constraints, Multi variable optimization with equality constraints, Multi variable optimization with inequality constraints, Convex and Concave programming.

**Learning Outcomes:**

After completion of this unit, students will be able to

- Build optimization problem. (I1)
- Solve various optimization problems(I3)
- Compare convex and concave programming (I4)

**UNIT -III**

**Single Variable Optimization:** Finite difference method, Central difference method, Runge-Kutta method, interval halving method, golden section method with MATLAB code.

### **Learning Outcomes:**

After completion of this unit, students will be able to

- Understand various methods involving single variable optimization. (I2)
- Develop codes in matlab for different methods. (I3)
- Identify methods for solving a single variable optimization problem. (I3)

### **UNIT- IV**

**Multi Variable Optimization:** Conjugate gradient method, Newton's method, Powell's method, Fletcher- Reeves method, Hook and Jeeves method, interior penalty function with MATLAB code.

### **Learning Outcomes:**

After completion of this unit, students will be able to

- Apply various methods involving multi variable optimization. (I2)
- Develop codes in matlab for solving various multi variable optimization problems. (I3)
- Choose methods for solving a multi variable optimization problem. (I3)

### **UNIT -V**

**Evolutionary Algorithms:** Overview, Genetic Algorithms: Basics of Genetic Algorithms, Options in MATLAB, Multi Objective Optimization using Genetic Algorithms, Ant Colony Optimization, Simulated Annealing, Particle Swarm Optimization.

### **Learning Outcomes:**

After completion of this unit, students will be able to

- Apply different types of genetic algorithms. (I3)
- Model optimization problems using genetic algorithms in matlab. (I3)
- Compare different genetic algorithms for performance. (I5)

### **Course Outcomes:**

After completion of this course the student can be able to

- Use optimization terminology and concepts, and understand how to classify an optimization problem.(I4)
- Apply optimization methods to engineering problems.(I3)
- Implement optimization algorithms.(I3)
- Compare different genetic algorithms. (I5)
- Solve multivariable optimization problems. (I4)

**TEXT BOOKS:**

1. Rao V.Dukkipati, MATLAB: “An Introduction with Applications”, Anshan, 2010.
2. Achille Messac, “Optimization in practice with MATLAB”, Cambridge University Press, 2015.
3. Jasbir S Arora, “Introduction to optimum design”, 2<sup>nd</sup> edition. Elsevier, 2004.

**REFERENCES:**

1. Cesar Perez Lopez, “MATLAB Optimization Techniques”, Academic press, Springer publications, 2014.
2. Steven C.Chapra, “Applied Numerical Methods with MATLAB for Engineers and scientists”: 4<sup>th</sup> edition, McGraw-Hill Education, 2018.

(19A04604a) **BASICS OF VLSI**  
**OPEN ELECTIVE-II**

**Course Objectives:**

The objectives of the course are to

- Learn and Understand IC Fabrication process steps required for various MOS circuits
- Understand and Experience VLSI Design Flow
- Learn Transistor-Level CMOS Logic Design
- Understand VLSI Fabrication and Experience CMOS Physical Design
- Learn to Analyze Gate Function and Timing Characteristics

**UNIT – I**

**Introduction:** Introduction to MOS Technology – MOS, PMOS, NMOS, CMOS and BiCMOS technologies, fabrication fundamentals: Oxidation, Lithography, Diffusion, Ionimplantation, Metallization and Encapsulation.

**Basic Electrical Properties:** Basic Electrical Properties of MOS, CMOS and BiCMOS Circuits,  $I_{DS}$ - $V_{DS}$  relationships, MOS transistor threshold Voltage,  $g_m$ ,  $g_{ds}$ , figure of merit  $\omega_0$ , Pass transistor, NMOS inverter, Various pull - ups, Determination of pull-up to pulldown ratio ( $Z_{pu} / Z_{pd}$ ), CMOS Inverter analysis and design, BiCMOS inverters, Latch-up in CMOS circuits.

**Learning Outcomes:**

After completion of this unit, students will be able to

- Demonstrate a clear understanding of CMOS fabrication flow and technology scaling (L2)
- Analyze the electrical properties of MOS and BiCMOS circuits (L3)
- Design MOSFET based logic circuit (L4)

**UNIT – II**

**VLSI Circuit Design Processes:** VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layouts, Lambda based design rules, Contact cuts, CMOS Lambda based design rules, Layout Diagrams for logic gates, Transistor structures, wires and vias, Scaling of MOS circuits- Scaling models, scaling factors, scaling factors for device parameters, Limitations of Scaling.

## **Learning Outcomes:**

After completion of this unit, students will be able to

- Understand the design rules and layout diagram for logic gates, limitations of scaling (L1)
- Draw the Layout of simple MOS circuit using Lambda based design rules (L2)

## **UNIT – III**

**Gate Level Design and Layout:** Architectural issues, Switch logic networks: Gate logic, Alternate gate circuit: Pseudo-NMOS Dynamic CMOS logic. Basic circuit concepts, Sheet Resistance  $R_s$  and its concept to MOS, Area Capacitance Units, Calculations, The delay unit  $T$ , Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out, Choice of layers

## **Learning Outcomes:**

After completion of this unit, students will be able to

- Apply basic circuit concepts to MOS circuits. (L2)
- Estimate the propagation delays in CMOS circuits (L3).

## **UNIT – IV**

**Subsystem Design:** Subsystem Design, Shifters, Adders, ALUs, Multipliers: Array multiplier, Serial/Parallel multiplier, Parity generator, Comparators, Zero/One Detectors, Up/Down Counter, Memory elements: SRAM, DRAM, ROM, Serial Access Memories.

## **Learning Outcomes:**

After completion of this unit, students will be able to

- Apply the Lambda based design rules for subsystem design (L2)
- Design of Adders, Multipliers and memories etc (L4)
- Design digital systems using MOS circuits (L4)

## **UNIT – V**

**Semiconductor Integrated Circuit Design:** PLDs, FPGAs, CPLDs, Standard Cells, Programmable Array Logic, Programmable Logic Array Design Approach.

## **Learning Outcomes:**

After completion of this unit, students will be able to

- Analyze various architectures and device technologies of PLDs(L3)
- Design simple logic circuit using PLA, PAL, FPGA and CPLD.(L4)

## **Course Outcomes:**

- Learn the basic fabrication process of MOS transistors, study CMOS inverter circuits, basic circuit concepts such as Sheet Resistance, Area Capacitance and Delay calculation, Field programmable gate arrays and realization techniques, CPLDs and FPGAs for implementing the various logic functions.
- Apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect, and to verify the functionality.
- Analyze the performance of CMOS Inverter circuits
- Compare various Scaling models and understand the effect of scaling on device parameters

## **TEXT BOOKS:**

1. Kamran Eshraghian, “Essentials of VLSI circuits and systems”, EshraghianDouglasand A. Pucknell, PHI, 2005 Edition
2. Wayne Wolf, “Modern VLSI Design”, 3rd Edition, Pearson Education, 1997.

## **REFERENCE BOOKS:**

1. John .P. Uyemura, “CMOS logic circuit Design”, Springer, 2007.
2. Neil H. E Weste, “CMOS VLSI Design – A Circuits and Systems Perspective”, 3<sup>rd</sup> edition, DavidHarris, Ayan Banerjee, Pearson, 2009.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (CE)– III-II Sem**  
**(19A04604b) PRINCIPLES OF COMMUNICATION SYSTEMS**  
**OPEN ELECTIVE-II**

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<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

- To understand the concept of various modulation schemes and multiplexing.
- To apply the concept of various modulation schemes to solve engineering problems.
- To analyse various modulation schemes.
- To evaluate various modulation scheme in real time applications.

**UNIT-I:**

**Amplitude Modulation**

Introduction to Noise and Fourier Transform. An overview of Electronic Communication Systems. Need for Frequency Translation, Amplitude Modulation: DSB-FC, DSB-SC, SSB-SC and VSB. Frequency Division Multiplexing. Radio Transmitter and Receiver.

**Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concept of noise, Fourier transform, carrier modulation and frequency division multiplexing (L1).
- Apply the concept of amplitude modulation to solve engineering problems (L2).
- Analyse various amplitude modulation schemes (L3).
- Evaluate various amplitude modulation schemes in real time applications (L3).

**UNIT-II:**

**Angle Modulation**

Angle Modulation, Tone modulated FM Signal, Arbitrary Modulated FM Signal, FM Modulation and Demodulation. Stereophonic FM Broadcasting.

**Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concept of angle modulation and its components (L1).

- Apply the concept of frequency modulation to solve engineering problems (L2).
- Analyse angle modulation schemes (L3).
- Evaluate frequency modulation scheme in real time applications (L3).

### **UNIT-III:**

#### **Pulse Modulation**

Sampling Theorem: Low pass and Band pass Signals. Pulse Amplitude Modulation and Concept of Time Division Multiplexing. Pulse Width Modulation. Digital Representation of Analog Signals.

#### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concept of various pulse modulation schemes and time division multiplexing (L1).
- Analyse various pulse modulation schemes (L3).

### **UNIT-IV:**

#### **Digital Modulation**

Binary Amplitude Shift Keying, Binary Phase Shift Keying and QuadraturePhase Shift Keying, Binary Frequency Shift Keying. Regenerative Repeater.

#### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concept of various digital modulation schemes (L1).
- Analyze various digital modulation schemes (L3).

### **UNIT-V:**

#### **Communication Systems**

Satellite, RADAR, Optical, Mobile and Computer Communication (Block diagram approach only).



## **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concept of various communication systems (L1).

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

## **Course Outcomes:**

- Understand the concept of various modulation schemes and multiplexing (L1).
- Apply the concept of various modulation schemes to solve engineering problems (L2).
- Analyse various modulation schemes, and evaluate various modulation scheme in real time applications (L3).

## **TEXT BOOKS:**

1. Herbert Taub, Donald L Schilling and Goutam Saha, “Principles of Communication Systems”, 3<sup>rd</sup> Edition, Tata McGraw-Hill Publishing Company Ltd., 2008.

## **REFERENCES:**

1. B. P. Lathi, Zhi Ding and Hari M. Gupta, “Modern Digital and Analog Communication Systems”, 4<sup>th</sup> Edition, Oxford University Press, 2017.
2. K. Sam Shanmugam “Digital and Analog Communication Systems”, Wiley India Edition, 2008.

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## **Blooms’ Learning levels:**

L1: Remembering and Understanding

L2: Applying

L3: Analyzing, Evaluating

(19A05604a) FUNDAMENTALS OF VR/AR/MR

Open Elective-II  
(Common to CSE & IT)

**Course Objectives:**

This course is designed to:

- Explore the history of spatial computing and design interactions
- Understand the foundational principles describing how hardware, computer vision algorithms function
- Learn Virtual reality animation and 3D Art optimization
- Demonstrate Virtual reality
- Introduce to the design of visualization tools

UNIT-I

**How Humans interact with Computers:** Common term definition, introduction, modalities through the ages (pre- 20<sup>th</sup> century, through world war-II, post world war-II, the rise of personal computing, computer miniaturization), why did we just go over all of this?, types of common HCI modalities, new modalities, the current state of modalities for spatial computing devices, current controllers for immersive computing systems, a note on hand tracking and hand pose recognition.

**Designing for our Senses, Not our Devices:** Envisioning a future, sensory technology explained, who are we building this future for?, sensory design, five sensory principles, Adobe's AR story.

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Explain common modalities and their pros and cons.(L2)
- Demonstrate Mapping modalities to current industry inputs(L2)
- Explore the importance of design with spatial computing(L5)

UNIT-II

**Virtual Reality for Art:** A more natural way of making 3D art, VR for animation.

**3D art optimization:** Introduction, draw calls, using VR tools for creating 3D art, acquiring 3D models vs making them from scratch.

**How the computer vision that makes augmented reality possible works:** Who are we?, a brief history of AR, how and why to select an AR platform, mapping, platforms, other development considerations, the AR cloud.

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Utilize VR tools for creating 3D Animations(L3)

- Analyze how and why to Select an AR Platform(L4)

### UNIT-III

**Virtual reality and augmented reality:** cross platform theory: Why cross platform? The role of game engines, understanding 3D graphics, portability lessons from video game design, simplifying the controller input.

**Virtual reality toolkit:** open source framework for the community: What is VRTK and why people use it?, the history of VRTK, welcome to the steam VR unity toolkit, VRTK v4, the future of VRTK, success of VRTK.

**Three virtual reality and augmented reality development practices:** Developing for virtual reality and augmented reality, handling locomotion, effective use of audio, common interaction paradigms.

#### Learning Outcomes:

At the end of the unit, students will be able to:

- Explain why the design approach should be considered at a holistic high level based on the goal of the experience(L2)
- Build VR solutions using Virtual reality toolkit(L6)
- Interpret the development practices in three Virtual reality and Augmented reality development(L2)

### UNIT-IV

**Data and machine learning visualization design and development in spatial computing:**

Introduction, understanding data visualization, principles for data and machine learning visualization design and development in spatial computing, why data and machine learning visualization works in spatial computing, 2D data visualization vs 3D data visualization in spatial computing, interactivity in data visualizations and in spatial computing, animation, failures in data visualization, good data visualization design optimize 3D spaces, data representations, info graphics, and interactions, defining distinctions in data visualization and big data for machine, how to create data visualization: data visualization creation pipeline, webXR, data visualization challenges in XR, data visualization industry use case examples of data visualization, 3D reconstruction and direct manipulation of real world data, data visualization is for everyone, hands on tutorials, how to create data visualization, resources.

#### Learning Outcomes:

At the end of the unit, students will be able to:

- Understand, define, and set data and machine visualization design and development principles in embodied reality(L1)
- Demonstrate best practices, and practical tools to create beautiful and functional data visualizations.(L2)

### UNIT-V

**Character AI and Behaviors:** Introduction, behaviors, current practice: Reactive AI, more intelligence in the system, Deliberative AI, machine learning.

**The virtual and augmented reality health technology ecosystem:** VR/AR health technology application design, standard UX isn't intuitive, tutorial: insight Parkinson's experiment, companies, case studies from leading Academic institutions.

### **Learning Outcomes:**

At the end of the unit, students will be able to:

- Design a behavioral AI system for a video game(L6)
- Identify issues related to design of virtual reality (VR) and augmented reality (AR) experiences deployed in a health-care context(L3)
- Explain the use of motion data from controllers to reduce the visible tremor of a Parkinson's patient in a virtual environment(L2)

### **Course outcomes**

Upon completion of the course, the students should be able to:

- Explain how the humans interact with computers (L2)
- Apply technical and creative approaches to make successful applications and experiences. (L3)
- Design audio and video interaction paradigms (L6)
- Design Data visualization tools (L6)
- Apply VR/MR/AR in various fields in industry (L3)

### **Text book**

1. Erin Pangilinan, Steve lukas, and Vasanth Mohan, "Creating Augmented & Virtual Realities", 1<sup>st</sup> edition, O'REILLY, 2019.

### **References**

1. Steve Aukstakalnis, "Practical Augmented Reality", Pearson Education, 2017.

**(19A05604b) DATA SCIENCE**  
**Open Elective-II**  
**(Common to CSE & IT)**

**Course Objectives**

This course is designed to:

- Understand the approaches for handling data related problems
- Explore the mathematical concepts required for Data science
- Explain the basic concepts of data science.
- Elucidate various Machine Learning algorithms.
- Introduce Natural Language Processing and Recommender Systems

**UNIT- I**

Introduction to Data Science, A Crash Course in Python, Visualising Data.

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Describe the importance of data analysis (L1).
- Identify the key connectors of Data Science (L4).
- Interpret and Visualize the data using bar charts, line charts and scatter plots (L3).

**UNIT-II**

Linear Algebra, Statistics, Probability, Hypothesis and Inference, Gradient Descent.

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Identify the Correlation between two vectors (L4).
- Test a given hypothesis (L3).
- Compute mean, median and mode for the given data (L3).

**UNIT-III**

Getting Data, Working with Data, Machine Learning, k-Nearest Neighbors, Naïve Bayes.

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Compute dimensionality reduction using PCA (L3).
- Differentiate supervised and unsupervised learning methods (L4).
- Describe overfitting, under fitting, bias, variance and goodness of learning (L1).
- Solve classification problem using k-nearest neighbour classifier (L3).
- Apply Naïve Bayes classifier to solve decision making problem (L3).

**UNIT-IV**

Simple Linear Regression, Multiple Regression, Logistic Regression, Decision Trees, Neural Networks.

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Describe gradient descent approach, maximum likelihood estimation and method of least squares (L1).
- Apply SVM to determine a hyperplane with maximum margin (L3).
- Determine decision tree for given data (L5).
- Describe Perceptron and Back Propagation (L3).

**UNIT-V**

Clustering, Natural Language Processing, Network Analysis, Recommender Systems.

Database and SQL, MapReduce

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Determine Clusters in data using k-means and Hierarchical Clustering methods (L5).
- Apply basic SQL Operations using NotQuiteABase (L3).
- Compare User-Based and Item-Based Collaborative Filtering (L2).
- Describe Grammer and MapReduce (L1).

**Course Outcomes:**

After completion of this course the student would be able to

- Visualize the data using bar charts, line charts and scatter plots (L4).
- Analyse Correlation between two data objects (L4).
- Demonstrate feature selection and dimensionality reduction.(L2)
- Solve decision making problems using k-NN, Naïve Bayes, SVM and Decision. Trees (L3).
- Determine Clusters in data using k-means and Hierarchical Clustering methods (L3).
- Design basic SQL Operations using NotQuiteABase (L6)
- Demonstrate the way to use machine learning algorithms using python. (L2)

**Text Books:**

1. Data Science from Scratch, First Principles with Python - Joel Grus, O'Reilly, First Edition.

**Reference Books:**

1. The Data Science Handbook, Field Cady, WILEY.
2. An Introduction to Data Science, Jeffrey M. Stanton, Jeffrey Stanton, 2012

**(19A27604a) FOOD TOXICOLOGY  
OPEN ELECTIVE II**

**PREAMBLE**

This text covers about toxins and their relation in food. Examination, identification and prevention of toxins.

**Course Objectives**

- To know the various toxins and their evaluation.
- To understand their tolerance and control measures.

**UNIT – I**

Principles of Toxicology: classification of toxic agents; characteristics of exposure; spectrum of undesirable effects; interaction and tolerance; biotransformation and mechanisms of toxicity. Evaluation of toxicity: risk vs. benefit: experimental design and evaluation: prospective and retrospective studies: Controls :Statistics (descriptive, inferential): animal models as predictors of human toxicity: Legal requirements and specific screening methods: LD50 and TD50: in vitro and in vitvo studies; clinical trials.

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Classification of toxic agents; characteristics of exposure;
- Spectrum of undesirable effects; interaction and tolerance; biotransformation and mechanisms of toxicity.
- Evaluation of toxicity: risk vs. benefit: experimental design and evaluation:
- Prospective and retrospective studies: Controls: Statistics (descriptive, inferential): animal models as predictors of human toxicity:
- Legal requirements and specific screening methods: LD50 and TD50: in vitro and in vitvo studies; clinical trials.

**UNIT – II**

Natural toxins in food: natural toxins of importance in food- toxins of plant and animal origin; microbial toxins (e.g., bacterial toxins, fungal toxins and Algal toxins), natural occurrence, toxicity and significance, determination of toxicants in foods and their management.



### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Natural toxins in food: natural toxins of importance in food- toxins of plant and animal origin
- Microbial toxins (e.g., bacterial toxins, fungal toxins and algal toxins), natural occurrence, toxicity and significance
- Determination of toxicants in foods and their management

### **UNIT – III**

Food allergies and sensitivities: natural sources and chemistry of food allergens; true/untrue food allergies; handling of food allergies; food sensitivities (anaphylactoid reactions, metabolic food disorders and idiosyncratic reactions); Safety of genetically modified food: potential toxicity and allergenicity of GM foods. Safety of children consumables.

### **Learning outcomes:**

At the end of unit, students will be able to understand the following

- Natural sources and chemistry of food allergens; true/untrue food allergies; handling of food allergies
- Food sensitivities (anaphylactoid reactions, metabolic food disorders and idiosyncratic reactions)
- Potential toxicity and allergenicity of gm foods. Safety of children consumables.

### **UNIT – IV**

Environmental contaminants and drug residues in food: fungicide and pesticide residues in foods; heavy metal and their health impacts; use of veterinary drugs (e.g. Malachite green in fish and  $\beta$ - agonists in pork); other contaminants in food, radioactive contamination of food, Food adulteration and potential toxicity of food adulterants.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Fungicide and pesticide residues in foods; heavy metal and their health impacts
- Use of veterinary drugs (e.g. Malachite green in fish and  $\beta$ - agonists in pork); other contaminants in food, radioactive contamination of food
- Food adulteration and potential toxicity of food adulterants.

## **UNIT – V**

Food additives and toxicants added or formed during food processing: safety of food additives; toxicological evaluation of food additives; food processing generated toxicants: nitroso-compounds, heterocyclic amines, dietary Supplements and toxicity related to dose: common dietary supplements; relevance of the dose; possible toxic effects.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Safety of food additives; toxicological evaluation of food additives;
- Nitroso-compounds, heterocyclic amines, dietary supplements and toxicity related to dose
- Common dietary supplements; relevance of the dose; possible toxic effects.

### **Course Outcomes**

By the end of course

- Student will gain knowledge on principles of toxicity and characteristics of toxins and their classification. Examination and prevention of toxins in foods and etc.

### **TEXT BOOKS**

1. Helferich, W., and Winter, C.K “Food Toxicology”,. CRC Press, LLC. Boca Raton, FL. 2007.
2. Shibamoto, T., and Bjeldanes, L. “Introduction to Food Toxicology”, 2009, 2<sup>nd</sup> Edition. Elsevier Inc., Burlington, MA.
3. Watson, D.H. “Natural Toxicants in Food”, CRC Press, LLC. Boca Raton, FL1998.

### **REFERENCES**

1. Duffus, J.H., and Worth, H.G. J. “Fundamental Toxicology”, The Royal Society of Chemistry. 2006.
2. Stine, K.E., and Brown, T.M. “Principles of Toxicology”, 2<sup>nd</sup> Edition. CRC Press. 2006.
3. Tönu, P. “Principles of Food Toxicology”. CRC Press, LLC. Boca Raton, FL. 2007.

**(19A27604b) FOOD PLANT EQUIPMENT DESIGN  
OPEN ELECTIVE - II**

**PREAMBLE**

This text focuses on materials used for food plant equipment and factors considered for design of various equipment.

**Course Objectives:**

- To understand the material properties and codes used.
- To know the design considerations.
- To study the design of evaporators, dryers, crystallizers and etc.

**UNIT – I**

Materials and properties: Materials for fabrication, mechanical properties, ductility, hardness, corrosion, protective coatings, corrosion prevention linings equipment, choice of materials, material codes. Design considerations: Stresses created due to static and dynamic loads, combined stresses, design stresses and theories of failure, safety factor, temperature effects, radiation effects, effects of fabrication method, economic considerations

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Materials for fabrication, mechanical properties, ductility, hardness, corrosion, protective coatings
- Corrosion prevention linings equipment, choice of materials, material codes
- Stresses created due to static and dynamic loads, combined stresses, design stresses and theories of failure, safety factor
- Temperature effects, radiation effects, effects of fabrication method, economic considerations

**UNIT – II**

Design of pressure and storage vessels: Operating conditions, design conditions and stress; Design of shell and its component, stresses from local load and thermal gradient, mountings and accessories. Design of heat exchangers: Design of shell and tube heat exchanger, plate heat exchanger, scraped surface heat exchanger, sterilizer and retort

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Design of pressure and storage vessels includes operating conditions, design conditions and stress
- Design of shell and its component, stresses from local load and thermal gradient, mountings and accessories
- Design of heat exchangers like shell and tube heat exchanger, plate heat exchanger, scraped surface heat exchanger, sterilizer and retort

### **UNIT – III**

Design of evaporators and crystallizers: Design of single effect and multiple effect evaporators and its components; Design of rising film and falling film evaporators and feeding arrangements for evaporators; Design of crystallizer and entrainment separator

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Design of evaporators like single effect and multiple effect evaporators and its components; rising film and falling film evaporators and feeding arrangements for evaporators;
- Design of crystallizer and entrainment separator

### **UNIT – IV**

Design of agitators and separators: Design of agitators and baffles; Design of agitation system components and drive for agitation. Design of centrifuge separator; Design of equipment components, design of shafts, pulleys, bearings, belts, springs, drives, speed reduction systems. Design of freezing equipment: Design of ice-cream freezers and refrigerated display system

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Design of agitators and baffles like Design of agitation system components and drive for agitation.
- Design of centrifuge separator like equipment components, design of shafts, pulleys, bearings, belts, springs, drives, speed reduction systems.
- Design of freezing equipment like ice-cream freezers and refrigerated display system

## **UNIT – V**

Design of dryers: Design of tray dryer, tunnel dryer, fluidized dryer, spray dryer, vacuum dryer, freeze dryer and microwave dryer. Design of extruders: Cold and hot extruder design, design of screw and barrel, design of twin screw extruder. Design of fermenters: Design of fermenter vessel, design problems

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Design of dryers like tray dryer, tunnel dryer, fluidized dryer, spray dryer, vacuum dryer, freeze dryer and microwave dryer
- Design of extruders like Cold and hot extruder design, design of screw and barrel, design of twin screw extruder.
- Design of fermenter vessel, design problems

### **Course Outcomes**

By the end of the course, the students will

- acquires knowledge on theoretical aspects to be design considerations for a food plant equipment and designing of evaporators, separators, storage vessels and etc.

### **TEXT BOOKS**

1. Antonio Lopez-Gomez, Gustavo V. Barbosa-Canovas, “Food plant design”, CRC press 2005.
2. George D. Saravacos and Zacharias B. Maroulis, “Food Plant Economics”, CRC Press 2007.

### **REFERENCES**

1. Peters M., Timmerhaus K. & Ronald W., “Plant Design & Economics for Chemical Engineers”, McGraw Hill.
2. James R Couper, “Process Engg. Economics (Chemical Industries) CRC Press 3. Aries & Newton, Chemical Engg. Cost Estimation”, McGraw Hill.

**(19A54604a) WAVELET TRANSFORMS AND ITS APPLICATIONS**

**OPEN ELECTIVE-II**

**Course Objective:**

This course provides the students to understand Wavelet transforms and its applications.

**UNIT-I-**

**Wavelets**

Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems -Haar Scaling Functions and Wavelets -effectiveness of Wavelet Analysis -The Discrete Wavelet Transform The Discrete-Time and Continuous Wavelet Transforms.

**Learning Outcomes:**

Students will be able to

- Understand wavelets and wavelet expansion systems.
- Find wavelet transforms in continuous as well as discrete domains.

**UNIT-II-**

**A Multiresolution Formulation of Wavelet Systems**

Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.

**Learning Outcomes:**

Students will be able to

- Illustrate the multi resolution analysis, scaling function.
- Implement parseval theorem.

**UNIT-III-**

**Filter Banks and the Discrete Wavelet Transform :** Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating -Synthesis - From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices and Lifting - - Different Points of View.

**Learning Outcomes:**

Students will be able to

- Form fine scale to coarse scale analysis.
- Perform decimating synthesis.
- Find the lattices and lifting.

**UNIT-IV**

Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform- Numerical Complexity of the Discrete Wavelet Transform.

**Learning Outcomes:**

Students will be able to

- Perform multi resolution versus time frequency analysis.
- Perform numerical complexity of discrete wavelet transforms.

**UNIT-V**

Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.

**Learning Outcomes:**

Students will be able to

- Understand the orthogonal bases and Biorthogonal Bases.
- Find the Frames and Tight Frames using Fourier series.

**Course Outcomes:**

After the completion of course, students will be able to

- Understand wavelets and wavelet expansion systems.
- Illustrate the multi resolution analysis and scaling functions.
- Form fine scale to coarse scale analysis.
- Find the lattices and lifting.
- Perform numerical complexity of discrete wavelet transforms.
- Find the frames and tight frames using fourier series.

**TEXT BOOKS:**

1. C. Sidney Burrus, Ramesh A. Gopinath, "Introduction to Wavelets and Wavelets Transforms", Prentice Hall, (1997).
2. James S. Walker, "A Primer on Wavelets and their Scientific Applications", CRC Press, (1999).

**REFERENCE BOOKS:**

1. Raghuveer Rao, "Wavelet Transforms", Pearson Education, Asia.



**(19A52604a) SOFT SKILLS**  
**(OPEN ELECTIVE-II)**

**Course Objectives**

- To develop awareness in students of the relevance and importance of soft skills
- To provide students with interactive practice sessions to make them internalize soft skills
- To develop Time management, Positive thinking & Decision making skills
- To enable to manage stress effectively
- To enable them to develop employability skills

**SYLLABUS**

**UNIT – I**

**INTRODUCTION**

Definition – Scope – Importance- – Methods of improving soft skills – Limits- Analysis – Interpersonal and intrapersonal skills - Verbal and Non-verbal skills.

**Learning Outcomes:**

At the end of the module, the learners will be able to

- Understand the importance of soft skills
- Identify the methods of improving soft skills
- Analyze various soft skills in different situations
- Distinguish various soft skills
- Apply various soft skills in day to day life and in workplace

**UNIT – II INTRAPERSONAL SKILLS**

Knowing self/temperaments/traits - Johari windows – quotient skills(IQ, EQ, SQ), creativity, decision-making-Attitude – Confidence Building - Positive Thinking –Time Management – Goal setting.

### **Learning Outcomes:**

At the end of the module, the learners will be able to

- Understand self and its temperament.
- Apply various techniques to know the self.
- Develop positive thinking
- Develop creative thinking and decision-making skills
- Apply self-knowing tools in day to day and professional life.

### **UNIT – III**

#### **INTERPERSONAL SKILLS**

Leadership Skills – Negotiation skills – Team-building – Crisis Management – Event Management – Ethics and Etiquettes.

### **Learning Outcomes:**

At the end of the module, the learners will be able to

- Understand the importance of interpersonal skills
- Analyze various tactics in negotiation skills.
- Develop team building spirit.
- Develop crisis management
- Apply interpersonal skills through etiquettes.

### **UNIT – IV**

#### **VERBAL SKILLS**

Importance of verbal skills in corporate climate, Listening skills –Mother Tongue Influence (MTI) - Speaking skills – Public speaking - Oral presentations - Writing skills –E-mail etiquettes – Memos - Indianism

### **Learning Outcomes:**

At the end of the module, the learners will be able to

- Understand the importance of verbal skills in corporate climate.
- Explain the need of listening skills.
- Explore MTI and suggest remedies to avoid it.
- Interpret various contexts of speaking.
- Apply verbal skills in personal and professional life.

## **UNIT – V NON-VERBAL SKILLS**

Importance of body language in corporate culture – body language-Facial expressions – eye contact – posture – gestures – Proxemics – Haptics – Dress Code – Paralanguage –Tone, pitch, pause& selection of words

### **Learning Outcomes:**

At the end of the module, the learners will be able to

- Comprehend the importance of non-verbal communication.
- Expound the need of facial expressions, postures and gestures.
- Analyze proxemics,haptics etc.
- Understand the importance of dress code.
- Apply various techniques to use para language

### **Course Outcomes**

- Recognize the importance of verbal and non verbal skills
- Develop the interpersonal and intrapersonal skills
- Apply the knowledge in setting the SMART goals and achieve the set goals
- Analyze difficult situations and solve the problems in stress-free environment
- Create trust among people and develop employability skills

### **Text Books**

1. Meenakshi Raman &ShaliniUpadhyay “ Soft Skills”,Cengage Learning, 2018.
2. S. Balasubramaniam, “Soft Skills for Interpersonal Communication”, Orient Black Swan, 2017.

### **References**

1. Barun K. Mitra, “Personality Development and Soft Skills”, –OXFORD Higher Education 2018.
2. AlkaWadkar, “Life Skills for Success “, Sage Publications 2016.
3. Robert M Sheffield, “Developing Soft Skills”, Pearson, 2010.
4. DianaBooher, “Communicate With Confidence”,Tata McGrawhill, 2012.

**HUMANITIES ELECTIVE-I**

**(19A52602a) ENTREPRENEURSHIP & INCUBATION**

**COURSE OBJECTIVES :**

The objective of this course is

- To make the student understand about Entrepreneurship
- To enable the student in knowing various sources of generating new ideas in setting up of New enterprise
- To facilitate the student in knowing various sources of finance in starting up of a business
- To impart knowledge about various government sources which provide financial assistance to entrepreneurs/ women entrepreneurs
- To encourage the student in creating and designing business plans

**Syllabus**

**UNIT-I**

Entrepreneurship - Concept, knowledge and skills requirement - Characteristics of successful entrepreneurs - Entrepreneurship process - Factors impacting emergence of entrepreneurship - Differences between Entrepreneur and Intrapreneur - Understanding individual entrepreneurial mindset and personality - Recent trends in Entrepreneurship.

**Learning Outcomes:**

At the end of the Unit, the learners will be able to

- Understand the concept of Entrepreneur and Entrepreneurship in India
- Know Entrepreneurship process and emergence of Entrepreneurship
- Analyze the differences between Entrepreneur and Intrapreneur
- Develop a creative mind set and personality
- Understand recent trends in Entrepreneurship across the globe

## **UNIT-II**

Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas - Opportunity recognition - Feasibility study - Market feasibility, technical/operational feasibility - Financial feasibility - Drawing business plan - Preparing project report - Presenting business plan to investors.

### **Learning Outcomes:**

At the end of the Unit, the learners will be able to

- Know the process of starting a new venture
- Analyze the sources of new methods in generating business idea
- Evaluate market feasibility, financial feasibility and technical feasibility
- Design and draw business plans in project preparation and prepare project reports

## **UNIT-III**

Sources of finance - Various sources of Finance available - Long term sources - Short term sources - Institutional Finance – Commercial Banks, SFC's in India - NBFC's in India - their way of financing in India for small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey- Institutions in aid of entrepreneurship development

### **Learning Outcomes:**

At the end of the Unit, the learners will be able to

- Know the various sources of finance to start a new venture
- Contrast & compare between Long term & Short term finance sources
- Analyze the role of banks and other financial institutions in promoting entrepreneurship in India
- Evaluate the need and importance of MSMEs in the growth of country

## **UNIT-IV**

Women Entrepreneurship - Entrepreneurship Development and Government - Role of Central Government and State Government in promoting women Entrepreneurship - Introduction to various incentives, subsidies and grants – Export- oriented Units - Fiscal and Tax concessions available - Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India - Issues & Challenges - Entrepreneurial motivations.

**Learning Outcomes:**

At the end of the Unit, the learners will be able to

- Understand the role of government in promoting women entrepreneurship
- Know various incentives, subsidies and grants available to women entrepreneurs
- Analyze the role of export-oriented units
- Know about the tax concessions available for Women entrepreneurs
- Prepare to face the issues and challenges.

**UNIT-V**

Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation and the business incubator and how they operate and influence the Type/benefits of incubators - Corporate/educational / institutional incubators - Broader business incubation environment - Pre-Incubation and Post - Incubation process - Idea lab, Business plan structure - Value proposition

**Learning Outcomes:**

At the end of the Unit, the learners will be able to:

- Understand the importance of business incubation
- Apply brilliant ideas in the process of business incubation
- Analyze the process of business incubation/incubators.
- Contrast & Compare between business incubation and business incubators.
- Design their own business incubation/incubators as viable-business unit.

**Course Outcomes:**

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

- Understand the concept of Entrepreneurship and challenges in the world of competition.
- Apply the Knowledge in generating ideas for New Ventures.
- Analyze various sources of finance and subsidies to entrepreneur/women Entrepreneurs.
- Evaluate the role of central government and state government in promoting Entrepreneurship.
- Create and design business plan structure through incubations.

## **TEXT BOOKS**

1. D F Kuratko and T V Rao, “Entrepreneurship” - A South-Asian Perspective – Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit : [login.cengage.com](http://login.cengage.com))
- 2 . Nandan H, “ Fundamentals of Entrepreneurship”, PHI, 2013

## **REFERENCES**

1. Vasant Desai, “Small Scale Industries and Entrepreneurship”, Himalaya Publishing 2012.
2. Rajeev Roy “Entrepreneurship”, 2<sup>nd</sup> Edition, Oxford, 2012.
3. B.Janakiramand M.Rizwanall “Entrepreneurship Development: Text & Cases”, Excel Books, 2011.
4. Stuart Read, Effectual “Entrepreneurship”, Routledge, 2013.

## **E-RESOURCES**

1. Entrepreneurship-Through-the-Lens-of-enture Capital
2. <http://www.onlinevideolecture.com/?course=mba-programs&subject=entrepreneurship>
3. [http://nptel.ac.in/courses/122106032/Pdf/7\\_4.pdf](http://nptel.ac.in/courses/122106032/Pdf/7_4.pdf)
4. <http://freevideolectures.com/Course/3514/Economics-/-Management-/-Entrepreneurhip/50>

**(19A52602b) MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS**

**Course Objectives :**

The objective of this course is

- To inculcate the basic knowledge of micro economics and financial accounting
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost
- To know the various types of Market Structures & pricing methods and its strategies
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on Accounting and to explain the process of preparing Financial statements

**Syllabus**

**UNIT I -**

**INTRODUCTION TO MANAGERIAL ECONOMICS DEMAND**

Managerial Economics – Definition – Nature & Scope - Contemporary importance of Managerial Economics - Demand Analysis - Concept of Demand - Demand Function - Law of Demand - Elasticity of Demand - Significance - Types of Elasticity - Measurement of Elasticity of Demand - Demand Forecasting - Factors governing Demand Forecasting - Methods of Demand Forecasting - Relationship of Managerial Economics with Financial Accounting and Management.

**Learning Outcomes:**

At the end of the Unit, the learners will be able to

- Know the nature and scope of Managerial Economics and its importance
- Understand the concept of demand and its determinants
- Analyze the Elasticity and degree of elasticity
- Evaluate Demand forecasting methods
- Design the process of demand estimation for different types of demand



## UNIT -II

### THEORY OF PRODUCTION AND COST ANALYSIS

**Production Function** – Least-cost combination - Short-run and Long-run Production Function - Isoquants and Isocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale – **Cost & Break Even Analysis** - Cost concepts and Cost behavior - Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems) - Managerial significance and limitations of Break-Even Analysis.

#### Learning Outcomes:

At the end of the Unit, the learners will be able to

- Know the production function, Input-Output relationship and different cost concepts
- Apply the least-cost combination of inputs
- Analyze the behavior of various cost concepts
- Evaluate BEA for real time business decisions
- Develop profit appropriation for different levels of business activity

## UNIT –III

### INTRODUCTION TO FORMS OF BUSINESS ORGANIZATIONS AND MARKETS

**Market structures** - Forms of Business Organizations - Sole Proprietorship - Partnership - Joint Stock Companies - Public Sector Enterprises-Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition – Monopoly - Monopolistic Competition – Oligopoly - Price-Output Determination - Pricing Methods and Strategies.

#### Learning Outcomes:

At the end of the Unit, the learners will be able to

- Know the structure of markets, features of different markets and forms of business organizations
- Apply the price output relationship in different markets
- Analyze the optimum output levels to maximize profit in different markets
- Evaluate price-output relationship to optimize cost, revenue and profit
- Interpret Pricing Methods and Strategies

## UNIT -IV

**CAPITAL AND CAPITAL BUDGETING** Concept of Capital - Significance - Types of Capital - Components of Working Capital - Sources of Short-term and Long-term Capital - Estimating Working capital requirements – Cash Budget - **Capital Budgeting** – Features of

Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

### **Learning Outcomes:**

At the end of the Unit, the learners will be able to

- Know the concept of capital budgeting and its importance in business
- Contrast and compare different investment appraisal methods
- Analyze the process of selection of investment alternatives using different appraisal methods
- Evaluate methods of capital budgeting for investment decision making and for maximizing returns
- Design different investment appraisals and make wise investments

## **UNIT –V**

### **INTRODUCTION TO FINANCIAL ACCOUNTING AND ANALYSIS**

Accounting Concepts and Conventions - Introduction Double-Entry Book Keeping, Journal, Ledger, Trial Balance - Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). *Financial Analysis* - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

### **Learning Outcomes:**

At the end of the Unit, the learners will be able to

- Know the concept, convention and significance of accounting
- Apply the fundamental knowledge of accounting while posting the journal entries
- Analyze the process and preparation of final accounts and financial ratios
- Evaluate the financial performance of an enterprise by using financial statements

### **Data Books Required:**

Present Value Factors table

### **Course Outcomes:**

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

- Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets
- Apply concepts of production, cost and revenues for effective business decisions
- Students can analyze how to invest their capital and maximize returns
- Evaluate the capital budgeting techniques
- Prepare the accounting statements and evaluate the financial performance of business entity.

**TEXT BOOKS:**

1. Varshney & Maheswari: “Managerial Economics”, Sultan Chand, 2013.
2. Aryasri: “Business Economics and Financial Analysis”, 4<sup>th</sup> edition, MGH, 2019

**REFERENCES:**

1. Ahuja Hl “Managerial economics” 3<sup>rd</sup> edition, Schand, ,2013
2. S.A. Siddiqui and A.S. Siddiqui: “Managerial Economics and Financial Analysis”, New Age International,. 2013.
3. Joseph G. Nellis and David Parker: “Principles of Business Economics”, 2<sup>nd</sup> edition, Pearson, New Delhi.
4. Domnick Salvatore: “Managerial Economics in a Global Economy”, Cengage, 2013.

### (19A52602c) BUSINESS ETHICS AND CORPORATE GOVERNANCE

#### Course Objectives :

The objectives of this course are

- To make the student understand the principles of business ethics
- To enable them in knowing the ethics in management
- To facilitate the student role in corporate culture
- Impart knowledge about the fair trade practices
- Encourage the student in knowing them about the corporate governance

#### Syllabus

### BUSINESS ETHICS AND CORPORATE GOVERNANCE

#### UNIT -I

**Introduction** – Meaning - Nature and Scope – Loyalty and Ethical Behaviour, Values across Cultures; Business Ethics – Ethical Practices in Management. Types of Ethics – Characteristics – Factors influencing , Business Ethics – Importance of Business Ethics - Arguments for and against business ethics Basics of business ethics Corporate Social Responsibility – Issues of Management – Crisis Management

#### Learning Outcomes:

After completion of this unit student will

- Understand the meaning of loyalty and ethical Behavior
- Explain various types of Ethics
- Know about the factors influencing business ethics
- Understand the corporate social responsibility of management

#### UNIT –II

#### ETHICS IN MANAGEMENT

Introduction – Ethics in HRM – Marketing Ethics – Ethical aspects of Financial Management- Technology Ethics and Professional ethics. The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures, Culture and Individual Ethics.

**Learning Outcomes:**

After completion of this unit student will

- Understand the meaning of Marketing Ethics
- Analyze Differentiate between Technical ethics and professional ethics
- Know about the ethical value system
- Understand the Code and culture

**UNIT-III****ROLE OF CORPORATE CULTURE IN BUSINESS**

Meaning – Functions – Impact of corporate culture – cross cultural issues in ethics, Emotional Honesty – Virtue of humility – Promote happiness – karma yoga – proactive – flexibility and purity of mind. The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures, Culture and Individual Ethics.

**Learning Outcomes:**

After completion of this unit student will

- Understand the corporate culture in business
- Analyze Ethical Value System Know about the ethical value system
- Know Universalism, Utilitarianism, Distributive Justice
- Differentiate Ethical Values in different Cultures

**UNIT- IV**

Law and Ethics – Relationship between Law and Ethics, Other Bodies in enforcing Ethical Business Behavior, Social Responsibilities of Business – Environmental Protection, Fair Trade Practices, Fulfilling all National Safeguarding Health and wellbeing of Customers.

**Learning Outcomes:**

After completion of this unit student will

- Understand Law and Ethics
- Analyze Social Responsibilities of Business
- Know Environmental Protection and Fair Trade Practices
- Implementing National Safeguarding Health and wellbeing of Customers

## **UNIT –V**

### **CORPORATE GOVERNANCE**

Meaning – scope - Issues, need, corporate governance code, transparency & disclosure, role of auditors, board of directors and shareholders; Global issues of governance, accounting and regulatory frame work, corporate scams, committees in India and abroad, corporate social responsibility composition of BODs - Cadbury Committee - various committees - reports on corporate governance - Benefits and Limitations of Corporate Governance with living examples.

### **Learning Outcomes:**

After completion of this unit student will

- Understand corporate governance code
- Analyze role of auditors, board of directors and shareholders
- Know accounting and regulatory frame work
- Implementing corporate social responsibility

### **Course Outcomes:**

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

- Understand business ethics and ethical practices in management.
- Understand the role of ethics in management
- Apply the knowledge in cross cultural ethics
- Analyze law and ethics
- Evaluate corporate governance

### **TEXT BOOKS:**

1. Murthy CSV: “Business Ethics and Corporate Governance”, HPH
2. Bholananth Dutta, S.K. Podder – “Corporation Governance”, VBH.

### **REFERENCE BOOKS:**

1. Dr. K. Nirmala, KarunakaraReaddy : “Business Ethics and Corporate Governance”, HPH
2. H.R.Machiraju: “Corporate Governance”
3. K. Venkataramana, “Corporate Governance”, SHBP.
4. N.M.Khandelwal : “Indian Ethos and Values for Managers”

### **(19A52602d) ENTERPRISE RESOURCE PLANNING**

#### **Course Objectives :**

The objectives of this course are

- To provide a contemporary and forward-looking on the theory and practice of
- Enterprise Resource Planning
- To enable the students in knowing the Advantages of ERP
- To train the students to develop the basic understanding of how ERP enriches the
- Business organizations in achieving a multidimensional growth.
- Impart knowledge about the historical background of BPR
- To aim at preparing the students, technologically competitive and make them ready to self-upgrade with the higher technical skills.

#### **Syllabus**

#### **UNIT-I**

**Introduction to ERP:** Enterprise – An Overview Integrated Management Information, Business Modeling, Integrated Data Model Business Processing Reengineering(BPR), Data Warehousing, Data Mining, On-line Analytical Processing(OLAP), Supply Chain Management (SCM), Customer Relationship Management(CRM),

#### **Learning Outcomes:**

After completion of this unit student will

- Understand the concept of ERP
- Explain various Business modeling
- Know the contemporary technology like SCM, CRM
- Understand the OLAP

#### **UNIT-II**

**Benefits of ERP:** Reduction of Lead-Time, On-time Shipment, Reduction in Cycle Time, Improved Resource Utilization, Better Customer Satisfaction, Improved Supplier Performance, Increased Flexibility, Reduced Quality Costs, Improved Information Accuracy and Design-making Capability

### **Learning Outcomes:**

After completion of this unit student will

- Understand the Advantages of ERP
- Explain the challenges associated with ERP System
- Analyze better customer satisfaction
- Differentiate Improved Information Accuracy and Design-making Capability

### **UNIT-III**

**ERP Implementation Lifecycle:** Pre-evaluation Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Reengineering, Configuration, Implementation Team Training, Testing, Going Live, End-user Training, Post-implementation (Maintenance mode)

### **Learning Outcomes:**

After completion of this unit student will

- Understand the implementation of ERP life cycle
- Explain the challenges associated with implementing ERP system
- Analyze the need of re-engineering
- Know the recent trends in team training testing and go-live

### **UNIT-IV**

**BPR:** Historical background: Nature, significance and rationale of business process reengineering (BPR), Fundamentals of BPR. Major issues in process redesign: Business vision and process objectives, Processes to be redesigned, Measuring existing processes,

### **Learning Outcomes:**

After completion of this unit student will

- Understand the business process reengineering
- Explain the challenges associated with BPR
- Analyze the need of process redesign
- Differentiate between process to be redesign and measuring existing process

### **UNIT-V**

**IT in ERP:** Role of information technology (IT) and identifying IT levers. Designing and building a prototype of the new process: BPR phases, Relationship between BPR phases. MIS - Management Information System, DSS - Decision Support System, EIS - Executive Information System.



**Learning Outcomes:**

After completion of this unit student will

- Understand the role of IT
- Explain the challenges in Designing and building a prototype of the new process
- Analyze the need of MIS
- Differentiate between DSS and EIS

**Course outcomes:**

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

- Understand the basic use of ERP Package and its role in integrating business functions.
- Explain the challenges of ERP system in the organization
- Apply the knowledge in implementing ERP system for business
- Evaluate the role of IT in taking decisions with MIS
- Create reengineered business processes with process redesign

**TEXT BOOKS:**

1. Pankaj Sharma. "Enterprise Resource Planning". Aph Publishing Corporation, New Delhi, 2004.
2. Alexis Leon, "Enterprise Resource Planning", IV Edition, Mc.Graw Hill, 2019

**REFERENCE BOOKS:**

1. Marianne Bradford "Modern ERP", 3<sup>rd</sup> edition.
2. "ERP making it happen Thomas f. Wallace and Michael
3. Directing the ERP Implementation Michael w pelphrey

### (19A52602e) SUPPLY CHAIN MANAGEMENT

#### Course Objectives :

The objectives of this course are

- To provide Knowledge on logistics and supply chain management
- To enable them in designing the distribution network
- To train the students in knowing the supply chain Analysis
- Impart knowledge on Dimensions of logistic
- To know the recent trends in supply chain management

#### Syllabus

##### UNIT-1

##### Introduction to Supply Chain Management

Supply chain - objectives - importance - decision phases - process view -competitive and supply chain strategies - achieving strategic fit – supply chain drivers - obstacles – framework - facilities -inventory-transportation-information-sourcing-pricing.

#### Learning Outcomes:-

After completion of this unit student will

- Understand the meaning and objectives of supply chain management
- Explain supply chain drivers
- Know the steps involved in SCM frame work
- Understand transportation information and pricing

##### UNIT-2

##### Designing the distribution network

Role of distribution - factors influencing distribution - design options - e-business and its impact – distribution networks in practice –network design in the supply chain - role of network -factors affecting the network design decisions modeling for supply chain. Role of transportation - modes and their performance – transportation infrastructure and policies - design options and their trade-offs tailored transportation.

### **Learning Outcomes:-**

After completion of this unit student will

- Understand the different distribution network
- Explain the factors influencing network design in the supply chain
- Know the Role of transportation
- Analyze design options and their trade-offs

### **UNIT-3**

#### **Supply Chain Analysis.**

Sourcing - In-house or Outsource - 3rd and 4th PLs - supplier scoring and assessment, selection - design collaboration - Procurement process - Sourcing planning and analysis. Pricing and revenue management for multiple customers, perishable products, seasonal demand, bulk and spot contracts.

### **Learning Outcomes:-**

After completion of this unit student will

- Understand the concept of supply chain Analysis
- Explain design collaboration
- Know procurement process -sourcing planning and analysis
- Understand seasonal demand, bulk and spot contracts

### **UNIT-4**

#### **Dimensions of Logistics**

A macro and micro dimension - logistics interfaces with other areas - approach to analyzing logistics systems - logistics and systems analysis - techniques of logistics system analysis - factors affecting the cost and importance of logistics. Demand Management and Customer Service Outbound to customer logistics systems - Demand Management –Traditional Forecasting - CPFRP - customer service - expected cost of stock outs - channels of distribution.

### **Learning Outcomes:-**

After completion of this unit student will

- Understand dimensions of logistics
- Explain logistics interfaces with other areas
- Know techniques of logistics system analysis
- Understand Demand Management

## **UNIT-5**

**Recent Trends in Supply Chain Management**-Introduction, New Developments in Supply Chain Management, Outsourcing Supply Chain Operations, Co-Maker ship, The Role of E-Commerce in Supply Chain Management, Green Supply Chain Management, Distribution Resource Planning, World Class Supply Chain Management

### **Learning Outcomes:-**

After completion of this unit student will

- Understand the recent trend in supply chain management
- Explain The Role of E-Commerce in Supply Management
- Know Green Supply Chain Management
- Understand Distribution Resource Planning

### **Course Outcomes:**

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

- Understand the strategic role of logistic and supply chain management in the cost reduction and offering best service to the customer
- Understand Advantages of SCM in business
- Apply the knowledge of supply chain Analysis
- Analyze reengineered business processes for successful SCM implementation
- Evaluate Recent trend in supply chain management

### **TEXT BOOKS:**

1. Sunil Chopra and Peter Meindl, Supply Chain Management – “Strategy, Planning and Operation”, 3<sup>rd</sup> Edition, Pearson/PHI, 2007.
2. Supply Chain Management by Janat Shah Pearson Publication 2008.

### **REFERENCE BOOKS:**

1. A Logistic approach to Supply Chain Management – Coyle, Bardi, Longley, Cengage Learning, 1/e
2. Donald J Bowersox, Dand J Closs, M Bixby Coluper, “Supply Chain Logistics Management”, 2<sup>nd</sup> edition, TMH, 2008.
3. Wisner, Keong Leong and Keah-Choon Tan, “Principles of Supply Chain Management A Balanced Approach”, Cengage Learning, 1/e
4. David Simchi-Levi et al, “Designing and Managing the Supply Chain” – Concepts

**(19A01601P) GEOTECHNICAL ENGINEERING LAB**

**OBJECTIVE:**

The object of the course is to enable the students to know the various characteristics soils

**LABORATORY EXPERIMENTS**

1. Specific gravity
2. Atterberg's Limits.
3. Field density-Core cutter and Sand replacement methods
4. Grain size analysis by sieving
5. Hydrometer Analysis Test
6. Permeability of soil - Constant and Variable head tests
7. Compaction test
8. Consolidation test (to be demonstrated)
9. Direct Shear test
10. Triaxial Compression test (UU Test)
11. Unconfined Compression test
12. Vane Shear test
13. Differential free swell (DFS)
14. CBR Test

**Course Outcomes:**

At the end of the course, the student must be able to:

- Identify various soils based on their characteristics.
- Evaluate permeability and seepage of soils.
- Determine plasticity characteristics of various soils.
- Design consolidation process by predicting settlement of soils.

**TEXT BOOKS:**

1. K. R. Arora, “Soil Mechanics and Foundation Engg”., Standard Publishers and Distributors, Delhi.
2. C. Venkataramiah, “Geotechnical Engineering”, New age International Pvt . Ltd, (2002).

**REFERENCES:**

1. B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, “Soil Mechanics and Foundation”, Laxmi publications Pvt. Ltd., New Delhi.
2. Gopal Ranjan & A. S. R. Rao, “Basic and Applied Soil Mechanics”, New age International Pvt . Ltd, New Delhi.
3. Braja M. Das “Principles of Geotechnical Engineering”, Cengage Learning.

**19A52601P      ENGLISH LANGUAGE SKILLS LAB**

**Course Objectives**

- Students will be exposed to a variety of self instructional, learner friendly modes of language learning
- Students will cultivate the habit of reading passages from the computer monitor. Thus providing them with the required facility to face computer based competitive exams like gre, toefl, and gmat etc.
- Students will learn better pronunciation through stress, intonation and rhythm
- Students will be trained to use language effectively to face interviews, group discussions, public speaking
- Students will be initiated into greater use of the computer in resume preparation, report writing, format making etc

**UNIT -I**

1. Phonetics for listening comprehension of various accents - 2
2. Formal Presentations using PPT slides without Graphic Elements
3. Paraphrasing

**Learning Outcomes**

At the end of the module, the learners will be able to

- Understand different accents spoken by native speakers of English
- Make formal structured presentations on general topics using PPT slides without graphical elements
- Paraphrase short academic texts using suitable strategies and conventions

**UNIT -II**

1. Debate – 2 (Following Argument)
2. Listening to short speeches/ short stories for note-making and summarizing
3. E-mail Writing

**Learning Outcomes**

At the end of the module, the learners will be able to

- Participate in formal discussions and speak clearly on a specific topic using suitable discourse markers

- Make formal structured presentations on academic topics using ppt slides with relevant graphical elements
- Write formal emails in the standard format

### **UNIT -III**

1. Listening for Discussions
2. Group Discussions
3. Writing Persuasive/argumentative essays on general topics

#### **Learning Outcomes**

At the end of the module, the learners will be able to

- Follow a discussion to identify the salient points
- Participate in group discussions using appropriate conventions and language strategies
- Produce logically coherent persuasive/argumentative essays

### **UNIT-IV**

1. Reviewing film/ book
2. Group Discussions – reaching consensus in Group Work
3. Resume Writing – Cover Letter – Applying for Internship

#### **Learning Outcomes**

At the end of the module, the learners will be able to

- Judge a film or book
- Express thoughts and ideas with acceptable accuracy and fluency with a view to reach consensus in group discussions
- Prepare a cv and write a cover letter to seek internship/ job

### **UNIT –V**

1. Writing Project Reports
2. Editing Short Texts
3. Answering FAQs in Interviews

#### **Learning Outcomes**

At the end of the module, the learners will be able to

- Collaborate with a partner to make effective presentations
- Understand the structure and produce an effective project report.
- Edit short texts according to different needs of the work place.



## Course Outcomes

- Remember and understand the different aspects of the English language proficiency with emphasis on LSRW skills
- Apply communication skills through various language learning activities
- Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.
- Evaluate and exhibit acceptable etiquette essential in social and professional settings
- Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.

## SUGGESTED SOFTWARE:

1. Walden Infotech English Language Communication Skills.
2. iTell- Orell Digital Language Lab
3. Digital Teacher
4. LES(Learn English Select) by British council
5. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
6. *DELTA's key to the Next Generation TOEFL Test: Advanced Skills Practice.*
7. Lingua TOEFL CBT Insider, by Dreamtech
8. English Pronunciation in Use (Elementary, Intermediate, Advanced) CUP
9. Cambridge Advanced Learners' English Dictionary with CD.

## REFERENCE BOOKS:

The software consisting of the prescribed topics elaborated above should be procured and used.

1. Meenakshi Raman & Sangeeta Sharma, "Technical Communication" O U Press 2009.
2. Barron's Books on TOEFL/GRE/GMAT/CAT/IELTS /DELTA/Cambridge University Press. 2012.
3. Butterfield Jeff, "Soft Skills for Everyone", Cengage Publications, 2011.
4. "Practice Psychometric Tests": How to familiarize yourself with genuine recruitment tests, 2012.
5. David A McMurrey & Joanne Buckely "Handbook for Technical Writing" CENGAGE Learning 2008.
6. "A Textbook of English Phonetics for Indian Students", 2<sup>nd</sup> Edition, T. Balasubramanyam. (Macmillan), 2012.
7. "A Handbook for English Laboratories", E. Suresh Kumar, P. Sreehari, Foundation Books, 2011

Note: Links provided by APSHE on LSRW, grammar and vocabulary

**19A01605 SOCIALLY RELEVANT PROJECT**

**Areas for Socially Relevant Project in 6th Semester**

- a) Structural condition assessment of school buildings
- b) Water resources management -Audit
- c) Survey of waste management systems-Swatch Bharat
- d) Survey of modern building materials & properties
- e) Survey on Implementation of Government welfare schemes

## **19A99601 MANDATORY COURSE: RESEARCH METHODOLOGY**

### **COURSE OBJECTIVES :**

The objective of this course is

- To understand the basic concepts of research and research problem
- To make the students learn about various types of data collection and sampling design
- To enable them to know the method of statistical evaluation
- To make the students understand various testing tools in research
- To make the student learn how to write a research report
- To create awareness on ethical issues in research

### **Syllabus**

#### **UNIT- I**

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining a Research Problem – Research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

#### **Learning Outcomes:-**

After completion of this unit student will

- Understand the concept of research and its process
- Explain various types of research
- Know the steps involved in research design
- Understand the different research approaches

#### **UNIT -II**

Sampling Design – steps in Sampling Design –Characteristics of a Good Sample Design – Random Sampling Design. Measurement and Scaling Techniques-Errors in Measurement – Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation. Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

### **Learning Outcomes:-**

After completion of this unit student will

- Understand the concept of sampling and sampling design
- Explain various techniques in measurement and scaling
- Learn various methods of data collection
- Design survey questionnaires for different kinds of research
- Analyze the questionnaires

### **UNIT- III**

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

### **Learning Outcomes:-**

After completion of this unit student will

- Know the association of two variables
- Understand the importance of correlation and regression
- Compare and contrast correlation and regression
- Learn various types of correlation
- Apply the knowledge of C&R Analysis to get the results

### **UNIT -IV**

Statistical Inference: Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multivariate Analysis

### **Learning Outcomes:-**

After completion of this unit student will

- Know the statistical inference
- Understand the hypothesis testing procedure
- Compare and contrast Parametric and Non-parametric Tests
- Understand the use of chi-square test in investigating the distribution of categorical variables
- Analyze the significance of variance and covariance

## **UNIT -V**

Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research.

### **Learning Outcomes:-**

After completion of this unit student will

- Learn about report writing
- Understand how to write research paper
- Explain various techniques of interpretation
- Understand the importance of professional ethics in research
- Design a scientific paper to present in the conferences/seminars

### **Course Outcomes:**

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

- Understand basic concepts and its methodologies
- Demonstrate the knowledge of research processes
- Read, comprehend and explain research articles in their academic discipline
- Analyze various types of testing tools used in research
- Design a research paper without any ethical issues

### **Text books:**

1. C.R.Kothari, “Research Methodology:Methods and Techniques”,2<sup>nd</sup> edition, New Age International Publishers.
2. A Step by Step Guide for Beginners, “Research Methodology”: Ranjit Kumar, Sage Publications

### **REFERENCES:**

1. P.Narayana Reddy and G.V.R.K.Acharyulu, “Research Methodology and Statistical Tools”, 1<sup>st</sup> Edition, Excel Books,New Delhi.
2. Donald R. “Business Research Methods”, Cooper & Pamela S Schindler, 9<sup>th</sup> edition.
3. S C Gupta, “Fundamentals of Statistics”, 7<sup>th</sup> edition Himalaya Publications

**(19A01701) GEOTECHNICAL ENGINEERING - II**

**Course Objective:**

- To know the necessity of soil exploration.
- To design the shallow foundations.
- To know and necessity of deep foundations
- To perform the stability analysis of slopes.
- To know the principles and design of earth retaining walls

To use the principles of Soil mechanics to design the foundations, Earth retaining structures and slope stability safely and economically knowledge of the subject is essential.

**UNIT – I**

**SOIL EXPLORATION:** Need – Methods of soil exploration – Boring and Sampling methods – Field tests – Penetration Tests – Plate load test – Pressure meter – planning of Programme and preparation of soil investigation report.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To learn about soil sampling (undisturbed and disturbed)
- To determine the bearing capacity of shallow foundations

**UNIT – II**

**SHALLOW FOUNDATIONS:** Types – choice of foundation – Location of depth – Safe Bearing Capacity – Terzaghi's, Meyerhoff's and Skempton's Methods ALLOWABLE BEARING PRESSURE : Safe bearing pressure based on N- value – allowable bearing pressure; safe bearing capacity and settlement from plate load test – allowable settlements of structures – Settlement Analysis

**Learning Outcomes:**

After completing this Unit, students will be able to

- To learn about various types of foundations
- To calculate the bearing capacity and settlement of foundations

## **UNIT – III**

**PILE FOUNDATION:** Types of piles – Load carrying capacity of piles based on static pile formulae – Dynamic pile formulae – Pile load tests – Load carrying capacity of pile groups in sands and clays – Settlement of pile groups.

**WELL FOUNDATIONS:** Types – Different shapes of wells – Components of wells – functions and Design Criteria – Sinking of wells – Tilts and shifts.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- To understand the behaviour of the piles under different loading conditions.
- To design the load carrying capacity of piles.
- To understand the behaviour of well foundations.

## **UNIT – IV**

**EARTH SLOPE STABILITY:** Infinite and finite earth slopes – types of failures – factor of safety of infinite slopes – stability analysis by Swedish arc method, standard method of slices, Bishop's Simplified method – Taylor's Stability Number- Stability of slopes of earth dams under different conditions.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- To learn about the failure of slopes.
- To design of infinite and finite slopes using various methods.

## **UNIT – V**

**EARTH PRESSURE THEORIES:** Rankine's theory of earth pressure – earth pressures in layered soils – Coulomb's earth pressure theory – Rebhann's and Culmann's graphical method  
**RETAINING WALLS:** Types of retaining walls – stability of retaining walls.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- To understand the role earth pressure on the stability of retaining systems.

### **Course Outcomes:**

- To enable the student to analyse shallow and deep foundations when subjected to various types of loadings.
- To enable the student to analyse slopes, retaining walls and well foundations.



**TEXT BOOKS:**

1. C.Venkataramaiah, “Geotechnical Engineering”, New Age Publications.
2. Arora, “Soil Mechanics and Foundation Engineering” Standard Publishers and Distributors, Delhi
3. B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Soil “Mechanics and Foundations”, Laxmi, publications Pvt. Ltd., New Delhi

**REFERENCES:**

1. Purushtoma Raj, “Soil Mechanics and Foundation Engineering”, Pearson Publications
2. Das, B.M., “Principles of Foundation Engineering”, 6<sup>th</sup> edition (Indian edition) Thomson Engineering(1999)
3. Varghese, P.C., “Foundation Engineering”, Prentice Hall of India., New Delhi.
4. V.N.S.Murthy, “Foundation Engineering”, CRC Press, New Delhi.
5. Bowles, J.E., “Foundation Analysis and Design”, 4<sup>th</sup> Edition, McGraw-Hill Publishing company, Newyork.
6. Manoj Dutta & Gulati S.K “Geotechnical Engineering”, Tata Mc.Grawhill Publishers New Delhi. (1988)

**(19A01702) ESTIMATION AND COSTING**

**Course Objectives:**

- To impart basic knowledge on different types of estimation
- To enrich with specifications and tender procedures.
- To give insights on various types of contract agreements.
- To inculcate data preparation for abstract estimation
- To teach procedure for valuation of buildings.

**UNIT -I:**

**Estimation**

Methods of estimation-advantages-types of estimates-detailed estimates of residential buildings-single storied and multi-storied buildings-earthwork-foundations-Super structure-Fittings including sanitary and electrical fittings-paintings.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Understand methods of Estimation
- Carryout estimation of quantities for structural components
- Estimate cost while using different types of sanitary and electrical fittings

**UNIT -II:**

**Specifications and Tenders**

Specifications-Detailed and general specifications-construction specifications-sources- types of specifications-Tender notices-types-corrigendum notice-tender procedures Drafting model tenders.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Prepare detailed and general specifications for a project
- Understand tender schedule and tender notices
- Draft tender documents for projects

### **UNIT -III:**

#### **Contracts**

Types of contracts-formation and conditions of contract-problems-contract for labor, material, design and construction-drafting of contract documents-construction contracts- arbitration and legal requirements.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- Prepare documents for different types of contracts
- Identify arbitration and legal issues and mitigation methods

### **UNIT -IV:**

#### **Rate Analysis and Preparation of Bills**

Data-Rate analysis-abstract estimate-report to accompany estimate-measurement book –bills-types

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- Calculate data for different materials
- Understand procedures for entries in measurement books and its importance
- Prepare abstract estimates based on SSR.

### **UNIT -V:**

#### **Valuation**

Principles of valuation-Value and Cost-value engineering-value analysis-phases in value engineering-information-function-escalation-evaluation-recommendation-implementation-Audit.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- Carry out valuation of buildings.
- Explain Auditing procedures and implementation

## **Course Outcomes**

On completion of the course, the students will be able to:

- Understand basics on methods and types of estimation.
- Formulate specifications and tender documents.
- Prepare contract agreements
- Determine rate analysis of different items.
- Valuation of buildings.

## **TEXT BOOKS:**

1. Dutta, B. N., “Estimating and Costing in Civil Engineering (Theory & Practice)”, UBS Publishers, 2016
2. B. S. Patil, “Civil Engineering Contracts and Estimates”, Universities Press Pvt Ltd, Hyderabad. 4<sup>th</sup> Edition 2015.

## **REFERENCES:**

1. M. Chakraborti, “Estimation, Costing and Specifications”, Laxmi publications.
2. D. D. Kohli & R. C. Kohli, “A Textbook of Estimating and Costing(Civil)”, S. Chand and Company Limited, New Delhi
3. Standard Schedule of rates and standard data book by public works department.
4. I. S. 1200 (Parts I to XXV, “Method of Measurement of Building and Civil Engineering works – B.I.S.)” 1974.

**Course Objective:**

- It deals with different types of loads on the bridges as per the I.R.C code provisions.
- It deals with the design procedures of bridges such as deck slab bridge, T – Beam Bridge, Plate girder bridge and Box culvert etc., based on the I.R.C provisions.
- It gives a good knowledge on different components like bridge bearing, piers and abutments of the bridges.
- It gives good knowledge on design of bridge bearings based on the I.R.C provisions.
- It makes the student to design a bridge independently as per the I.R.C provisions

**UNIT – I**

**INTRODUCTION:** Importance of site investigation in Bridge design. Highway Bridge loading standards. Impact factor. Railway Bridge loading standards (B.G. ML Bridge) various loads in bridges.

**BRIDGE BEARINGS :** General features – Types of Bearings – Design principles of steel Rocker & Roller Bearings – Design of a steel Rocker Bearing – Design of Elastomeric pad Bearing.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Understand different types of I.R.C loads on the bridges.
- Understand the different types of bridge bearings and their suitability.

**UNIT - II**

**DECK SLAB BRIDGE:** Introduction – Effective width method of Analysis Design of deck slab bridge (Simply supported) subjected to class AA Tracked Vehicle only.

**BOX CULVERT:** General aspects. Design loads, Design of Box culvert subjected to IRC class AA tracked vehicle only.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Know the effective width method of analysis of bridge decks
- Know the design of the deck slab bridges
- Understand the different forces acting on the box culverts and its design.

### **UNIT - III**

**BEAM & SLAB BRIDGE (T-BEAM BRIDGE)** General features – Design of interior panel of slab – Pigeauds method – Design of a T-beam bridge subjected to class AA tracked vehicle only.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Know the pigeauds method of analysis of deck slabs of T beam bridges
- Design the T beam bridges

### **UNIT – IV**

**PLATE GIRDER BRIDGE:** Introduction – elements of a plate girder and their design. Design of a Deck type welded plate girder – Bridge of single line B.G.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Know the forces acting on the plate girder bridge
- Understand the design of plate girder bridge

### **UNIT V**

**PIERS & ABUTMENTS:** General features – Bed Block – Materials piers & Abutments Types of piers – Forces acting on piers – Stability analysis of piers – General features of Abutments – forces acting on abutments – Stability analysis of abutments – Types of wing walls – Approaches – Types of Bridge foundations (excluding Design).

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Know the forces acting on the piers and abutments and their stability analysis.
- Know the different types of wings walls.

**Note: Relevant IRC & Railway Bridge Codes are to be permitted in the examination hall**

**Course outcomes:**

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

- Understand different types of bridges and loads coming over the bridge as per the I.R.C codal provisions.
- Understand the design procedures of the bridges as per the I.R.C recommendations
- Understand the different forces acting on the piers and abutments and their stability analysis

**TEXT BOOKS:**

1. Ponnu Swamy, “Bridge Engineering”, TATA Mcgraw Hill Company, New Delhi.
2. N.Krishnam Raju, “Design of Bridges”, Oxford & IBH, Publishing Company Pvt.ltd., Delhi.
3. D.J.Victor, “Design of Bridges Structure”
4. Relevant, “ IRC & Railway bridge Codes”.

**REFERENCE BOOKS :-**

1. B.C. Punmia, “Design of Steel structures”, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications, New Delhi.
2. Ramachandra. “Design of Steel structures”,
3. B.C. Punmia, “Design of R.C.C. structures”, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications, New Delhi.
4. T.R.Jagadish & M.A.Jayaram “Design of Bridges Structure”, Prentice Hall of India

**(19A01703a2) PRESTRESSED CONCRETE  
PROFESSIONAL ELECTIVE-III**

**Course Objectives**

These are to

- Analyze PSC beams with straight, concentric, eccentric, bent and parabolic tendons and design beams of rectangular and I sections for flexure.
- Design shear reinforcements, structural elements for shear, torsion and anchorage as per the provisions of BIS.
- Interpret the transmission mechanism of pre-stressing force by bond and compute deflection of beams under loads

**UNIT -I**

**Introduction:**

Principles of pre-stressing – pre stressing systems - pre-tensioning and post tensioning- Advantages and limitations of Pre stressed concrete- need for high strength materials. Methods of pre-stressing: Pre-tensioning (Hoyer system) and Post-tensioning methods (Freyssinet system and Gifford- Udall System).

**Learning Outcomes:**

After completing this Unit, students will be able to

- Understand pre tensioning and post tensioning
- Identify different type of prestressing systems.

**UNIT –II**

**Losses of pre-stress:**

Loss of pre-stress in pre-tensioned and post-tensioned members due to elastic shortening, shrinkage and creep of concrete, relaxation of stress in steel, anchorage slip and frictional losses.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Classify different types of losses in prescreening
- Estimate losses of pre stress



## **UNIT -III**

### **Flexure and shear:**

Analysis of beams for flexure and shear - beams pre-stressed with straight, concentric, eccentric, bent and parabolic tendons- Kern line - Cable profile - design of PSC beams (rectangular and I sections) using IS 1343. Analysis and design of rectangular and I beams for shear. Introduction to Transmission length and End block (no Design and Analytical problems).

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Analyze beams for flexure and shear
- Understand prestressing with different types of tendons on beams of varying shape
- Know the end block characteristics and its significance

## **UNIT – IV**

### **Deflections:**

Control of deflections- Factors influencing deflections - short term deflections of uncracked beams- prediction of long time deflections.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Distinguish between short term and long term deflections in PSC beams
- Estimate the short and long term deflections of PSC beam.

## **UNIT – V**

### **Composite beams:**

Different Types- Propped and Un-propped- stress distribution- Differential shrinkage- Analysis of composite beams.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Identify different types of composite beams
- Analyze PSC composite beams.

## **Course Outcomes**

At the end of the course the student will be able to:

- Understand the concepts of pre-stressing and methods of pre stressing.
- Compute losses of pre-stress in pre-stressed concrete members.
- Design PSC beams under flexure and shear.
- Estimate the short and long term deflections of PSC beams.
- Apply prestressing concepts for composite beams.

## **TEXT BOOKS:**

1. N. Krishna Raju, “Prestressed Concrete”, Tata Mc.Graw Hill Publications.
2. Praveen Nagrajan, “Prestressed Concrete Design”, Pearson publications, 2013.

## **REFERENCES:**

1. T.Y. Lin & Ned H. Burns, “Design of Prestressed Concrete Structures”, John Wiley & Sons.
2. Ramamrutham, “Prestressed Concrete”, Dhanpatrai Publications.
3. Rajagopalan, “Prestressed concrete”, Narosa Publishing House.
4. BIS code on “prestressed concrete”, IS: 1343 to be permitted into the examination Hall.

**(19a01703b1) EXPANSIVE SOILS  
PROFESSIONAL ELECTIVE-III**

**Course Objectives:**

These are to

- Familiarize Students with Nature of Soils and Soil Structure
- Equip student with concepts of Swelling and methods of determination
- Understand foundation practices in expansive soils
- Familiarize different materials and techniques for stabilization
- Understand procedure to improve shear strength of expansive soils

**UNIT – I**

**Clay Mineralogy:** Nature of Soils-Clay mineral structure- Diffused double layer theory- Cation exchange – Soil water- Soil Structure-Soil water interaction

**Learning Outcomes:**

After completing this Unit, students will be able to

- Understand mineralogical structure of soil.
- Know the effects of soil water interaction

**UNIT- II**

**Swelling Characteristics-** Swelling- Factors effecting Swelling- Swelling Potential- Swell Pressure- Methods of Determination-Factors effecting Swelling potential and swell pressure- Heave- Factors effecting Heave- Methods of determination of heave.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Understand swelling and its effects
- Understand heave and its effects

**UNIT-III**

**Foundation Practices in Expansive Clays:** Sand Cushion-Belled Piers-CNS layer technique- Under reamed Pile foundation- Construction Techniques- Design Specifications- Load-carrying

capacity in compressive and uplift of single and multi under reamed piles in clays and sands- Granular pile Anchors.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Understand about inconveniences with expansive soils
- Design foundation on expansive soils.

### **UNIT-IV**

Lime Soil columns and Lime Slurry pressure injection- Stabilization with admixtures- Propounding- Vertical and Horizontal Moisture barriers.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Know the stability concepts with various admixtures.

### **UNIT: V**

Shear strength of expansive soils- Katti's concept of bilinear envelope- Stress –state variables in partly saturated soils- Frelend's strength parameters- Determination of matrix suction by filter paper method- axis translation technique and field suction measurement.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Determine shear strength of expansive soils by different techniques

### **Course Outcomes:**

At the end of this course the student will be able to

- Demonstrate behavior of expansive soils.
- Explain need of foundation practice on expansive soils.
- Perform methods of stabilization of expansive soils.
- Select additives and methodology for stabilization.
- Apply the gained knowledge for suitable performance

**TEXT BOOKS:**

1. F. C. Chen, “Foundation on Expansive Soils”, Elsevier Scientific Publishing Company, Newyork
2. J. D. Nelson and D. I. Miller, “Expansive soils- Problems and Practice in Foundation and pavement Engineering”, John Wiley & Sons Inc

**REFERENCES:**

1. D. G. Fredlund and H. Rhardjo, “Soil Mechanics for Unsaturated Soils”, WILEY Inter Science Publication, John Wiley & Sons, Inc
2. D. R. Katti, A. R. Katti, “Behavior of Saturated Expansive Soils and Control Methods”, Taylor and Francis
3. Malcolm D Bolton , “Guide to Soil Mechanics”, Universities Press, 2003.
4. Manfred R. Haussmann, “Engineering Principles of Ground Modification”, McGraw Hill Pub. Co.,New, York, 1990

**Codes:**

IS: 2720 (Part XV)-1977 Measurement of Swelling Pressure of Soils

**(19A01703b2) ROCK MECHANICS**  
**PROFESSIONAL ELECTIVE-III**

**Course Objectives:**

To give details of Mechanics of rock failure and other aspects of stability of underground and open cost workings including mechanics of subsidence, design of slopes and foundations resting on mass

**UNIT-I**

Physico-mechanical properties of rocks, Elastic and time dependent behavior, Rock mass classification.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Understand the physical and mechanics properties of rock with time
- Classify the various types rocks

**UNIT-II**

Theories of rock failure, Stress analysis, Insitu stress and stress distribution around mine openings. Ground failure and pressure on supports, Stability of wide openings, Design of supports in mine workings.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Understand the behaviour of stress and strain characteristics of rocks
- Design the support systems for mining works

**UNIT-III**

Subsidence: Causes and impacts of subsidence, Mechanics of surface subsidence, discontinuous and continuous subsidence. Monitoring, prediction, control and management of subsidence.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Understand the gradual caving in or sinking of rocks.

- Predict the subsidence

#### **UNIT-IV**

Plane failure analysis. Wedge failure analysis analytical, Stereographic methods. Buckling and toppling failures, Rock falls, Landslides.

##### **Learning Outcomes:**

After completing this Unit, students will be able to

- Understand the various types of failure in rock mechanics
- Learn about the design of rock slopes against planar and wedge failures

#### **UNIT-V**

Foundations: Bearing capacity, settlement and stress distribution in intact and layered rocks. Foundations of dams. Deep foundations. Tension foundations, Codal provisions. Foundation improvement. Use of appropriate software packages.

##### **Learning Outcomes:**

After completing this Unit, students will be able to

- Calculate the bearing capacity of foundations resting on rocks
- Compare the various codal provisions regarding bearing capacity

##### **Course Outcomes:**

Upon the successful completion of this course, the students will be able to:

- Know the physical properties of rocks and their classification
- Study various aspects of ground control problems in underground
- Know open cost mines with a better understandings of scope for application of various numerical methods and model studies in geo-mechanics.

**TEXT BOOKS:**

1. Jager. J C & Cook NGW, "Fundamentals of Rock Mechanics", Blackwell Publishers
2. Jumikis Alfreds. R, "Rock Mechanics" , Trans Tech Publishers

**REFERENCE BOOKS:**

1. Peng. Syd. S. "Coal Mining Ground Control West Virginia University"
- 2 Brady, BHG& Brown.ET, "Rock mechanics for underground mining", George Allen & Unwio Ltd, 1992



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (CE)– IV-I**  
**(19A01703c1) INDUSTRIAL WASTE & WASTE WATER ENGINEERING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**PROFESSIONAL ELECTIVE-III**

**Course Objectives:**

- To teach Health and Environment Concerns in waste water management
- To teach material balance and design aspects of the reactors used in waste water treatment.
- To impart knowledge on selection of treatment methods for industrial waste water
- To teach common methods of treatment in different industries
- To provide knowledge on operational problems of common effluent treatment plant

**UNIT –I**

**Industrial water Quantity and Quality requirements:**

Boiler and cooling waters–Process water for Textiles, Food processing, Brewery Industries, power plants, fertilizers, sugar mills Selection of source based on quality, quantity and economics. Use of Municipal wastewater in Industries – Adsorption, Reverse Osmosis, Ion Exchange, Ultra filtration, Freezing, Elutriation, Removal of Colour, Odour and Taste.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Learn the procedures for assessment of quality of Industrial water
- Suggest different processes of handling waste water

**UNIT –II**

**Basic theories of Industrial Wastewater Management:** Industrial waste survey - Measurement of industrial wastewater Flow-generation rates – Industrial wastewater sampling and preservation of samples for analysis -Wastewater characterization-Toxicity of industrial effluents-Treatment of wastewater-unit operations and processes-Volume and Strength reduction – Neutralization and Equalization, Segregation and proportioning- recycling, reuse and resources recovery

**Learning Outcomes:**

After completing this Unit, students will be able to

- Know the quantity of measurement of Industrial waste water

- Know about the characterization of waste water
- Suggest techniques for treatment of waste water.

### **UNIT –III**

**Industrial wastewater disposal management:** Discharges into Streams, Lakes and oceans and associated problems, Land treatment - Common Effluent Treatment Plants: advantages and suitability, Limitations and challenges- Recirculation of Industrial Wastes- Effluent Disposal Method

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- Understand options for waste water disposal.
- Explain functioning of common effluent treatment plants

### **UNIT – IV**

**Process and Treatment of specific Industries-1:** Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Steel plants, Fertilizers, Textiles, Paper and Pulp industries, Oil Refineries, Coal and Gas based Power Plants

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- Understand the characteristics of waste water from Steel plants and refineries
- Suggest suitable waste water treatment techniques

### **UNIT – V**

**Process and Treatment of specific Industries-2:** Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Tanneries, Sugar Mills, Distillers, Dairy and Food Processing industries, Pharmaceutical Plants

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- Understand the character of waste water from tanneries and distilleries
- Suggest suitable waste water treatment techniques

**Course Outcomes:**

Upon the successful completion of this course, the students will be able to:

- Design treatment methods for any industrial wastewater.
- Examine the manufacturing process of various industries.
- Assess need for common effluent treatment plant for an industry
- Test and analyse BOD, COD, TSS and MPN in waste water.

**TEXT BOOK**

1. M. N. Rao and A. K. Dutta, “Wastewater Treatment”, Oxford & IBH, New Delhi.
2. K.V. S. G. Murali Krishna, “Industrial Water and Wastewater Management”.

**REFERENCES**

1. A. D. Patwardhan, Industrial Wastewater treatment, PHI Learning, Delhi
2. Metcalf and Eddy Inc., Wastewater Engineering, Tata McGraw Hill co., New Delhi.
3. G. L. Karia & R.A. Christian Wastewater Treatment- Concepts and Design Approach, Prentice Hall of India.

**PROFESSIONAL ELECTIVE-III**

**Course Objectives:**

These are to

- Introduce the basic principles of Remote Sensing and GIS techniques.
- Teach various types of satellite sensors and platforms
- Impart concepts of visual and digital image analyses
- Teach concepts of principles of spatial analysis
- Teach about the application of RS and GIS in Civil engineering

**UNIT – I**

**Introduction to photogrammetry:**

Principles & types of aerial photograph, geometry of vertical aerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy, fiducially points, parallax measurement using fiducially line.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Understand concepts of photogrammetry
- Estimate heights and distances.

**UNIT – II**

**Remote sensing:**

Basic concepts and foundation of remote sensing – elements involved in remote sensing, electromagnetic spectrum, remote sensing terminology and units. Energy resources, energy interactions with earth surface features and atmosphere, resolution, sensors and satellite visual interpretation techniques, basic elements, converging evidence, interpretation for terrain evaluation, spectral properties of water bodies, introduction to digital data analysis.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Understand advantages of remote sensing

- Demonstrate concepts of remote sensing.

### **UNIT – III**

#### **Geographic information system:**

Introduction, GIS definition and terminology, GIS categories, components of GIS, fundamental operations of GIS, A theoretical framework for GIS. Data collection and input overview, data input and output. Keyboard entry and coordinate geometry procedure, manual digitizing and scanning, Raster GIS, Vector GIS – File management, Spatial data – Layer based GIS, Feature based GIS mapping.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- Understand concepts of GIS.
- Explain data collection and data interpretation
- Develop terrain characteristics using Mapping

### **UNIT – IV**

#### **GIS spatial analysis:**

Computational Analysis Methods (CAM), Visual Analysis Methods (VAM), Data storage-vector data storage, attribute data storage, overview of the data manipulation and analysis. Integrated analysis of the spatial and attribute data.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- Know applications of GIS and data interpretation.

### **UNIT – V**

#### **Water resources applications:**

Land use/Land cover in water resources, Surface water mapping and inventory -Watershed management for sustainable development and Watershed characteristics - Reservoir sedimentation, Fluvial Geomorphology - Ground Water Targeting, Identification of sites for artificial Recharge structures - Inland water quality survey and management, water depth estimation and bathymetry.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- Know applications of RS & GIS in water resources applications.

- Study technological problems like reservoir sedimentation ground water identification

### **Course outcomes**

At the end of the course the student will be able to

- Comparing with ground, air and satellite based sensor platforms.
- Interpret the aerial photographs and satellite imageries.
- Create and input spatial data for GIS application.
- Apply RS and GIS concepts in water resources engineering.
- Applications of various satellite data.

### **TEXT BOOKS:**

1. B. Bhatta, “Remote Sensing and GIS”, Oxford University Press, New Delhi.
2. Satheesh Gopi, Advanced surveying: Total station GIS and remote sensing, Pearson publication.

### **REFERENCES:**

1. George Joseph, “Fundamentals of remote sensing”, Universities press, Hyderabad.
2. C. P. Lo Albert, K.W. Yonng, “Concepts & Techniques of GIS”, Prentice Hall (India) Publications.
3. M. Anji Reddy “Remote sensing and GIS”, B. S. Publications, New Delhi.
4. L. R. A. Narayana, “Remote Sensing and its applications”, University Press 1999.

**PROFESSIONAL ELECTIVE-III**

**Course Objectives:**

The course will address the following:

- It will enable the student to understand the various characteristics of traffic system
- It will make the student to have the knowledge of intersections and their design
- It will impart the knowledge of design of interchanges and parking facilities

**UNIT- I**

Characteristics of Traffic System: Human-vehicle-environment system, Fundamental parameters of traffic and relationships; Microscopic and macroscopic characteristics

Traffic Data Collection studies: Traffic study components, types of data; Volume studies; Speed studies; Travel time and delay studies; Intersection studies, Pedestrian studies; Parking studies, Vehicle detection methods; Advanced methods: GPS, Instrumented Vehicles, Image Processing, Bluetooth, Infrared methods.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To enable the student to know about the traffic characteristics.
- It makes the student familiar with traffic data collection studies.

**UNIT- II**

Highway Capacity Analysis: Capacity and level of service concepts; Factors affecting capacity and LOS; Freeway and multi-lane analysis; Capacity of Urban arterials; Signalised intersections; Un-signalised intersections; US Highway Capacity Manual (HCM) and IRC standards, Indo-HCM standards.

**Learning Outcomes:**

After completing this Unit, students will be able to

- It makes the student to get familiar with highway capacity analysis.

### **UNIT- III**

Design of unsignalised intersections: At grade intersections types and their suitability, factors affecting design, data requirement, parameters selection, intersection controls, estimation of conflict points, uncontrolled intersection analysis, sight distance requirements, roundabouts and design methodologies, capacity of roundabouts, miniroundabouts.

Design of signalized intersections: Warrants for signalization, saturation flow rate and capacity, estimation of amber time, design of all aspects of signal timings, LOS studies, estimation of queue length and control delay, signal coordination, channelization and its objectives, channelizing devices, design considerations, typical channelizing examples.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- It makes the student to design the unsignalized and signalized intersections

### **UNIT-IV**

Design of Interchanges: Necessities of interchanges, classification and types of common interchanges, layouts of interchange, interchange warrants, interchange design elements

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- It makes the student to know the types of interchanges and design of interchanges

### **UNIT-V**

Design of parking facilities: Parking and influencing factors, type of parking system, parking angles and aisle width, on-street parking design, design parameters, parking surveys and demand estimation, various parking layouts and vehicle circulation, design of off street parking facilities, types and layouts, design examples.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- It allows the student to understand parking facilities .
- It also allows the student to make parking surveys and design parameters to be considered in parking design.



**Course outcomes:**

- Upon the successful completion of this course, the students will be able to:
- Conduct traffic studies and estimate basic characteristics of traffic stream.
- Analyze the traffic data and interpret the results.
- Design the geometric elements for better traffic system.
- Analyze and design uncontrolled and signalized intersection with collected data.

**TEXT BOOKS:**

1. L.R. Kadiyali, "Traffic Engineering and Transportation Planning", Khanna Publishers, 2011.
2. Roger P. Roess, Elena S. Prassas and William R. McShane, "Traffic Engineering", Prentice Hall, 4th Edition, 2010.
3. Adolf D. May, "Traffic Flow Fundamentals", Prentice Hall, 1990.
4. Chakroborty Partha, Das Animesh, "Principles of Transportation Engineering", PHI Learning Pvt. Ltd., 1st Edition, 2009.
5. C. Jotin Khisty <http://www.amazon.com/Transportation-Engineering-Introduction> 3<sup>rd</sup> Edition
6. B. Kent Lall, Transportation Engineering: An Introduction, Prentice Hall; 3rd Edition, 2003.

**REFERENCE BOOKS:**

1. Fred L. Mannering, Scott S. Washburn, Kilareski Walter P., "Principles Of Highway Engineering And Traffic Analysis", Wiley India Pvt Ltd., 4th Edition, 2011.
2. L.R. Kadiyali, Traffic Engineering and Transportation Planning, Khanna Publishers, 2011.
3. Louis J. Pignataro and Edmund J. Cantilli, Traffic Engineering: Theory and Practice; Prentice hall, Inc., 1973.
4. Mike Slinn, Paul Matthews, Peter Guest, "Traffic Engineering Design: Principles and Practice, Butterworth" -heinemann, 2nd Edition, 2005.
5. Nicholas J. Garber, Lester A. Hoel, Nicholas J. Garber, Lester A. Hoel, "Principles of Traffic and Highway Engineering", Cengage Learning India, 2nd Edition, 2010.
6. TRB Highway Capacity Manual, "Transportation Research Board", Washington, D.C., 2010.

**(19A01703d2) URBAN TRANSPORT PLANNING**

**PROFESSIONAL ELECTIVE-III**

**Course Objective:**

- To make the student to know the travel characteristics.
- To make the student to know the transportation planning process.
- To make the students understand, trip generation models.
- To introduce the concept of Traffic assignment and Mode Split.
- To make the students to understand the concept of Economic Evaluation of Transportation plans.

**UNIT -I**

**Concept Of Travel Demand;** Travel Characteristics - Origin, Destination, Route, Mode, Purpose; Travel Demand As A Function Of Independent Variables; Assumptions In Demand Estimation Relation Between Land Use And Travel; Four Step Process Of Transportation Planning.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the travel characteristics.

**UNIT - II**

**Transportation Planning Process;** General Concept Of Trip; Trip Generation; Trip Distribution, Traffic Assignment And Mode Split, Aggregate And Disaggregate Models. Date Collection And Sequential And Sequential Recursive Models. Date Collection And Inverntories; Definition Of Study Area; Zoning Principles; Types And Sources Of Date, Home Interview Surveys; Road Side Interview Surveys; Goods. Taxi, IPT Surveys; Sampling Techniques; Expansion Factors And Accuracy Check; Desire Line Diagram And Use.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Identify the principles of transportation planning.
- Know about the sampling techniques.

### **UNIT - III**

**Trip Generation Models;** Factors Governing Trip Generation And Attraction; Multiple Linear Regression Models, Category Analysis, Trip Distribution Models Methods Of Trip Distribution; Growth Factor Models Uniform Growth Factor Method; Average Growth Factor Method; Factor Method; Furnes Method; Limitation Of Growth Factor Models Concept Of Gravity Model.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- Know about the steps involved in different trip generation models.

### **UNIT -IV**

**Traffic assignment and Mode Split;** Purpose of Assignment and General Principles; Assignment Techniques - All - or- nothing. Assignment; Multiple route assignment, Capacity restraint method. Minimum path trees; Diversion Curves. Factors affecting mode split; probit, logit and discriminant Analysis.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- Know traffic assignment and mode split in the traffic analysis.
- Know about the factors affecting the mode split.

### **UNIT – V**

**Economic Evaluation of Transportation plans;** Costs And Benefits Of Transportation Projects; Vehicle Operating Cost; Timesaving Accident Costs. Methods Of Economic Evaluation - Benefit Cost Ratio Method; Net Present Value Method; Internal Rate Of Return Method.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- Know cost and benefits of transportation projects .
- Know different methods of economic evaluation of transportation projects.

## **Course Outcomes**

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

- Understand the concept of travel demand.
- Understand the different types of transportation planning processes.
- Understand the different types of trip generation models.
- Understand necessity of traffic assignment and mode split.
- Understand the economic evaluation of transportation projects.

## **REFERENCES:**

1. L.R.Kadiyalli; “Traffic Engineering and Transportation Planning”, Khanna Publishers, Delhi.
2. Papa Costas C.S.; “Fundamentals of Transportation Engineering”, Prentice Hall, India.
3. Khistry C.J.”Transportation Engineering”, An Introduction Prentice Hall

**(19A01703e1) WATER RESOURCES SYSTEM ANALYSIS**  
**PROFESSIONAL ELECTIVE-III**

**Course Objectives:**

These are to

- Teach Concepts of systems techniques in water resources engineering
- Teach Linear Optimization concepts
- Demonstrate the Development system approach to reservoir operation
- Planning water allocation to different crops
- Expertise on River operation policies

**UNIT 1**

Concept of System and System Analysis - Definition and Types of Systems - Basic Principles of Systems Approach and Analysis. Systems Techniques in Water Resources.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To Understand the concepts of water resource system.

**UNIT II**

Introduction to Optimization - Linear and Dynamic Programming - Simulation - Combined Simulation and Optimization. Economics of Water Resources Projects - Cost Benefit Analysis - Cost Allocation among various projects in a Multi-purpose Project.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Know about the optimization of water resource projects.
- Carryout cost analysis on different projects

**UNIT III**

Systems Approach to Reservoir - Deterministic Flows - Reservoir Sizing and Reservoir Operations. Basic Concepts of Random Flows Reliability.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To learn the different types of operations in water resource system.

**UNIT IV**

Application of Linear Programming to Water Resources Systems - Irrigation Water Allocation for Single and Multiple Crops. Reservoir Operation for Irrigation and Hydropower Generation.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To understand applications of linear programming on applications of water resource system for crops.

**UNIT V**

Applications of Dynamic Programming to Water Resources Systems - Optimal Crop Water Application - Steady State Reservoir Operating Policy for Irrigation. Real Time Reservoir Operation for Irrigation.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To develop knowledge on dynamic programming on applications of water resource system for crops.

**Course Outcomes:**

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

- Apply basic principles of system approach.
- Judging Economics of water resources of multipurpose projects.
- Apply optimization principles to single and multi crop applications.
- Designing reservoir operation leading to optimum crop water application.

**TEXT BOOKS:**

1. Loucks, D. P. and Eelco Van Beek, “Water Resources systems planning and management”: An Introduction to methods, models and applications. UNESCO. (2005).
2. Vedula, S. and Mujumdar, P. P., “Water resources Systems: Modeling techniques and analysis”, Tata McGraw Hill, New Delhi. (2005).

**REFERENCES:**

1. Mays, L.W. and Tung, Y.K., “Hydro systems Engineering and Management”, McGraw Hill, USA. (1992).
2. Simonovic, S.P., “Managing water resources: Methods and tools for a systems approach”, UNESCO Publishing, France. (2009).
3. R. K. Sharma & T. K. Sharma, “A Textbook Of Irrigation Engineering”, S. Chand and Company Limited, New Delhi

**(19A01703e2) RIVER BASIN MANAGEMENT  
PROFESSIONAL ELECTIVE-III**

**Course Objectives:**

These are to

- Teach the basic concepts of river basin management
- Demonstrate the various types flows and catchment process
- Explain various monitoring systems and regulations in river basin management
- Teach river basin management techniques

**UNIT –I**

**Introduction:**

Basic Concepts of River Basin Management (RBM) - Integrated River Basin Management (IRBM) - River Basin Organizations (RBOs) - Types. Theories and Principles of IRBM - Need for RBM & Need for Irrigation-Objectives and Benefits of IRBM - Key Activities and Challenges in IRBM - Various Guiding Principles of IRBM - Scenarios in Developed and Developing Countries.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Learn basic concepts of river basin management.
- Identify key activities and challenges of IRBM

**UNIT –II**

**River Systems:**

Recapitulation of Basic Principles of Hydrology - River Basins and Catchments - Hydrologic, Geo-morphological, Physical & Chemical Processes. Stream Corridors, Stream Order Model- Functions of River Systems - Provisioning, Regulating, Cultural and Supporting Services - Low Base Flows - Ecological Stresses to Rivers - Human Interventions and Impacts - Man's Attitude towards Nature and Development. Engineered River Systems.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Understand river basin systems.



- Explain functions of river system
- Identify ecological stress on rivers and necessity of engineering river systems

### **UNIT – III**

#### **Tools and Methods of IRBM:**

Monitoring and Water Resources Information System - Monitoring, Acquisition and Processing of Water Resources Data - Statistical Tools - Decision Support Systems. Governance Issues - Water Governance - Its Importance - Fundamental Requirements for Good TBM - Rules, Regulations and Laws - Various Acts Enforced by Government of India for River Basin Management and Development.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- To learn tools and methods of river basin management.

### **UNIT – IV**

#### **River Basin Planning And Management - I (Strategies)**

Water Resources Planning and Management of - Need, Various Aspects and Approaches of Planning and Management - Planning Process - Operational Management - Instruments of Operational Management - Water Quality Management - Water Charges and Cost Recovery - Issues related to Water Right and Water Allocation.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- To Understand river basin planning and strategic management..

### **UNIT – V**

#### **River Basin Planning And Management – II (Technologies)**

River Restoration: Disturbances to River Systems - River Restoration Planning and Design. Implementation, Monitoring and Adoptive Management - Sediment Management in Rivers - Preliminary Sedimentation Aspects, Sediment Inflow Reduction - Recovery, Increase or Reallocation of Storage Volume - Pressure Flushing, Empty Flushing, Dredging, Dry Excavation and Structural Modifications.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- To understand river basin planning and technical management..

**Course Outcomes:**

At the end of the course, student is able to

- Summarise the concepts of river basin management.
- Implement the techniques in river basin management.
- Compare methods and tools in river basin management
- Check the river basin to obtain most possible benefits.
- Planning and management of river basin.

**TEXT BOOKS:**

1. A Handbook for Integrated Water Resources Management in Basins Published by Global Water Partnership and International Network of Basin Organizations (INBO)
2. Lawrence K. Wang and Chih Ted Yang, “Modern Water Resources Engineering” Edited, Humana Press

**REFERENCES**

1. Santosh Kumar Garg “Irrigation Engineering and Hydraulic Structure”, Khanna Publishers.
2. Chow V. T., D. R Maidment and L. W. Mays, “Applied hydrology”, Tata McGraw Hill Education Pvt. Ltd, (2011), New Delhi.
3. Mays L.W., “Water Resources Engineering”, Wiley India Pvt. Ltd, (2013).
4. Integrated River Basin Management - [www.universitywaterspectrumpartnership.org](http://www.universitywaterspectrumpartnership.org).

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**(19A01704a) AIR POLLUTION AND CONTROL**  
**OPEN ELECTIVE-III**

**Course Objectives:**

- To identify the sources of air pollution
- To know the composition and structure of atmosphere
- To know the pollutants dispersion models
- To understand the working of air pollution control equipments
- To identify the sources of noise pollution and their controlling methods

**UNIT I**

Introduction: sources, effects on – ecosystems, characterization of atmospheric pollutants, air pollution episodes of environmental importance. Indoor Air Pollution– sources, effects.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To understand the character of atmospheric pollutants and their effects

**UNIT II**

Meteorology - composition and structure of the atmosphere, wind circulation, solar radiation, lapse rates, atmospheric stability conditions, wind velocity profile, Maximum Mixing Depth (MMD), Temperature Inversions, Wind rose diagram.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Understand the composition and structure and structure of atmosphere
- To understand the maximum mixing depth and windrose diagram

**UNIT III**

General characteristics of stack emissions, plume behaviour, heat island effect. Pollutants dispersion models – description and application of point, line and areal sources. Monitoring of particulate matter and gaseous pollutants –respirable, non-respirable and nano - particulate matter. CO, CO<sub>2</sub>, Hydrocarbons (HC), SOX and NOX, photochemical oxidants.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the general characteristics of stack emissions and their behavior
- To understand the monitoring of particulate matter and gaseous pollutants

**UNIT IV**

Air Pollution Control equipment for particulate matter & gaseous pollutants– gravity settling chambers, centrifugal collectors, wet collectors, fabric filters, electrostatic precipitator (ESP). – Adsorption, Absorption, Scrubbers, Condensation and Combustion.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the various air pollution control equipments

**UNIT V**

Noise - sources, measurements, effects and occupational hazards. Standards, Noise mapping, Noise attenuation equations and methods, prediction equations, control measures, Legal aspects of noise.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the noise sources, mapping, prediction equations etc.,

**Course Outcomes:**

Upon the successful completion of this course, the students will be able to:

- Identify the sources of air pollution
- Understand the composition and structure and structure of atmosphere.
- Know about the general characteristics of stack emissions and their behavior
- Know about the general characteristics of stake emission and their behavior
- Know about the noise sources, mapping, prediction equations etc.,

## REFERENCES:

1. WarkK ., Warner C.F., and Davis W.T., “Air Pollution - Its Origin and Control”, Harper & Row Publishers, New York.
2. Lee C.C., and Lin S.D., “Handbook of Environmental Engineering Calculations”, McGraw Hill, New York.
3. Perkins H.C., “Air Pollution”, McGraw Hill.
4. Crawford M., “Air Pollution Control Theory”, TATA McGraw Hill.
5. Stern A.C., “Air Pollution”, Vol I, II, III.
6. Seinfeld N.J., “Air Pollution”, McGraw Hill.
7. Stern A.C. Vol. V, “Air Quality Management”.
8. M N Rao and HVN Rao, Air Pollution” Tata McGraw Hill publication

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**(19A01704b) BASICS OF CIVIL ENGINEERING**  
**OPEN ELECTIVE-III**

**Course Objectives:**

- To identify the traditional materials that are used for building constructions
- To know the principles of building planning
- To know the causes of dampness in structures and its preventive measures
- To know about the low cost housing techniques
- To know the basic principles of surveying

**UNIT I**

Traditional materials: Stones- Types of stone masonry -Brick-types of brick masonry- lime Cement – Timber – Seasoning of timber - their uses in building works

**Learning Outcomes:**

After completing this Unit, students will be able to

- To understand the characteristics of different building materials.

**UNIT II**

Elements of building planning- basic requirements-orientation-planning for energy efficiency-planning based on utility-other requirements.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To understand the principles of planning in buildings

**UNIT III**

Dampness and its prevention: Causes of dampness- ill effects of dampness-requirements of an ideal material for damp proofing-materials for damp proofing –methods of damp proofing.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the causes of dampness in buildings and its ill effects
- To know about the general characteristics of ideal material for damp proofing

## **UNIT IV**

Cost effective construction techniques in mass housing schemes: Minimum standards –Approach to cost effective mass housing schemes- cost effective construction techniques.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the various cost effective techniques in mass housing schemes.

## **UNIT V**

Introduction to Surveying: Object and uses of surveying- Primary divisions in surveying- Fundamental principles of surveying- Classification of surveying-plans and maps-scales-types of graphical scales- units and measurements

### **Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the objects of surveying and its classification.

### **Course Outcomes:**

Upon the successful completion of this course, the students will be able to:

- Identify the traditional building materials that are used in building construction.
- Plan the buildings based on principles of planning.
- Identify the sources of dampness and its ill effects on buildings and its prevention.
- Know the cost effective construction in mass housing schemes.
- Know the importance of surveying in planning of the buildings.

### **Text books:**

1. S.S.Bhavikatti, “Basic civil engineering”, New age international publishers.
2. S.S.Bhavikatti, “Building Construction:”, Vikas Publishing house, New Delhi.
3. G.C.Sahu and Joygopal jena, “Building materials and Construction”, McGraw Hill Education.

### **Reference books:**

1. N.Subramanian, “Building Materials testing and sustainability”, Oxford university press.

**(19A02704a) RENEWABLE ENERGY SYSTEMS**

**OPEN ELECTIVE-III**

**Course Objectives:**

At the end of the course the student will be able to

- Identify various sources of Energy and the need of Renewable Energy Systems.
- Understand the concepts of Solar Radiation, Wind energy and its applications.
- Distinguish between solar thermal and solar PV systems
- Interpret the concept of geo thermal energy and its applications.
- Understand the use of biomass energy and the concept of Ocean energy and fuel cells.

**UNIT -I**

**Solar Energy**

Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

**Learning Outcomes:**

At the end of the course the student will be able to

- To understand about solar thermal parameters
- To distinguish between flat plate and concentrated solar collectors
- To know about thermal storage requirements
- To know about measurement of solar radiation

**UNIT – II**

**PV Energy Systems**

Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems.

**Learning Outcomes:**

After completing this Unit, students will be able to



- Understand the concept of PV effect in crystalline silicon and their characteristics
- Understand other PV technologies
- To know about electrical characteristics of PV cells & modules
- To know about grid connected PV systems

## **UNIT - III**

### **Wind Energy**

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- To understand basics of wind energy conversion and system
- To distinguish between VAWT and HAWT systems
- To understand about design considerations
- To know about site selection considerations of WECS

## **UNIT - IV**

### **Geothermal Energy**

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- Understand the Geothermal energy and its mechanism of production and its applications
- Analyze the concept of producing Geothermal energies
- To learn about disadvantages and advantages of Geo Thermal Energy Systems
- To know about various applications of GTES

## **UNIT -V**

### **Miscellaneous Energy Technologies**

**Ocean Energy:** Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations.

**Bio mass Energy:** Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration

**Fuel cell:** Principle of working of various types of fuel cells and their working, performance and limitations.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Analyze the operation of tidal energy
- Analyze the operation of wave energy
- Analyze the operation of bio mass energy
- Understand the principle, working and performance of fuel cell technology
- Apply these technologies to generate power for usage at remote centres

### **Course Outcomes:**

Upon the successful completion of this course, the students will be able to:

- To distinguish between various alternate sources of energy for different suitable application requirements
- To differentiate between solar thermal and PV system energy generation strategies
- To understand about wind energy system
- To get exposed to the basics of Geo Thermal Energy Systems
- To know about various diversified energy scenarios of ocean, biomass and fuel cells

### **Text Books:**

1. Stephen Peake, “Renewable Energy Power for a Sustainable Future”, Oxford International Edition, 2018.
2. G. D. Rai, “Non-Conventional Energy Sources”, 4<sup>th</sup> Edition, Khanna Publishers, 2000.

### **References:**

1. S. P. Sukhatme, “Solar Energy”, 3<sup>rd</sup> Edition, Tata Mc Graw Hill Education Pvt. Ltd, 2008.
2. B H Khan , “ Non-Conventional Energy Resources”, 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.
3. S. Hasan Saeed and D.K.Sharma, “Non-Conventional Energy Resources”, 3<sup>rd</sup> Edition, S.K.Kataria & Sons, 2012.
4. G. N. Tiwari and M.K.Ghosal, “Renewable Energy Resource: Basic Principles and Applications”, Narosa Publishing House, 2004.

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**(19A02704b) ELECTRIC VEHICLE ENGINEERING**  
**OPEN ELECTIVE-III**

**Course Objectives:**

After completing this Unit, students will be able to

- To get exposed to new technologies of battery electric vehicles, fuel cell electric vehicles
- To get exposed to EV system configuration and parameters
- To know about electro mobility and environmental issues of EVs
- To understand about basic EV propulsion and dynamics
- To understand about fuel cell technologies for EV and HVEs
- To know about basic battery charging and control strategies used in electric vehicles

**UNIT-I**

**Introduction to EV Systems and Parameters**

Past, Present and Future EV, EV Concept, EV Technology, State-of-the Art EVs, EV configuration, EV system, Fixed and Variable gearing, single and multiple motor drive, in-wheel drives, EV parameters: Weight, size, force and energy, performance parameters.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about past, present and latest technologies of EV
- To understand about configurations of EV systems
- To distinguish between EV parameters and performance parameters of EV systems
- To distinguish between single and multiple motor drive EVs
- To understand about in-wheel EV

**UNIT-II**

**EV and Energy Sources**

Electro mobility and the environment, history of Electric power trains, carbon emissions from fuels, green houses and pollutants, comparison of conventional, battery, hybrid and fuel cell electric systems

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about various types of EV sources
- To understand about e-mobility
- To know about environmental aspects of EV
- To distinguish between conventional and recent technology developments in EV systems

### **UNIT-III**

#### **EV Propulsion and Dynamics**

Choice of electric propulsion system, block diagram, concept of EV Motors, single and multi motor configurations, fixed and variable geared transmission, In-wheel motor configuration, classification, Electric motors used in current vehicle applications, Recent EV Motors, Vehicle load factors, vehicle acceleration.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- To know about what is meant by propulsion system
- To understand about single and multi motor EV configurations
- To get exposed to current and recent applications of EV
- To understand about load factors in vehicle dynamics
- To know what is meant acceleration in EV

### **UNIT-IV**

#### **Fuel Cells**

Introduction of fuel cells, basic operation, model, voltage, power and efficiency, power plant system – characteristics, sizing, Example of fuel cell electric vehicle.

Introduction to HEV, brake specific fuel consumption, comparison of series, series-parallel hybrid systems, examples

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- To know about fuel cell technology of EV
- To know about basic operation of FCEV
- To know about characteristics and sizing of EV with suitable example
- To get exposed to concept of Hybrid Electric Vehicle using fuel cells
- To know about the comparison of various hybrid EV systems

### **UNIT-V**

#### **Battery Charging and Control**

**Battery charging:** Basic requirements, charger architecture, charger functions, wireless charging, power factor correction.

**Control:** Introduction, modelling of electro mechanical system, feedback controller design approach, PI controllers designing, torque-loop, speed control loop compensation, acceleration of battery electric vehicle

### **Learning Outcomes:**

After completing this Unit, students will be able to

- To understand about basic requirements of battery charging and its architecture
- To know about charger functions
- To get exposed to wireless charging principle
- To understand about block diagram, modelling of electro mechanical systems of EV
- To be able to design various compensation requirements

### **Course Outcomes:**

Upon the successful completion of this course, the students will be able to:

- To understand and differentiate between conventional and latest trends in Electric Vehicles
- To know about various configurations in parameters of EV system
- To know about propulsion and dynamic aspects of EV
- To understand about fuel cell technologies in EV and HEV systems
- To understand about battery charging and controls required of EVs

### **TEXT BOOKS:**

1. C.C Chan, K.T Chau: “Modern Electric Vehicle Technology”, Oxford University Press Inc., New York 2001.
2. James Larminie, John Lowry, “Electric Vehicle Technology Explained”, Wiley, 2003.

### **REFERENCE BOOKS:**

1. Iqbal Husain,, “Electric and Hybrid Vehicles Design Fundamentals”, CRC Press 2005.
2. Ali Emadi, “Advanced Electric Drive Vehicles”, CRC Press, 2015.

**(19A03704a) FINITE ELEMENT METHODS**  
**OPEN ELECTIVE-III**

**Course Objectives:**

- Familiarize basic principles of finite element analysis procedure.
- Explain theory and characteristics of finite elements that represent engineering structures.
- Apply finite element solutions to structural, thermal, dynamic problem.
- Learn to model complex geometry problems and solution techniques.

**UNIT – I**

Introduction to finite element methods for solving field problems, Stress and equilibrium, Boundary conditions, Strain-Displacement relations, Stress- strain relations for 2D and 3D Elastic problems. Potential energy and equilibrium, The Rayleigh-Ritz method, Formulation of Finite Element Equations.

**One dimensional problems:** Finite element modeling coordinates and shape functions. Assembly of global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Understand the concept of nodes and elements.(12)
- Understand the general steps of finite element methods.(12)
- Understand the role and significance of shape functions in finite element formulations (12)
- Formulate and solve axially loaded bar problems. (16)

**UNIT - II**

**Analysis of trusses:** Stiffness Matrix for plane truss element. Stress Calculations and Problems.

**Analysis of beams:** Element Stiffness Matrix for two noded, two degrees of freedom per node beam element and simple problems.

### **Learning Outcomes:**

At the end of the unit, the student will be able to

- Explain the use of the basic finite elements for structural applications using truss and beam. (L2)
- Formulate and analyze truss and beam problems. (L6)

### **UNIT - III**

Finite element modeling of two dimensional stress analysis - constant strain triangles-quadrilateral element-treatment of boundary conditions. Estimation of load Vector, Stresses. Finite element modeling of Axi-symmetric solids subjected to axi-symmetric loading with triangular elements. Two dimensional four noded Isoparametric elements and problems.

### **Learning Outcomes:**

At the end of the unit, the student will be able to

- Explain the formulation of two – dimensional elements (Triangular and Quadrilateral Elements). (L2)
- Apply the formulation techniques to solve two – dimensional problems using triangle and quadrilateral elements. (L3)
- Formulate and solve axisymmetric problems. (L6)

### **UNIT - IV**

**Steady state heat transfer analysis:** One dimensional analysis of slab and fin, two dimensional analysis of thin plate.

Analysis of a uniform shaft subjected to torsion loading.

### **Learning Outcomes:**

At the end of the unit, the student will be able to

- Explain the application and use of the Finite Element Methods for heat transfer problems. (L2)
- Formulate and solve heat transfer problems. (L6)
- Analyse the

### **UNIT V**

**Dynamic analysis:** Formulation of finite element model, element –mass matrices, evaluation of Eigen values and Eigen vectors for a stepped bar truss.

**3D Problems:** Finite Element formulation- Tetrahedron element-Stiffness matrix.

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Understand problems involving dynamics using Finite Element Methods.
- Evaluate the Eigen values and Eigen Vectors for steeped bar.
- Develop the stiffness matrix for tetrahedron element.

**Course Outcomes:**

Upon successful completion of this course you should be able to

- Understand the concepts behind variational methods and weighted residual methods in FEM.
- Identify the application and characteristics of FEA elements such as bars, beams, and isoparametric elements, and 3-D element.
- Develop element characteristic equation procedure and generation of global stiffness equation will be applied.
- Able to apply Suitable boundary conditions to a global structural equation, and reduce it to a solvable form.
- Able to identify how the finite element method expands beyond the structural domain, for problems involving dynamics, heat transfer and fluid flow.

**TEXT BOOKS**

1. Chandraputla, Ashok & Belegundu, "Introduction to Finite Element in Engineering", Prentice Hall.
2. S.S.Rao, "The Finite Element Methods in Engineering", 2<sup>nd</sup> Edition, Elsevier Butterworth - Heinemann 2011.

**REFERENCE BOOKS**

1. J N Reddy, "An introduction to the Finite Element Method", McGraw – Hill, New York, 1993.
2. R D Cook, D S Malkus and M E Plesha, "Concepts and Applications of Finite Element Analysis", 3<sup>rd</sup> Edition, John Wiley, New York, 1989.
3. K J Bathe, "Finite Element Procedures in Engineering Analysis", Prentice-Hall, Englewood Cliffs, 1982.
4. T J R Hughes, "the Finite Element Method, Prentice", Hall, Englewood Cliffs, NJ, 1986.
5. C Zienkiewicz and R L Taylor, "the Finite Element Method", 3<sup>rd</sup> Edition. McGraw-Hill, 1989.



**(19A03704b) PRODUCT MARKETING**  
**OPEN ELECTIVE-III**

**Course Objectives:**

- Introduce the basic concepts of Product marketing.
- Familiarize with market information systems and research
- Understand the nature and importance of industrial market
- Discuss the major stages in new product development
- Identify the factors affecting pricing decisions

**UNIT I:**

**Introduction (7 Hours)**

Historical development of marketing management, Definition of Marketing, Core marketing concepts, Marketing Management philosophies, Micro and Macro Environment, Characteristics affecting Consumer behaviour, Types of buying decisions, buying decision process, Classification of consumer products, Market Segmentation Concept of Marketing Myopia. Importance of marketing in the Indian Socio economic system.

**Learning Outcomes:**

At the end of this student, the student will be able to

- Define Marketing. (L1)
- Discuss marketing philosophies. (L2)
- Sketch the buying decision process. (L3)
- Understand the importance of marketing in the Indian socio economic system. (L2)

**UNIT II:**

**Marketing of Industrial Products (6 Hours)**

Components of marketing information system–benefits & uses marketing research system, marketing research procedure, Demand Estimation research, Test marketing, Segmentation Research - Cluster analysis, Discriminate analysis. Sales forecasting: objective and subjective methods. Nature and importance of the Industrial market, classification of industrial products, participants in the industrial buying process, major factors influencing industrial buying behavior, characteristics of industrial market demand. Determinants of industrial market demand Buying power of Industrial users, buying motives of Industrials users, the industrial buying process, buying patterns of industrial users.

### **Learning Outcomes:**

At the end of this student, the student will be able to

- Identify the components of marketing information system. (L2)
- List the advantages and uses of marketing research system. (L1)
- Demonstrate sales forecasting. (L3)
- Explain the major factors influencing industrial buying behaviour. (L2)

### **UNIT III:**

#### **Product Management And Branding (7 Hours)**

The concept of a product, features of a product, classification of products, product policies – product planning and development, product line, product mix – factors influencing change in product mix, product mix strategies, meaning of “New – product; major stages in new – product development product life cycle. Branding: Reasons for branding, functions of branding features of types of brands, kinds of brand name.

### **Learning Outcomes:**

At the end of this student, the student will be able to

- Identify the factors influencing change in product mix. (L2)
- Sketch various stages in product life cycle. (L2)
- Recall the features of a product and product policies. (L1)
- Demonstrate on features, functions and reasons of branding. (L3)

### **UNIT IV:**

#### **Pricing And Packaging (7Hours)**

Importance of Price, pricing objectives, factors affecting pricing decisions, procedure for price determination, kinds of pricing, pricing strategies and decisions Labeling: Types, functions advantages and disadvantages, Packaging: Meaning, growth of packaging, function of packaging, kinds of packaging.

### **Learningt Outcomes:**

At the end of this student, the student will be able to

- List the factors affecting pricing decisions. (L1)
- Explain the procedure for price determination. (L2)

- Employ Pricing strategies and decisions. (L3)
- Understand the functions of labelling and packaging. (L2)

## **UNIT V:**

### **Product Promotion (6Hours)**

Importance of Price, pricing objectives, factors affecting pricing decisions, procedure for price determination, kinds of pricing, pricing strategies and decisions. Advertising and sales promotion: Objectives of advertisement function of advertising, classification of advertisement copy, advertisement media – kinds of media, advantages of advertising. Objectives of sales promotion, advantages sales promotion. Personal Selling : Objectives of personal selling, qualities of good salesman, types of salesman, major steps in effective selling

### **Learning Outcomes:**

At the end of this student, the student will be able to

- Discuss the procedures for price determination. (L2)
- Explain the objectives of advertisement function of advertising. (L2)
- List the advantages and disadvantages of advertising. (L1)
- Describe the major steps in effecting selling. (L2)

### **Course Outcomes:**

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

- Understand basic marketing management concepts and their relevance to business development. (L2)
- Prepare a questionnaire for market research. (L5)
- Design marketing research plan for business organizations. (L5)
- Optimize marketing mix to get competitive advantage. (L4)

### **Text Books:**

1. Philip Kotler, “Principles of Marketing”, Prentice – Hall.
2. Philip Kotler, “Marketing Management”, Prentice – Hall.

### **Reference Books:**

1. William J Stanton, “Fundamentals of Marketing”, McGraw Hill
2. R.S.N. Pillai and Mrs. Bagavathi, “Marketing”, S. Chand & Co. Ltd
3. Rajagopal, “Marketing Management Text & Cases”, Vikas Publishing House

**(19A04704a) INTRODUCTION TO MICROCONTROLLERS & APPLICATIONS  
OPEN ELECTIVE-III**

**Course Objectives:**

This course will enable students to:

- Describe the Architecture of 8051 Microcontroller and Interfacing of 8051 to external memory.
- Write 8051 Assembly level programs using 8051 instruction set.
- Describe the Interrupt system, operation of Timers/Counters and Serial port of 8051.
- Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051.

**UNIT – I**

**8051 Microcontroller:**

Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.

**Learning Outcomes:**

At the end of this student, the student will be able to

- Understand the importance of Microcontroller and acquire the knowledge of Architecture of 8051 Microcontroller. (L1)
- Analyze interface required memory of RAM & ROM. (L3)

**UNIT – II**

Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples to use these instructions.

**Learning Outcomes:**

At the end of this student, the student will be able to

- Explain different types instruction set of 8051. (L1)
- Develop the 8051 Assembly level programs using 8051 instruction set. (L3)

### UNIT – III

**8051 Stack, Stack and Subroutine instructions.** Simple Assembly language program examples to use subroutine instructions. 8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin.

#### Learning Outcomes:

At the end of this student, the student will be able to

- Describe Stack and Subroutine of 8051. (L1)
- Design Timer /counters using of 8051. (L4)

### UNIT –IV

**8051 Serial Communication-** Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially. **8051 Interrupts.** 8051 Assembly language programming to generate an external interrupt using a switch.

#### Learning Outcomes:

At the end of this student, the student will be able to

- Acquire knowledge of Serial Communication and develop serial port programming. (L1)
- Develop an ALP to generate an external interrupt using a switch. (L3)

### UNIT – V

8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Interfacing with relays and opto isolators, Stepper Motor Interfacing, DC motor interfacing, PWM generation using 8051.

#### Learning Outcomes:

At the end of this student, the student will be able to

- Apply and Interface simple switches, simple LEDs, ADC 0804 and LCD to using 8051 I/O ports. (L2)
- Design Stepper Motor and f motor interfacing of 8051. (L4)

**Course outcomes:**

- Understand the importance of Microcontroller and Acquire the knowledge of Architecture of 8051 Microcontroller.
- Apply and Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to using 8051 I/O ports.
- Develop the 8051 Assembly level programs using 8051 instruction set.
- Design the Interrupt system, operation of Timers/Counters and Serial port of 8051.

**TEXT BOOKS:**

1. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; “The 8051 Microcontroller and Embedded Systems – using assembly and C”, PHI, 2006 / Pearson, 2006.
2. Kenneth J. Ayala, “The 8051 Microcontroller”, 3rd Edition, Thomson/Cengage Learning.

**REFERENCE BOOKS:**

1. Manish K Patel, “The 8051 Microcontroller Based Embedded Systems”, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. Raj Kamal, “Microcontrollers: Architecture, Programming, Interfacing and System Design”, Pearson Education, 2005.

**Course Objectives:**

- To explain about signals and perform various operations on it.
- To understand discrete time signals and systems.
- To solve Laplace transforms and z-transforms for various signals.
- To find Discrete Fourier Transform of a sequence by using Fast Fourier Transform.
- To design and realize IIR and FIR filters.

**UNIT- I:**

**INTRODUCTION TO SIGNALS**

Classification of Signals: Analog, Discrete, Digital, Deterministic & Random, Periodic & Aperiodic, Even & Odd, Energy & Power signals. Basic operations on signals: Time shifting, Time scaling, Time reversal, Amplitude scaling and Signal addition. Elementary Signals: Unit step, Unit ramp, Unit parabolic, Impulse, Sinusoidal function, Exponential function, Gate function, Triangular function, Sinc function and Signum function.

**Learning Outcomes:**

At the end of this student, the student will be able to

- Define basic signals and its operations, Classify discrete time signals and systems. (L1)
- Understand various basic operations on signals (L1)

**UNIT – II:**

**DISCRETE TIME SIGNALS AND SYSTEMS**

**Discrete Time Signals:** Elementary discrete time signals, Classification of discrete time signals: power and energy signals, even and odd signals. Simple manipulations of discrete time signals: Shifting and scaling of discrete-time signals.

**Discrete Time Systems:** Input-Output description of systems, Block diagram representation of discrete time systems, Linear Constant Coefficient Difference Equations, Classification of discrete time systems: linear and nonlinear, time-invariant and variant systems, causal and non causal, stable and unstable systems.

### **Learning Outcomes:**

At the end of this student, the student will be able to

- Define basic signals and its operations, Classify discrete time signals and systems. (L1)
- Understand various basic operations on signals (L1)

### **UNIT- III:**

#### **LAPLACE TRANSFORMS AND Z- TRANSFORMS**

**Laplace Transforms:** Laplace transforms, Partial fraction expansion, Inverse Laplace transform, Concept of Region of Convergence (ROC), Constraints on ROC for various classes of signals, Properties of Laplace transforms.

**Z-Transforms:** Concept of Z-transform of a discrete sequence, Region of convergence in Z-Transform, constraints on ROC for various classes of signals, inverse Z-transform, properties of Z-Transforms.

### **Learning Outcomes:**

At the end of this student, the student will be able to

- Understand the basic concepts of Laplace and Z transforms (L1)
- Apply the transform techniques to solve the problems (L2)

### **UNIT – IV:**

#### **FAST FOURIER TRANSFORMS**

Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), Radix-2 Fast Fourier Transforms (FFT), Decimation in Time and Decimation in Frequency FFT Algorithms: radix-2 DIT-FFT, DIF-FFT, and Inverse FFT: IDFT-FFT.

### **Learning Outcomes:**

At the end of this student, the student will be able to

- Understand the importance of DTFT, DFT, FFT and their inverse transforms with respect to signals and systems (L1)
- Analyze the Decimation in time and frequency algorithms (L3)

### **UNIT – V:**

#### **IIR AND FIR DIGITAL FILTERS**



**IIR DIGITAL FILTERS:** Analog filters approximations: Butterworth and Chebyshev, Design of IIR digital filters from analog filters. Realization of IIR filters: Direct form-I, Direct form-II, cascade form and parallel form.

**FIR DIGITAL FILTERS:** Characteristics of FIR digital filters, frequency response. Design of FIR digital filters using window techniques: Rectangular window, Triangular or Bartlett window, Hamming window, Hanning window, Blackman window. Realization of FIR filters: Linear phase and Lattice structures.

### **Learning Outcomes:**

At the end of this student, the student will be able to

- Understand the importance of IIR and FIR digital Filters (L1)
- Realize IIR filters and analyze various windowing techniques in FIR filters (L2)
- Design IIR and FIR filters (L4)

### **Course outcomes:**

- Define basic signals and its operations, Classify discrete time signals and systems.
- Solve Laplace Transform and z-Transform for various signals, Calculate DFT of a given sequence by using Fast Fourier Transform.
- Analyze the continuous and discrete signals and systems
- Design and realize IIR and FIR filters from the given specifications.

### **TEXT BOOKS:**

1. B. P. Lathi, "Signals, Systems and Communications", BS Publications, 2008.
2. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, principles, Algorithms and applications", 4<sup>th</sup> edition, Pearson Education/PHI, 2007.
3. A.V. Oppenheim and R.W. Schaffer, "Discrete Time Signal Processing", 2<sup>nd</sup> edition., PHI.

### **REFERENCES:**

1. A.V. Oppenheim, A.S. Will sky and S.H. Nawab, "Signals and Systems", PHI, 2<sup>nd</sup> Edition, 2013.
2. A. Anand Kumar, "Signals and Systems", PHI Publications, Third Edition, 2013
3. P. Ramesh Babu. "Digital Signal Processing".
4. Andreas Antoniou, "Digital signal processing", Tata McGraw Hill, 2006.
5. R S Kaler, M Kulkarni., Umesh Gupta, "A Text book on Digital Signal processing" –I K International Publishing House Pvt. Ltd.
6. M H Hayes, Schaum's Outlines, "Digital Signal Processing", Tata Mc-Graw Hill, 2007.

**(19A05704a) FUNDAMENTALS OF GAME DEVELOPMENT**

**(Common to CSE & IT)**

**Course Objectives:**

This course is designed to:

- Get familiarized with the various components in a game and game engine.
- Explore the leading open source game engine components.
- Elaborate on game physics.
- Introduce to the game animation.
- Expose to network-based gaming issues.

**Unit – 1: Introduction to Game**

What is a Game? The Birth of Games, The Rise of Arcade Games, The Crash and Recovery, The Console Wars, Online Games and Beyond.

**The Game Industry:** Game Industry Overview, Game Concept Basics, Pitch Documentation, pitching a Game to a Publisher, Managing the developer-Publisher Relationship, Legal Agreements, Licenses, Console Manufacturers Approval.

**Roles on the Team:** Production, Art, Engineering, Design, Quality Assurance Testing, Team Organization, Corporate.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Demonstrate online games and beyond. [L2]
- Outline the process carried out in the Game Industry [L2]
- Inspect the roles on the Team[L4]

**Unit – 2: Teams**

Project Leadership, Picking Leads, Team Building, Team Buy-in and Motivation.

**Effective Communication:** Written Communication, Oral Communication, Nonverbal Communication, Establishing Communication Norms, Communication Challenges.

**Game Production Overview:** Production Cycle, Preproduction, Production, Testing, Postproduction.

## **Learning Outcomes:**

After completing this Unit, students will be able to

- Build a team and pick a leader. [L6]
- Develop Effective communication. [L3]
- Outline the Game Production cycle [L2]

## **Unit – 3: Game Concept**

Introduction, Beginning the Process, Defining the Concept, Game Programming Basics, Prototyping, Risk Analysis, Pitch Idea, Project Kickoff.

**Characters, setting, and Story:** Story Development, Gameplay, Characters, Setting, Dialogue, Cinematics, Story Documentation.

**Game Requirements:** Define Game Features, Define Milestones and Deliverables, Evaluate Technology, Define Tools and Pipeline, Documentation, Approval, Game Requirements Outline

## **Learning Outcomes:**

After completing this Unit, students will be able to

- Design a game. [L6]
- Demonstrate the game play. [L2]
- Identify the Game requirements [L3]

## **Unit – 4 : Game Plan**

Dependencies, Schedules, Budgets, Staffing, Outsourcing, Middleware, Game Plan Outline.

**Production Cycle:** Design Production Cycle, Art Production Cycle, Engineering Production Cycle, Working Together.

**Voiceover and Music:** Planning for Voiceover, choosing a Sound Studio, Casting Actors, Recording Voiceover, Voiceover Checklist, Planning for Music, Working with a Composer, Licensing Music.

## **Learning Outcomes:**

After completing this Unit, students will be able to

- Outline the Game plan. [L2]
- Define the production cycle. [L1]
- Make use of voiceover and music in game development. [L3]

## **Unit – 5 :Localization**

Creating International Content, Localization-Friendly Code, Level of Localization, Localization Plan, Testing, Localization Checklist.

**Testing and Code Releasing:** Testing Schedule, Test Plans, Testing Pipeline, Testing Cycle, External Testing, Determining Code Release, Code Release Checklist, Gold Masters, Postmortems.

**Marketing and Public Relations:** Software Age Ratings, Working with Marketing, Packaging, Demos, Marketing Assets, Game Builds, Working with Public Relations, Asset Deliverable Checklist.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Explain the importance of localization. [L2]
- Summarize Testing and code releasing [L2]
- Illustrate Marketing and public relations. [L2]

**Course Outcomes:**

Upon completion of the course, the students should be able to:

- Design games for commercialization (L6)
- Predict the trends in game development (L5)
- Design Game Plan and production cycle (L6)
- Dramatize the game playing environment (L4)

**Text Book:**

1. Heather Maxwell Chandler, and Rafael Chandler, “Fundamentals of Game Development”, Jones& Bartlett Learning, 2011.

**References:**

1. Flint Dille and John Zuur Platten, The Ultimate guide to Video Game Writing, Loan Eagle publisher, 2008.
2. Adams, Fundamentals of Game Design, 3<sup>rd</sup> edition, Pearson Education India, 2015.

**(19A05704b) CYBER SECURITY**  
**(Common to CSE & IT)**

**Course Objectives:**

This course is designed to:

- Understand essential building blocks and basic concepts of cyber security
- Explore Web security and Network security
- Explain the measures for securing the networks and cloud
- Understand privacy principles and policies
- Describe the legal issues and ethics in computer security

**UNIT I**

Introduction: Introduction to Computer Security, Threats, Harm, Vulnerabilities, Controls, Authentication, Access Control, and Cryptography, Authentication, Access Control, Cryptography.

Programs and Programming: Unintentional (Non-malicious) Programming Oversights, Malicious Code—Malware, Countermeasures.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Explain Vulnerabilities, threats and. Counter measures for computer security[L2]
- Interpret the design of the malicious code [L2]

**UNIT II**

Web Security: User Side, Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks.

Operating Systems Security: Security in Operating Systems, Security in the Design of Operating Systems, Rootkit.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Outline the attacks on browser, Web and email. [L2]
- Explain the security aspects of Operating Systems. [L3]

**UNIT III**

Network Security: Network Concepts, Threats to Network Communications, Wireless Network Security, Denial of Service, Distributed Denial-of-Service Strategic Defenses: Security Countermeasures, Cryptography in Network Security, Firewalls, Intrusion Detection

and Prevention Systems, Network Management .

Cloud Computing and Security: Cloud Computing Concepts, Moving to the Cloud, Cloud Security Tools and Techniques, Cloud Identity Management, Securing IaaS.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Identify the network security threats and attacks. [L3]
- Design the Counter measures to defend the network security attacks. [L6]
- Analyze the security tools and techniques for Cloud computing [L4]

### **UNIT IV**

Privacy: Privacy Concepts, Privacy Principles and Policies, Authentication and Privacy, Data Mining, Privacy on the Web, Email Security, Privacy Impacts of Emerging Technologies, Where the Field Is Headed.

Management and Incidents: Security Planning, Business Continuity Planning, Handling Incidents, Risk Analysis, Dealing with Disaster.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Interpret the need for Privacy and its impacts of Emerging Technologies. [L2]
- Explain how to handle incidents and deal with Disaster. [L2]

### **UNIT V**

Legal Issues and Ethics: Protecting Programs and Data, Information and the Law, Rights of Employees and Employers, Redress for Software Failures, Computer Crime, Ethical Issues in Computer Security, Incident Analysis with Ethics, Emerging Topics: The Internet of Things, Economics, Computerized Elections, Cyber Warfare.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Adapt legal issues and ethics in computer security. [L6]
- Elaborate on the Emerging topics. [L6]

### **Course Outcomes:**

Upon completion of the course, the students should be able to:

- Illustrate the broad set of technical, social & political aspects of Cyber Security and security management methods to maintain security protection (L2)
- Assess the vulnerabilities and threats posed by criminals, terrorist and nation states to

national infrastructure (L5)

- Identify the nature of secure software development and operating systems (L3)
- Demonstrate the role security management in cyber security defense (L2)
- Adapt the legal and social issues at play in developing solutions.(L6)

**Text Books:**

- 1) Pfleeger, C.P., Security in Computing, Prentice Hall, 2010, 5th edition.
- 2) Schneier, Bruce. Applied Cryptography, Second Edition, John Wiley & Sons, 1996

**Reference Books:**

- 1) Rhodes-Ousley, Mark. Information Security: The Complete Reference, Second Edition, Information Security Management: Concepts and Practice, McGraw-Hill, 2013.
- 2) Whitman, Michael E. and Herbert J. Mattord. Roadmap to Information Security for IT and Infosec Managers. Boston, MA: Course Technology, 2011.

**(19A27704a) CORPORATE GOVERNANCE IN FOOD INDUSTRIES**  
**OPEN ELECTIVE III**

**PREAMBLE**

This text focuses on corporate governance, business ethics and emerging trends in food industries.

**Course Objectives**

- To understand the concepts of corporate governance in view of food industry

**UNIT – I**

Corporate Governance- A Conceptual Foundation: Concept, nature, issues and importance of corporate governance, origin and development of corporate governance, concept of corporate management, Different models of corporate governance, corporate governance in family business, corporate governance failure with examples.

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Concept, nature, issues and importance of corporate governance
- origin and development of corporate governance, concept of corporate management
- Different models of corporate governance
- corporate governance in family business, corporate governance failure with examples

**UNIT – II**

Role Players: Role of various players viz. Role of shareholders their rights and responsibilities, Role of board of directors in corporate governance- executive and non executive directors, independent and nominee directors, Role of Auditors, audit committee, media.

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Role of shareholders their rights and responsibilities



- Role of board of directors in corporate governance- executive and non executive directors, independent and nominee directors
- Role of Auditors, audit committee, media.

### **UNIT – III**

Corporate governance in India and the Global Scenario: Corporate Governance practices /codes in India, UK, Japan, USA. Contributions of CII-recommendations on corporate governance by different committees in India, SEBI guidelines, Kumar Manglam Birla Committee, Naresh Chandra committee Report, OECD Principles, Cadbury Committee

#### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Corporate Governance practices /codes in India, UK, Japan, USA.
- Contributions of CII-recommendations on corporate governance by different committees in India, SEBI guidelines,
- Have detail study of committees like Kumar Manglam Birla Committee, Naresh Chandra committee Report, OECD Principles, Cadbury Committee

### **UNIT – IV**

Emerging trends: Emerging Trends and latest developments in Corporate Governance. Corporate Governance initiative in India and Abroad, Corporate Governance Rating- Role of rating agencies in corporate governance. ICRA Corporate governance rating method for examining the quality and effectiveness of corporate governance.

#### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Emerging Trends and latest developments in Corporate Governance.
- Corporate Governance initiative in India and Abroad,
- Corporate Governance Rating- Role of rating agencies in corporate governance
- ICRA Corporate governance rating method for examining the quality and effectiveness of corporate governance.

## **UNIT – V**

Business ethics and corporate governance. Social responsibility and corporate governance. Corporate governance and value creation. Political economy of corporate governance.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Business ethics and corporate governance.
- Social responsibility and corporate governance.
- Corporate governance and value creation.
- Political economy of corporate governance.

### **Course Outcomes:**

By the end of the course, the students will

- Attain knowledge on system of corporate governance in food industries.
- Get to know about business ethics and values.

### **TEXT BOOKS**

1. Subhash Chandra Das, “Corporate Governance in India”, PHI Pvt. Ltd., New Delhi(2008),
2. Dennis Campbell, “Susan Woodley Trends and Developments In Corporate Governance”. (2004)

### **REFERENCES**

1. Jayati Sarkar. “Corporate Governance in India”. Sage Publications, New Delhi,2012.
2. Vasudha, Joshi “Corporate Governance The Indian Scenario”. Foundations Books Pvt. Ltd. New Delhi. 2012,

**(19A27704b) PROCESS TECHNOLOGY FOR CONVENIENCE & RTE FOODS**  
**OPEN ELECTIVE III**

**PREAMBLE**

This text focuses on various aspects and technologies involved in processing of convenience and Read-to-eat foods.

**Course Objectives:**

- To understand the importance and demand for convenience foods in present day scenario
- To learn the various technical aspects of convenience and Read-to-eat foods.

**UNIT – I**

Overview of grain-based snacks: whole grains – roasted, toasted, puffed, popped and flakes  
Coated grains-salted, spiced and sweetened Flour based snack– batter and dough based products;  
savoury and farsans; formulated chips and wafers, papads.

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Role of cereal based ingredients in snacks industries.
- Various technologies and equipments involved in Snacks industries

**UNIT – II**

Technology for fruit and vegetable based snacks: chips, wafers, papads etc. Technology of ready to eat fruits and vegetable based food products like, sauces, fruit bars, glazed candy etc. Technology of ready to eat canned value added fruits/vegetables and mixes and ready to serve beverages etc.

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Role of Fruits and vegetables in convenience products.
- Processing of various Fruit and vegetable based products.

### **UNIT – III**

Technology of ready- to- eat baked food products, drying, toasting roasting and flaking, coating, chipping. Extruded snack foods: Formulation and processing technology, colouring, flavouring and packaging. Technology for coated nuts – salted, spiced and sweetened products- chikkis, Sing bhujia.

#### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Various methods involved in processing of ready to eat baked products
- Various methods involved in processing of extruded snack foods
- Technology involved in processing different coated nuts

### **UNIT IV**

Technology for ready-to-cook food products- different puddings and curried vegetables etc. Technology for ready-to-cook and ready to eat meat and meat food products. Technology for preparation of instant cooked rice, carrot and other cereals based food products.

#### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Technology involved in processing different ready to cook food products
- Technology involved in processing different ready to cook and ready to eat meat and meat products
- Technology involved in processing different instant cooked cereal products

### **UNIT – V**

Technology of ready to eat instant premixes based on cereals, pulses etc. Technology for RTE puffed snack- sand puffing, hot air puffing, explosion puffing, gun puffing etc. Technology for preparation of traditional Indian dairy products.

#### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Technology involved in processing different ready to eat instant premixes based on cereals and pulses and etc.
- Technology involved in processing different RTE puffed snacks

- Technology involved in processing different traditional dairy products

### **Course Outcomes:**

By end of the course students will understand

- Technology for processing ready to eat and ready cook different products and equipment used for manufacturing of RTE products

### **TEXT BOOKS**

1. Edmund WL. "Snack Foods Processing". AVI Publ.
2. Kamaliya M.K and Kamaliya K.B. 2001. Vol.1 and 2, "Baking Science and Industries", M.K.Kamaliya Publisher, Anand.

### **REFERENCES**

1. Frame ND . "Technology of Extrusion Cooking". Blackie Academic1994. .
2. Gordon BR. "Snack Food", AVI Publ, 1997.
3. Samuel AM. "Snack Food Technology", AVI Publ. 1976.

**(19A54704a) NUMERICAL METHODS FOR ENGINEERS**  
**OPEN ELECTIVE-III**  
**(ECE , CSE, IT & CIVIL)**

**Course objectives:**

This course aims at providing the student with the knowledge on various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.

**UNIT-I:**

**Solution of Algebraic & Transcendental Equations:**

Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson method.  
System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.

**Learning Outcomes:**

Students will be able to

- Calculate the roots of equation using Bisection method and Iterative method.
- Calculate the roots of equation using Regula falsi method and Newton Raphson method.
- Solve the system of algebraic equations using Gauss Jordan method and Gauss Siedal method.

**UNIT-II:**

**Curve Fitting**

Principle of Least squares- Fitting of curves- Fitting of linear, quadratic and exponential curves.

**Learning Outcomes:**

Students will be able to

- understand curve fitting
- understand fitting of several types of curves

**UNIT-III:**

**Interpolation**

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

### **Learning Outcomes:**

Students will be able to

- Understand the concept of interpolation.
- Derive interpolating polynomial using Newton's forward and backward formulae.
- Derive interpolating polynomial using Lagrange's formulae.
- Derive interpolating polynomial using Gauss forward and backward formulae.

### **UNIT-IV:**

#### **Numerical Integration**

Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule

### **Learning Outcomes:**

Students will be able to

- Solve integral equations using Simpson's 1/3 and Simpson's 3/8 rule.
- Solve integral equations using Trapezoidal rule.

### **UNIT-V:**

#### **Solution of Initial value problems to Ordinary differential equations**

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.

### **Learning Outcomes:**

Students will be able to

- Solve initial value problems to ordinary differential equations using Taylor's method.
- Solve initial value problems to ordinary differential equations using Euler's method and Runge Kutta methods.

### **Course Outcomes:**

After the completion of course, students will be able to

- Apply numerical methods to solve algebraic and transcendental equations.
- Understand fitting of several kinds of curves.
- Derive interpolating polynomials using interpolation formulae.

- Solve differential and integral equations numerically.

**Text Books:**

1. B.S.Grewal, “Higher Engineering Mathematics”, Khanna publishers.
2. Ronald E. “Probability and Statistics for Engineers and Scientists”, Walpole,PNIE.
3. Erwin Kreyszig, “Advanced Engineering Mathematics”, Wiley India

**Reference Books:**

1. B.V.Ramana, “Higher Engineering Mathematics”, Mc Graw Hill publishers.
2. Alan Jeffrey, “Advanced Engineering Mathematics”, Elsevier.



**HUMANITIES ELECTIVE-II**

**(19A52701a) ORGANISATIONAL BEHAVIOUR**

**Course Objectives :**

The objectives of this course are

- To make the student understand about the organizational behavior
- To enable them to develop self motivation, leadership and management
- To facilitate them to become powerful leaders
- Impart knowledge about group dynamics
- To make them understand the importance of change and development

**Syllabus**

**UNIT-I**

Organizational Behavior - Introduction to OB - Meaning and definition, scope - Organizing Process – Making organizing effective - Understanding Individual Behavior – Attitude - Perception - Learning - Personality Types

**Learning Outcomes:**

After completion of this unit student will

- Understand the concept of Organizational Behavior
- Contrast and compare Individual & Group Behavior and attitude
- Analyze Perceptions
- Evaluate personality types

**UNIT-II**

Motivation and Leading - Theories of Motivation - Maslow's Hierarchy of Needs - Herzberg's Two Factor Theory - Leading - Leading Vs Managing

**Learning Outcomes:**

After completion of this unit student will

- Understand the concept of Motivation
- Understand the Theories of motivation

- Explain how employees are motivated according to Maslow's Needs Hierarchy
- Compare and contrast leading and managing

### **UNIT-III**

Leadership and Organizational Culture and Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Conflict Management - Evaluating Leader - Women and Corporate leadership.

#### **Learning Outcomes:**

After completion of this unit student will

- Know the concept of Leadership
- Contrast and compare Traits theory and Managerial Grid
- Know the difference between Transactional and Transformational Leadership
- Evaluate the qualities of good leaders
- Emerge as the good leader

### **UNIT – IV**

Group Dynamics - Types of groups - Determinants of group behavior - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building - Conflict in the organization – Conflict resolution

#### **Learning Outcomes:**

After completion of this unit student will

- Know the concept of Group Dynamics
- Contrast and compare Group behavior and group development
- Analyze Group decision making
- Know how to resolve conflicts in the organization

### **UNIT - V**

Organizational Change and Development - Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development

#### **Learning Outcomes:**

- After completion of this unit student will
- Know the importance of organizational change and development

- Apply change management in the organization
- Analyze work stress management
- Evaluate Managerial implications of organization

### **Course outcomes:**

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

- Understand the nature and concept of Organizational behavior
- Apply theories of motivation to analyze the performance problems
- Analyze the different theories of leadership
- Evaluate group dynamics
- Develop as powerful leader

### **TEXT BOOKS:**

1. Luthans, Fred, “Organisational Behaviour” , McGraw-Hill, 12 Th edition 2011
2. P Subba Rao, Organisational Behaviour, Himalya Publishing House 2017

### **REFERENCES BOOKS:**

1. McShane, “Organizational Behaviour”, TMH 2009
2. Nelson, “Organisational Behaviour”, Thomson, 2009.
3. Robbins, P.Stephen, Timothy A. Judge, “Organisational Behaviour”, Pearson 2009.
4. Aswathappa, “Organisational Behaviour”, Himalaya, 2009

**Course objectives :**

The objectives of this course are

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
- To make the students aware of the contemporary issues in management

**Syllabus**

**UNIT- I**

**INTRODUCTION TO MANAGEMENT**

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Eltan Mayo's Human relations - Systems Theory - **Organisational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

**Learning Outcomes:**

At the end if the Unit, the learners will be able to

- Understand the concept of management and organization
- Apply the concepts & principles of management in real life industry.
- Analyze the organization chart & structure for an enterprise.
- Evaluate and interpret the theories and the modern organization theory.

## UNIT II

### OPERATIONS MANAGEMENT

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control - Deming's contribution to Quality. **Material Management** - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - **Marketing Management** - Concept - Meaning - Nature- Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

#### Learning Outcomes:

At the end of the Unit, the learners will be able to

- Understand the core concepts of Management Science and Operations Management
- Apply the knowledge of Quality Control, Work-study principles in real life industry.
- Evaluate Materials departments & Determine EOQ
- Analyze Marketing Mix Strategies for an enterprise.
- Create and design advertising and sales promotion

## UNIT III

### HUMAN RESOURCES MANAGEMENT (HRM)

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning(HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process and Tests in Employee Selection - Employee Training and Development - On-the- job & Off-the-job training methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

#### Learning Outcomes:

At the end if the Unit, the learners will

- Understand the concepts of HRM in Recruitment, Selection, Training & Development
- Apply Managerial and operative Functions
- Analyze the need of training
- Evaluate performance appraisal
- Design the basic structure of salaries and wages

## **UNIT IV STRATEGIC & PROJECT MANAGEMENT**

Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - **Project Management** - Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

### **Learning Outcomes:**

At the end of the Unit, the learners will be able to

- Understand Mission, Objectives, Goals & strategies for an enterprise
- Apply SWOT Analysis to strengthen the project
- Analyze Strategy formulation and implementation
- Evaluate PERT and CPM Techniques
- Creative in completing the projects within given time

## **UNIT V**

### **CONTEMPORARY ISSUES IN MANAGEMENT**

The concept of Management Information System(MIS) - Materials Requirement Planning (MRP) - Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card - Knowledge Management.

### **Learning Outcomes:**

At the end if the Unit, the learners will be able to

- Understand modern management techniques
- Apply Knowledge in Understanding in modern
- Analyze CRM, MRP, TQM
- Evaluate Six Sigma concept and SCM

### **Course Outcomes:**

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

- Understand the concepts & principles of management and designs of organization in a practical world

- Apply the knowledge of Work-study principles & Quality Control techniques in industry
- Analyze the concepts of HRM in Recruitment, Selection and Training & Development.
- Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.
- Create Modern technology in management science.

### **TEXT BOOKS:**

1. A.R Aryasri, "Management Science", TMH, 2013
2. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.

### **REFERENCES:**

1. Koontz & Weihrich, "Essentials of Management", 6<sup>th</sup> edition, TMH, 2005.
2. Thomas N.Duening & John M.Ivancevich, "Management Principles and Guidelines", Biztantra.
3. Kanishka Bedi, "Production and Operations Management", Oxford University Press, 2004.
4. Samuel C.Certo, "Modern Management", 9<sup>th</sup> edition, PHI, 2005

### Course Objectives :

The objectives of this course are

- To make the student understand about the business environment
- To enable them in knowing the importance of fiscal and monetary policy
- To facilitate them in understanding the export policy of the country
- Impart knowledge about the functioning and role of WTO
- Encourage the student in knowing the structure of stock markets

### Syllabus

#### UNIT – I

**An Overview of Business Environment** – Types of Environment - Internal & External - Micro and Macro environment - Competitive structure of industries - Environmental analysis - Scope of business - Characteristics of business - Process & limitations of environmental analysis.

#### Learning Outcomes:

After completion of this unit student will

- Understand the concept of Business environment
- Explain various types of business environment
- Know about the environmental analysis of business
- Understand the business process

#### UNIT – II

**FISCAL POLICY** - Public Revenues - Public Expenditure - Public debt - Development activities financed by public expenditure - Evaluation of recent fiscal policy of Government of India - Highlights of Budget - **MONETARY POLICY** - Demand and Supply of Money – RBI - Objectives of monetary and credit policy - Recent trends - Role of Finance Commission.

#### Learning Outcomes:

After completion of this unit student will

- Understand the concept of public revenue and public Expenditure
- Explain the functions of RBI and its role
- Analyze the Monetary policy in India



- Know the recent trends and the role of Finance Commission in the development of our country
- Differentiate between Fiscal and Monetary Policy

### **UNIT – III**

**INDIA'S TRADE POLICY** - Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank - **BALANCE OF PAYMENTS** – Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.

#### **Learning Outcomes:**

After completion of this unit student will

- Understand the role of Indian international trade
- Understand and explain the need for Export and EXIM Policies
- Analyze causes for Disequilibrium and correction measure
- Differentiate between Bilateral and Multilateral Trade Agreements

### **UNIT – IV**

**WORLD TRADE ORGANIZATION** - Nature and Scope - Organization and Structure - Role and functions of WTO in promoting world trade - Agreements in the Uruguay Round – TRIPS, TRIMS, and GATT - Dispute Settlement Mechanism - Dumping and Anti-dumping Measures.

#### **Learning Outcomes:**

After completion of this unit student will

- Understand the role of WTO in trade
- Analyze Agreements on trade by WTO
- Understand the Dispute Settlement Mechanism
- Compare and contrast the Dumping and Anti-dumping Measures.

### **UNIT – V**

**MONEY MARKETS AND CAPITAL MARKETS** - Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI - Stock Exchanges - Investor protection and role of SEBI.

**Learning Outcomes:**

After completion of this unit student will

- Understand the components of Indian financial system
- Know the structure of Money markets and Capital markets
- Analyze the Stock Markets
- Apply the knowledge in future investments
- Understand the role of SEBI in investor protection.

**Course Outcomes:**

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

- Understand various types of business environment.
- Understand the role of WTO
- Apply the knowledge of Money markets in future investment
- Analyze India's Trade Policy
- Evaluate fiscal and monetary policy
- Develop a personal synthesis and approach for identifying business opportunities

**TEXT BOOKS:**

1. Francis Cherunilam (2009), "International Business": Text and Cases, Prentice Hall of India.
2. K. Aswathappa, "Essentials of Business Environment": Texts and Cases & Exercises 13th Revised Edition. HPH 2016.

**REFERENCE BOOKS:**

1. K. V. Sivayya, V. B. M Das (2009), Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
2. Sundaram, Black (2009), International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.
3. Chari. S. N (2009), International Business, Wiley India.
4. E. Bhattacharya (2009), International Business, Excel Publications, New Delhi.

### **Course objectives :**

The objectives of this course are

- To introduce the concepts of strategic management and understand its nature in
- competitive and organizational landscape
- To provide an understanding of internal and external analysis of a firm/individual
- To provide understanding of strategy formulation process and frame work
- Impart knowledge of Corporate culture
- Encourage the student in understanding SWOT analysis BCG Matrix

### **Syllabus**

#### **UNIT: I**

**Introduction of Strategic Management:** meaning, nature, importance and relevance. The Strategic Management Process: – Corporate, Business and Functional Levels of strategy. Vision, mission and purpose –Business definition, objectives and goals – Stakeholders in business and their roles in strategic management. Balance scorecard.

#### **Learning Outcomes:**

After completion of this unit student will

- Understand the meaning and importance of strategic management
- Explain Strategic Management Process and Corporate, Business
- Know about the Business definition, objectives and goals
- Understand Stakeholders their roles in strategic management

#### **UNIT: II**

**External and Internal Analysis:** The Strategically relevant components of a Company's External Environment Analysis, Industry Analysis - Porter's Five Forces model – Industry driving forces – Key Success Factors. Analyzing a company's resources and competitive position

## **Learning Outcomes:**

After completion of this unit student will

- Understand the components of a Company's environment
- Explain External Environment Analysis, Industry Analysis
- Know how to analyze industry competition through the Porter's Five Forces model
- Analyze Key Success Factors in a company's competitive position

## **UNIT: III**

**Competitive Strategies:** Generic Competitive Strategies: Low cost, Differentiation, Focus. Grand Strategies: Stability, Growth (Diversification Strategies, Vertical Integration Strategies, Mergers, Acquisition & Takeover Strategies, Strategic Alliances & Collaborative Partnerships), Retrenchment, Outsourcing Strategies. Tailoring strategy to fit specific industry – Life Cycle Analysis - Emerging, Growing, Mature & Declining Industries.

## **Learning Outcomes:**

After completion of this unit student will

- Understand the Competitive Strategies
- Explain Stability, Growth Mergers, Acquisition & Takeover Strategies
- Know about the Retrenchment, Outsourcing Strategies
- Differentiate Life Cycle Analysis, Mature & Declining Industries

## **UNIT: IV**

**Strategy Implementation and control** - Strategy implementation; Organization Structure – Matching structure and strategy. Behavioral issues in implementation – Corporate culture – Mc Kinsey's 7s Framework. Functional issues – Functional plans and policies – Financial, Marketing, Operations, Personnel, IT.

## **Learning Outcomes:**

After completion of this unit student will

- Understand the Organization Structure
- Explain Matching structure and strategy
- Know about the Corporate culture
- Analyze Functional plans and policies

**Unit: V**

**Strategy Evaluation:** Strategy Evaluation – Operations Control and Strategic Control- Relationship between a Company's Strategy and its Business Model.- SWOT analysis – Value Chain Analysis –Benchmarking- Portfolio Analysis: BCG Matrix – GE 9 Cell Model.

**Learning Outcomes:**

After completion of this unit student will

- Understand the Operations Control and Strategic Control
- Explain Company's Strategy and its Business Model
- Know about the SWOT analysis
- Analyze BCG Matrix and GE 9 Cell Model

**Course Outcomes:**

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

- Understand the relevance and importance of strategic management
- Explain industry driving forces
- Analyze the competitive strategy
- Evaluate strategy implementation and control
- Create SWOT Analysis

**Suggested Text Books and References****TEXT BOOKS:**

1. Arthur A. Thompson Jr., AJ Strickland III, John E Gamble, "Crafting and Executing Strategy", 18th edition, Tata McGraw Hill, 2012.
2. Subba Rao P, "Business Policy and Strategic Management" –HPH

**REFERENCES:**

1. Robert A. Pitts & David Lei, "Strategic Management: Building and Sustaining Competitive Advantage" 4th edition, Cengage Learning.
2. Hunger, J. David, "Essentials of Strategic Management" 5<sup>th</sup> edition, Pearson.
3. Ashwathappa, "Business Environment for Strategic Management", HPH.

**Course Objectives:**

- To provide knowledge on emerging concept on E-Business related aspect.
- To understand various electronic markets models which are trending in India
- To give detailed information about electronic payment systems net banking.
- To exact awareness on internet advertising, market research strategies and supply chain management.
- To understand about various internet protocols-security related concept.

**SYLLABUS**

**UNIT – I**

**Electronic Business:** Definition of Electronic Business - Functions of Electronic Commerce (EC) - Advantages of E-Commerce – E-Commerce and E-Business Internet Services Online Shopping-Commerce Opportunities for Industries.

**Learning Outcomes:**

After completion of this unit student will

- Understand the concept of E-Business
- Contrast and compare E-Commerce E-Business
- Analyze Advantages of E-Commerce
- Evaluate opportunities of E-commerce for industry

**UNIT – II**

**Electronic Markets and Business Models:**E-Shops-E-Malls E-Groceries - Portals - Vertical Portals-Horizontal Portals - Advantages of Portals - Business Models-Business to Business(B2B)-Business to Customers(B2C)-Business to Government(B2G)-Auctions-B2B Portals in India

### **Learning Outcomes:**

After completion of this unit student will

- Understand the concept of business models
- Contrast and compare Vertical portal and Horizontal portals
- Analyze Advantages of portals
- Explain the B2B,B2C and B2G model

### **UNIT – III**

**Electronic Payment Systems:** Digital Payment Requirements-Designing E-payment System-Electronic Fund Transfer (EFT)-Electronic Data Interchange (EDT)-Credit Cards-Debit Cards-E-Cash-Electronic Cheques -Smart Cards-Net Banking-Digital Signature.

### **Learning Outcomes:**

After completion of this unit student will

- Understand the Electronic payment system
- Contrast and compare EFT and EDT
- Analyze debit card and credit card
- Explain the on Digital signature

### **UNIT – IV**

**E-Security:** Internet Protocols - Security on the Internet –Network and Website Security – Firewalls –Encryption – Access Control – Secure Electronic transactions.

### **Learning Outcomes:**

After completion of this unit student will

- Understand E-Security
- Contrast and compare security and network
- Analyze Encryption
- Evaluate electronic transitions

### **UNIT – V**

**E-Marketing:** Online Marketing – Advantages of Online Marketing – Internet Advertisement – Advertisement Methods – Conducting Online Online Market Research– Data mining and Marketing Research Marketing Strategy On the Web – E-Customer Relationship

Management(e-CRM) –E- Supply Chain Management.(e-SCM) –New Trends in Supply Chain Management.

### **Learning Outcomes:**

After completion of this unit student will

- Understand the concept of online marketing
- Analyze advantages of online marketing
- Compare the e-CRM and e-SCM
- Explain the New trends in supply chain management

### **Course Outcomes:**

- They will be able to identify the priority of E-Commerce in the present globalised world.
- Will be able to understand E-market-Models which are practicing by the organization
- Will be able to recognize various E-payment systems & importance of net banking.
- By knowing E-advertisement, market research strategies, they can identify the importance of customer role.
- By understanding about E-security, they can ensure better access control to secure the information.

### **TEXT BOOKS:**

3. C.S.V Murthy “E-Commerce”, Himalaya publication house, 2002.
4. P.T.S Joseph, “E-Commerce” , 4<sup>th</sup> Edition, Prentice Hall of India 2011

### **REFERENCES:**

5. KamaleshKBajaj,DebjaniNa, “E-Commerce”, 2<sup>nd</sup> Edition TataMcGrwHills 2005
6. Dave Chaffey – “E-Commerce E-Management”, 2<sup>nd</sup> Edition, Pearson, 2012.
7. Henry Chan, “E-Commerce Fundamentals and Application”, Raymond Lee,Tharm Wiley India 2007
8. S. Jaiswall “E-Commerce”, Galgotia Publication Pvt Ltd 2003.



**(19A01404P) CONCRETE TECHNOLOGY LAB**

**Course Objectives:**

- To find the various physical characteristics of cement, coarse and fine aggregates
- To find the various properties of green and hardened concrete.

**List of Experiments:**

1. Grading Curve of Coarse & Fine aggregates
2. Bulking of Fine aggregate
3. Specific gravity of Fine and coarse aggregate
4. Specific gravity, fineness, Initial and final setting times of Cement
5. Soundness and Compressive Strength test of Cement
6. Slump, compaction factor and Vee-Bee time tests on concrete.
7. Compressive and split tensile strength of concrete.
8. Non destructive tests on concrete (any two)

**Course Outcomes:**

At the end of the course, the student will be able

- To find the characteristics of fine and coarse aggregates
- To evaluate the properties of the binding materials for their suitability in building construction.
- To understand the workability behaviour of concrete through various tests
- To evaluate the strength of hardened concrete through destructive and non-destructive tests

**(19A01705) COMPUTER AIDED DESIGN LAB**

**Course Objectives:**

- 1) To make the student familiar with civil engineering softwares related to design and drawing

CAD:

SOFTWARE:

STAAD PRO or Equivalent EXERCISES:

1. 2-D Frame Analysis and Design
2. Steel Tabular Truss Analysis and Design
3. 3-D Frame Analysis and Design
4. Retaining Wall Analysis and Design
5. Simple tower Analysis and Design
6. One Way Slab Analysis & Design
7. Two Way Slab Analysis & Design
8. Column Analysis & Design

TEXT BOOK: 1.Computer Aided Design Lab Manual by Dr.M.N.Sesha Prakash And Dr.C.S.Suresh

**Course Outcomes:**

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

- 1) Design various civil engineering structural elements.

**(19A01801a1) FINITE ELEMENT METHODS  
PROFESSIONAL ELECTIVE-IV**

**Course Objectives**

These are

- To introduce fundamentals of elasticity and steps involved in FEM.
- To describe element stiffness matrix formulation for 1D and 2D cases.
- To impart isoparametric formulation concepts.
- To teach formulation of stiffness matrix for axi-symmetric problems.
- To demonstrate numerical solution techniques used in FEM.

**UNIT-I**

**Introduction:**

Concepts of FEM – Steps involved – merits & demerits – energy principles – Discretization – Rayleigh – Ritz method of functional approximation. Principles of Elasticity: Equilibrium equations – strain displacement relationships in matrix form – Constitutive relationships for plane stress, plane strain and Axi-symmetric bodies of revolution with axi-symmetric loading.

**Learning Outcomes:**

After completion of this unit student will

- Update basic concepts of theory of elasticity
- Understand stages involved in FEM

**UNIT-II**

**One Dimensional & Two Dimensional Elements:** Stiffness matrix for bar element – shape functions – 1D and 2D elements – types of elements for plane stress and plane strain analysis – Displacement models – generalized coordinates – shape functions – convergent and compatibility requirements – Geometric invariance – Natural coordinate system – area and volume coordinates

### **Learning Outcomes:**

After completion of this unit student will

- Study types of elements and their degrees of freedom
- Develop stiffness matrices for 1D and 2D elements.

### **UNIT-III**

#### **Element stiffness matrix:**

Generation of element stiffness and nodal load matrices for 3-node triangular element and four-noded rectangular elements.

### **Learning Outcomes:**

After completion of this unit student will

- Develop stiffness matrices for 3-noded triangular element and four-noded rectangular element.

### **UNIT-IV**

#### **Iso-parametric Formulation:**

Iso-parametric elements for 2D analysis –formulation of CST element, 4-noded and 8-noded iso-parametric quadrilateral elements –Lagrangian and Serendipity elements. AXI-SYMMETRIC ANALYSIS: Basic principles-Formulation of 4-noded iso-parametric axisymmetric element.

### **Learning Outcomes:**

After completion of this unit student will

- Study types of elements and their degrees of freedom
- Develop stiffness matrices for 2D and axisymmetric solution techniques.

### **UNIT-V**

#### **Solution techniques:**

Numerical Integration, Static condensation, assembly of elements and solution techniques for static loads.

## **Learning Outcomes:**

After completion of this unit student will

- Apply numerical solution techniques in FEM.

## **Course Outcomes**

Upon completion of the course, the student will be able to

- Develop finite element formulations of 1D & 2D problems.
- Solve complex problems using FEM.
- Formulate isoparametric elements with different irregular boundaries.
- Implement solution techniques for higher order problems in practice.
- Apply concepts for carrying out research.
- Apply concepts for modeling of non-linear materials and geometry.

## **TEXT BOOK:**

1. Tirupathi R Chandraputla, “Finite Element Analysis for Engineering and Technology”, Universities Press Pvt Ltd, Hyderabad. 2003.
2. C. S. Krishna Murthy, “Finite Element analysis-Theory & Programming”, Tata Mc.Graw Hill Publishers.

## **REFERENCES:**

1. H.V. Lakshminaryana, “Finite element analysis and procedures in engineering”, 3<sup>rd</sup> edition, Universities press, Hyderabad.
2. Robert D. Cook, Michael E Plesha, Concepts and applications of Finite Element Analysis, John Wiley & sons Publications
3. S. Rajasekharan, “Finite element analysis in Engineering Design”, S. Chand Publications, New Delhi.

**(19A01801a2) ADVANCED R.C.C STRUCTURAL DESIGN**

**PROFESSIONAL ELECTIVE-IV**

**Course Objectives:**

- To design and detailing of reinforcement of an interior panel of a flat slab
- To design a circular bunker with the detailing of reinforcement
- To design a concrete chimney with detailing of reinforcement.
- To design different elements of the circular and rectangular shape water tanks.
- To design and detailing of the reinforcement in the various members of the cantilever and counter fort retaining walls.

**UNIT-I**

Design of a flat slab( Interior panel only )

**Learning Outcomes:**

After completion of this unit student will

- To know the components of interior slab panel
- To understand the design procedure and detailing of reinforcement of interior panel of the flat slab

**UNIT-II**

Design of concrete bunkers of circular shape – (excluding staging) – Introduction to silos

**Learning Outcomes:**

After completion of this unit student will

- To know and understand the components of bunker
- To have a clear view of the design procedure and detailing of reinforcement of bunker

**UNIT-III**

Design of concrete chimney (excluding seismic loads)

**Learning Outcomes:**

After completion of this unit student will

- To have a comprehensive understanding of various forces acting on the chimney.
- To design the concrete chimney.

**UNIT-IV**

Design of circular and rectangular water tank resting on the ground

**Learning Outcomes:**

After completion of this unit student will

- To have a good understanding of design of water tanks resting on the ground.

**UNIT-IV**

Design of cantilever and counter forte retaining wall with horizontal back fill only.

**Learning Outcomes:**

After completion of this unit student will

- To know the applications of cantilever and counter forte retaining walls.
- To perform the stability analysis of the retaining walls
- To design and detailing of the cantilever and counter forte retaining walls

**FINAL EXAMINATION**

QUESTION PAPER PATTERN: The question paper shall consists of two parts. First part will be with 20 marks with 10 number of questions with each carrying 2 marks. Second part consists of two design questions of either or type from the above five units carrying 50marks.

NOTE: Relevant IS Codes may be permitted in the examination hall.

**Course Outcomes**

Upon completion of the course, the student will be able to

- Design and detail the flatslabs
- Design and detail bunkers and silos
- Design and detail concrete chimney

- Design and detail water tanks resting on the ground
- Design and detail cantilever and counterfort retaining walls

#### **TEXT BOOKS:-**

1. Krishnam Raju, “Structural Design and drawing (RCC and steel)” Universities .Press , New Delhi
3. Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, R.C.C “Structures”, Laxmi Publications, New Delhi
4. Varghese , “Advanced RCC”, PHI Publications, New Delhi.
5. M.L.Gambhir “Design of RCC structures”, P.H.I. Publications, New Delhi.

#### **REFERENCE BOOKS:-**

1. Sushil kumar , “R.C.C Designs standard” publishing house.
2. N.C.Sinha and S.K.Roy, “Fundamentals of RCC”, S.Chand Publications, New Delhi.



**(19A01801a3) ADVANCED STEEL STRUCTURES**  
**PROFESSIONAL ELECTIVE-IV**

**Course Learning Objectives**

The objective of this course is:

- To impart knowledge on advanced topics of steel structures.
- To teach concepts of steel bridges.
- To insist the students to observe and practical construction of all steel structures.
- To teach the design concepts of steel water tanks.
- To demonstrate the functions of steel towers.

**UNIT –I**

**BRIDGES:** Classification-loadings-deck type welded plate girder bridges.

**Learning Outcomes:**

After completion of this unit student will

- To understand the functions of bridges and loading standards
- To design the deck type plate girder bridge.

**UNIT –II**

**BEARINGS:** Types of bearings-plate bearing- rocker bearing- roller bearing-knuckle pin bearing.

**Learning Outcomes:**

After completion of this unit student will

- To understand the functions of bearings
- To understand the types of bearings.

**UNIT –III**

**WATER TANKS:** Introduction-design of elevated circular and rectangular water tanks

**Learning Outcomes:**

After completion of this unit student will

- To identify different components of water tanks
- To understand the loads on water tanks.
- To design water tanks

**UNIT –IV**

**PLASTIC ANALYSIS:** Introduction to plastic theory- conditions of plastic analysis- theorem of plastic analysis-shape factor – finding the collapse load for simple beams and single bay single storey frames.

**Learning Outcomes:**

After completion of this unit student will

- To understand the steel plastic behaviour
- To calculate the collapse load for beams and frames.

**UNIT –V**

**STEEL FRAMES:** Finding the moments in frames subjected to horizontal forces by portal method and cantilever method

**Learning Outcomes:**

After completion of this unit student will

- To find the magnitude of bending moments in steel frames.

**Course Outcomes:**

Upon the successful completion of this course, the students will be able to:

- Complete analysis and design of advanced steel structures.
- Able to design plate girder bridges and bridge bearings
- Able to design steel water tanks and able to find the bending moment in frames

**TEXT BOOKS:**

1. S.K.Duggal, “Limit state Design of steel structures”, Mc graw hill Publishers
2. Ramchandra and Veerendra gahlote, “Limit state design of steel structures”, Scientific publishers.

**REFERENCE BOOKS:**

1. N.Subramanyam “Design of steel structures”, Oxford university press
2. L.S.Jayagopal and D.Tensing, “Design of steel structures”, Vikas publishers.
3. Edwin H.Gaylord, Jr., Charles N.Geylord and James E. Stallmeyer “Desing of steel structures”  
3<sup>rd</sup> edition- –Tata Mc Graw hill Edition.

**(19A01801b1) ADVANCED FOUNDATION ENGINEERING  
PROFESSIONAL ELECTIVE-IV**

**Course Objectives:**

- To impart how Meyerhof's general bearing capacity equations are important over Terzaghi's bearing capacity equation.
- To teach special methods of computation of settlements and the corrections to be applied to settlements and to understand the advanced concepts of design of pile foundations.
- To throw light on pile and mat foundation designs.
- To teach the difference between isolated and combined footings, the determination of bearing capacity of mats and proportioning of footings.

**UNIT-I**

Bearing capacity of Foundations using general bearing capacity equation – Meyerhof's, Brinch Hansen's and Vesic's methods- Bearing capacity of Layered Soils: Strong layer over weak layer, Weak layer on strong layer – Bearing capacity of foundations on a top of slope – Bearing capacity of foundations at the edge of the slope.

**Learning Outcomes:**

After completion of this unit student will

- Understand bearing capacity of soils
- Determine the bearing capacity of soils.

**UNIT-II**

Settlement analysis: Immediate settlement of footings resting on granular soils – Schmertmann & Hartman method – De Beer and Martens method - Immediate settlement in clays – Janbu's method – correction for consolidation settlement using Skempton and Bjerrum's method – Correction for construction period.

**Learning Outcomes:**

After completion of this unit student will

- Understand settlement analysis by various methods.

- Study corrections for construction period

### **UNIT-III**

Mat foundations – Purpose and types of isolated and combined footings – Mats/ Rafts – Proportioning of footings – Ultimate bearing capacity of mat foundations – allowable bearing capacity of mats founded in clays and granular soils – compensated rafts- annular foundations.

#### **Learning Outcomes:**

After completion of this unit student will

- List out various types of footings
- Design mat foundation

### **UNIT-IV**

Earth-retaining structures – cantilever sheet piles – anchored bulkheads – fixed and free earth support methods – design of anchors – braced excavations – function of different components – forces in ties – Basal heaving stability against bottom heave.

#### **Learning Outcomes:**

After completion of this unit student will

- Explain need and importance of earth retaining structures
- Design of earth retaining structures according to stability concepts.

### **UNIT-V**

Pile foundations – single pile versus group of piles – load-carrying capacity of pile groups – negative skin friction (NSF) -settlement of pile groups in sands and clays – laterally loaded piles in granular soils – Reese and Matlock method – laterally loaded piles in cohesive soils – Davisson and Gill method – Broms' analysis.

#### **Learning Outcomes:**

After completion of this unit student will

- Explain conditions for adopting pile foundations
- Design piles and pile caps in different soils.

#### **Course Outcomes:**

Upon successful completion of this course, student will be able to

- Compute the safe bearing capacity of footings subjected to vertical and inclined loads.
- Understand the advanced methods of settlement computations and proportion foundation footings.
- Judging the methods of computing the pull-out capacity and negative skin friction of piles and compute the settlements of pile groups in clays.
- Evaluate the problems posed by expansive soils and the different foundation practices devised.
- Judging the difference between isolated footings and combined footings and mat foundations.

#### **TEXT BOOKS:**

1. J. E. Bowles “Foundation Analysis and Design”, John Wiley
2. V. N. S. Murthy, “Soil Mechanics and Foundation Engineering”, CBS Publishers

#### **REFERENCES:**

1. W.C. Teng, “Foundation Design”, Prentice Hall Publishers
2. C. Venkataramiah, “Geotechnical Engineering”, New age International Pvt . Ltd, (2002).
3. Bowles, J.E., “Foundation Analysis and Design”, 4<sup>th</sup> Edition, McGraw-Hill Publishing Company, Newyork. (1988)
4. Poulos, H. G., and Davis, E. H., Pile “Foundation Analysis and Design”, John Wiley, 1980.

**(19A01801b2) SOIL STRUCTURE INTERACTION  
PROFESSIONAL ELECTIVE-IV**

Purpose to understand the mechanism of soils, their interactive behavior, analysis, its influences in the design parameters through design charts and software packages.

**INSTRUCTIONAL OBJECTIVES**

- To understand the soil behavior and the methods to analyze the models
- To solve the problems for beam and plate on elastic medium.
- To analyze the pile for its settlement and load distribution.

**UNIT I**

**SOIL-FOUNDATION INTERACTION:**

Introduction to soil - Foundation interaction problems, Soil behavior, Foundation behavior, Interface, behavior, Scope of soil-foundation interaction analysis, soil response models, Winkler, Elastic continuum, Two parameter elastic models, Elastic plastic behavior, Time dependent behavior.

**Learning Outcomes:**

After completion of this unit student will

- Understand the behavior of the foundations.
- Understand the models for soil structure interactions.

**UNIT II**

**BEAM ON ELASTIC FOUNDATION - SOIL MODELS:** Infinite beam, Two parameters, Isotropic elastic half space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness.

**Learning Outcomes:**

After completion of this unit student will

- Design shallow foundations, assuming it as a finite beam.
- Calculate the bending moments and shear forces.

### **UNIT III**

**PLATE ON ELASTIC MEDIUM:** Infinite plate, Winkler, Two parameters, Isotropic elastic medium, Thin and thick plates, Analysis of finite plates, rectangular and circular plates, Numerical analysis of finite plates, simple solutions.

#### **Learning Outcomes:**

After completion of this unit student will

- Design shallow foundations, assuming it as a plate resting on elastic medium.
- Calculate the bending moments and shear forces.

### **UNIT IV**

**ELASTIC ANALYSIS OF PILE:** Elastic analysis of single pile, Theoretical solutions for settlement and load distribution, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap.

#### **Learning Outcomes:**

After completion of this unit student will

- To understand the behavior of pile foundations supported by elastic medium.

### **UNIT V**

#### **LATERALLY LOADED PILE:**

Load deflection prediction for laterally loaded piles, sub-grade reaction and elastic analysis, Interaction analysis, and pile raft system, solutions through influence charts.

#### **Learning Outcomes:**

After completion of this unit student will

- To understand the behavior of lateral loaded piles supported by elastic medium.

#### **Course Outcomes:**

Upon successful completion of this course, student will be able to

- Understand the foundation behavior



- Analyze the beams resting on elastic foundation.
- Behavior of plates on elastic foundation.
- Have the knowledge of design of laterally loaded piles.

## **REFERENCES BOOKS:**

1. Hemsley.J.A, “Elastic Analysis of Raft Foundations”, Thomas Telford, 1998.
2. McCarthy, D.F, “Essentials of Soil Mechanics and Foundations”, basic geotechnics (6th Edition), Prentice Hall, 2002.
3. Selvadurai.A.P.S, “Elastic Analysis of Soil Foundation Interaction”, Elsevier, 1979.
4. Poulos.H.G and Davis.E.H, “Pile Foundation Analysis and Design”, John Wiley, 1980.
5. Scott.R.F, “Foundation Analysis”, Prentice Hall, 1981.
6. “Structure Soil Interaction” - State of Art Report, Institution of structural Engineers, 1978.
7. ACI 336, “Suggested Analysis and Design Procedures for Combined Footings and Mats”, American Concrete Institute, Dehit, 1988

**(19A01801c1) ENVILRONMENTAL IMPACT ASSESSMENT  
PROFESSIONAL ELECTIVE-IV**

**Course Objectives:**

- To impart knowledge on different concepts of Environmental Impact Assessment
- To teach procedures of risk assessment
- To teach the EIA methodologies and the criterion for selection of EIA methods
- To teach the procedures for environmental clearances and audit

**UNIT –I:**

**Concepts and methodologies of EIA**

Initial environmental Examination, Elements of EIA, - factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters- Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods and cost/benefit Analysis.

**Learning Outcomes:**

After completion of this unit student will

- Understand the elements of EIA.
- Explain the criteria for selection of EIA methodology

**UNIT – II**

**Impact of Developmental Activities and Land Use**

Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives. Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures. E I A in surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Air pollution sources, Generalized approach for assessment of Air pollution Impact.

### **Learning Outcomes:**

After completion of this unit student will

- Study the factors causing impact of development activities
- Decide mitigation measures of pollution on environment

### **UNIT –III**

#### **Assessment of Impact on Vegetation, Wildlife and Risk Assessment**

Introduction - Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation - Risk assessment and treatment of uncertainty-key stages in performing an Environmental Risk Assessment- advantages of Environmental Risk Assessment

### **Learning Outcomes:**

After completion of this unit student will

- Understand effect of development activities on environment.
- Know the design procedures for assessment of environmental risk

### **UNIT – IV**

#### **Environmental audit:**

Introduction - Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report.

### **Learning Outcomes:**

After completion of this unit student will

- Learn about the process of environmental auditing.
- Understand procedures for preparation of environmental audit report

### **UNIT – V**

#### **Environmental Acts and Notifications:**

The Environmental protection Act, The water preservation Act, The Air (Prevention & Control of pollution Act), Wild life Act - Provisions in the EIA notification, procedure for environmental clearance, procedure for conducting environmental impact assessment report- evaluation of EIA report. Environmental legislation objectives, evaluation of Audit data and preparation of Audit report. Post Audit activities, Concept of ISO and ISO 14000.

## **Learning Outcomes:**

After completion of this unit student will

- Understand the importance of environmental protection acts
- Explain acts and notifications in Environmental legislation

## **Course Outcomes**

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

- Prepare EMP, EIS, and EIA report.
- Identify the risks and impacts of a project.
- Choose an appropriate EIA methodology.
- Evaluation the EIA report.
- Estimate the cost benefit ratio of a project.
- Know the role of stakeholder and public hearing in the preparation of EIA.

## **TEXT BOOKS:**

1. Canter Larry W., “Environmental Impact Assessment”, McGraw-Hill education Edi (1996)
2. Y. Anjaneyulu, “Environmental Impact Assessment Methodologies”, B. S. Publication, Hyderabad.

## **REFERENCES:**

1. Peavy, H. S, Rowe, D. R, Tchobanoglous, “Environmental Engineering”, G.Mc-Graw Hill International Editions, New York 1985
2. J. Glynn and Gary W. Hein Ke, “Environmental Science and Engineering”, Prentice Hall Publishers
3. Suresh K. Dhaneja, “Environmental Science and Engineering”, S.K., Katania & Sons Publication, New Delhi.
4. H. S. Bhatia, “ Environmental Pollution and Control”, Galgotia Publication (P) Ltd, Delhi

**(19A01801c2) ENVILRONMENTAL ECONOMICS  
PROFESSIONAL ELECTIVE-IV**

**Course Objectives:**

- To impart knowledge on sustainable development and economics of energy
- To teach regarding environmental degradation and economic analysis of degradation
- To inculcate the knowledge of economics of pollution and their management
- To demonstrate the understanding of cost benefit analysis of environmental resources
- To make the students to understand principles of economics of biodiversity

**UNIT– I**

Sustainable Development: Introduction to sustainable development - Economy-Environment inter-linkages - Meaning of sustainable development - Limits to growth and the environmental Kuznets curve – The sustainability debate - Issues of energy and the economics of energy – Nonrenewable energy, scarcity, optimal resources, backstop technology, property research, externalities, and the conversion of uncertainty.

**Learning Outcomes:**

After completion of this unit student will

- Understand the importance of sustainable development, environmental linkages etc.,
- Understand the issues of energy and their economics

**UNIT– II**

Environmental Degradation: Economic significance and causes of environmental degradation - The concepts of policy failure, externality and market failure - Economic analysis of environmental degradation – Equi –marginal principle.

**Learning Outcomes:**

After completion of this unit student will

- To understand the principles of environmental degradation and its economic analysis

### **UNIT– III**

Economics of Pollution: Economics of Pollution - Economics of optimal pollution, regulation, monitoring and enforcement - Managing pollution using existing markets: Bargaining solutions – Managing pollution through market intervention: Taxes, subsidies and permits.

#### **Learning Outcomes:**

After completion of this unit student will

- To understand the basics of economics of pollution and its economics

### **UNIT– IV**

Cost – Benefit Analysis: Economic value of environmental resources and environmental damage - Concept of Total Economic Value - Alternative approaches to valuation – Cost-benefit analysis and discounting.

#### **Learning Outcomes:**

After completion of this unit student will

- To know about the cost benefit analysis and discounting

### **UNIT – V**

Economics of biodiversity: Economics of biodiversity conservation - Valuing individual species and diversity of species -Policy responses at national and international levels. Economics of Climate Change – stren Report

#### **Learning Outcomes:**

After completion of this unit student will

- To understand the importance of biodiversity and economics of climate changes

#### **Course Objectives:**

- After the completion of the course, the students will be able to know
- The information on sustainable development and economics of energy
- The information regarding environmental degradation and economic analysis of degradation

- The identification of economics of pollution and their management
- The cost benefit analysis of environmental resources
- The principles of economics of biodiversity

### **Reference Books:**

1. D.W. Pearce, A. Markandya and E.B. Barbier “ Blueprint for a Green Economy”, Earthscan, London. (1989),
2. R.K. Turner, D.W. Pearce and I. Bateman “Environmental Economics: An Elementary Introduction”, Harvester Wheatsheaf, London. (1994),
3. D.W. Pearce and R.K. Turner “Economics of Natural Resources and the Environment”, Harvester Wheatsheaf, London. (1990),
4. Michael S. Common and Michael Stuart “Environmental and Resource Economics: An Introduction”, 2<sup>nd</sup> Edition, Harlow: Longman. (1996),
5. Roger Perman, Michael Common, Yue Ma and James McGilvray “Natural Resource and Environmental Economics”, 3<sup>rd</sup> Edition, Pearson Education. (2003),
6. N. Hanley, J. Shogren and B. White “An Introduction to Environmental Economics”, Oxford University Press. (2001),

**(19A01801d1) DOCKS AND HARBOR ENGINEERING  
PROFESSIONAL ELECTIVE-III**

**Course Objectives:**

The course will address the following:

- To teach Water Transportation in India
- To impart knowledge on water waves and effects on harbour and structure design
- To Develop facilities that are required for setting up of a port
- To Plan ports for effective cargo handling and economical considerations

**UNIT – I**

**Water Transportation:**

Scope, Merits, Developments of Water Transportation in India, Inland Waterways, River, Canal, Inland water Transportation, Development of Port & Harbors, Harbor Classification, Site Selection – Classification of ports .

**Learning Outcomes:**

After completion of this unit student will

- Classify Harbors and Ports.
- Explain development of ports and harbors

**UNIT – II**

**Natural Phenomena:** Wind, Tides, Water waves, Wave Decay & Ports, Wave Diffraction Breaking, Reflection, Littoral Drift, Sedimentation Transport, Effects on Harbor and Structure Design

**Learning Outcomes:**

After completion of this unit student will

- Understand effects of natural forces
- Understand conditions for the design of harbors



### **UNIT – III**

#### **Harbor Infrastructure:**

Types of Break Waters, Jetty, Dock Fenders, Wharves, Dolphin Mooring Accessories, Repair Facilities, Wet Docks, Lift Docks, Dry Docks, Gates for Graving Docks, Floating Docks, Slipways, Locks and Gates

#### **Learning Outcomes:**

After completion of this unit student will

- Understand components of harbor.
- Differentiate between Docks and Other Components.

### **UNIT – IV**

#### **Port Facility:**

Transit Shed, Warehouses, Cargo Handling, Container Handling, Inland Port Facility, Navigational Aids, Types, Requirements of Signals, Lighthouses, Beacon lights, Buoys, Dredging & Coastal protection, Types of Dredges, Choices, Usage of Dredge Material, Sea Wall Protection, Sea Wall Revetments, Bulkhead.

#### **Learning Outcomes:**

After completion of this unit student will

- Knowledge on facilities to be developed in port for navigation.
- Understanding importance of dredging.

### **UNIT – V**

#### **Planning of Ports:**

Regional and Intercontinental Transportation Development, Forecasting Cargo & Passenger Demand, Regional Connectivity, Cargo Handling, Capacity Of Port, Economic Evaluation Of Port Projects, Impact Of Port Activities.

#### **Learning Outcomes:**

After completion of this unit student will

- Study the connectivity of ports.
- Understand cargo handling facilities.

**Course outcomes:**

Upon the successful completion of this course, the students will be able to:

- Enhance the knowledge on Docks and Harbour Engineering for water transportation in the context of regional and intercontinental transportation.
- Know techniques of planning and designing the Infrastructures required for Harbour and Port area.
- Analyze cargo and passenger demand forecasting cargo handling capacity of ports and economic evaluation of port project.
- Understand environmental and other impact impended due to water transportation and port activities.

**TEXT BOOKS**

1. C.Venkataramaiah., “Transportation Engineering (Vol – II)”, Universities Press Pvt Ltd, Hyderabad.
2. Bindra, S.P, “A Course in Docks and Harbor Engineering”, Dhanpat Rai and Sons, New Delhi, India, 1992.

**REFERENCES**

1. R. Srinivasa Kumar, “Transportation Engineering: Railways, Airports, Docks and Harbors”, Universities Press Pvt Ltd, Hyderabad. 2014.
2. Alozo Def. Quinn, “Design and Construction of Ports and Marine Structures”, McGraw-Hill Book Company, New York
3. Srinivasan R., “Docks & Tunnel Engineering”, Charotar Publishing House, Anand.
4. V.N. Vazirani and S.P. Chandola, “Docks and Harbour Engineering” – Text book of Transport Engineering Vol. II, Khanna Publishers, New Delhi.

**(19A01801d2) TRAFFIC ANALYSIS  
PROFESSIONAL ELECTIVE-II**

**Course Objective:**

- To teach the application of statistical distributions for Traffic Data Analysis.
- To introduce queuing theory and its applications to traffic.
- To make the students understand, types of pedestrian crossing facilities and warrants associated.
- To introduce the concept of shock wave theory and its applications in bottle neck analysis.
- To make the students to understand the concept of simulation and steps involved.

**UNIT-I:**

**Traffic Flow Description:** Types Of Statistical Distributions; Discrete And Continuous Distributions; Counting And Interval Distributions Used In Traffic Analysis; Poisson's Distribution For Vehicle Arrivals; Headway Distributions – Exponential Distribution; Shifted Exponential Distribution; Erlang Distribution; Composite Distribution. Numerical Exercises.

**Learning Outcomes:**

After completion of this unit student will

- Apply the statistical distribution for given traffic situation.
- Comprehend the difference between the various distribution.

**UNIT-II:**

**Queuing Theory: M/M/1 & D/D/1 System:**

Introduction To Queuing Theory; Notation Used For Describing A Queue System; Analysis Of M/M/1 System; Assumptions And Derivation Of System State Equations; Application Of M/M/1 Analysis For Parking Garages And Toll Plazas- Numerical Examples.

Queuing Theory - D/D/1 System: Traffic Interruptions Like Accidents Or Bottlenecks; Analysis Of D/D/1 System For Delay Characteristics; Traffic Signal Analysis As D/D/1 System; Computation Of Delays And Queue Dissipation Time – Numerical Examples.

### **Learning Outcomes:**

After completion of this unit student will

- Apply different Queuing systems to traffic analysis.
- Differentiate between various Queuing systems.

### **UNIT-III:**

**Pedestrian Delays And Gaps:** Pedestrian Gap Acceptance And Delays; Concept Of Blocks, Anti-Blocks, Gaps And Non-Gaps; Underwood's Analysis For Pedestrian Delays; Warrants For Pedestrian Crossing Facilities – Minimum Vehicular Volume Warrant, Minimum Pedestrian Volume Warrant, Maximum Pedestrian Volume Warrant.

### **Learning Outcomes:**

After completion of this unit student will

- Understand pedestrian Gap acceptance behavior.
- Analyze the pedestrian flow based on warrants.

### **UNIT-IV:**

**Shockwave Theory:** Concept Of Shockwave; Causes For Traffic Interruptions And Shockwaves; Flow-Density Diagram Use In Shockwave Analysis; Use Of Time-Space Diagram For Shockwave Description; Bottleneck Situations And Shockwaves; Traffic Signal And Shockwave Theory; Numerical Examples For Application Of Shockwave Theory.

### **Learning Outcomes:**

After completion of this unit student will

- Understand the concept of shockwave theory.
- Analyze bottlenecks using shockwave theory.

### **UNIT-V:**

#### **Traffic Simulation:**

Introduction To Simulation; Need For Simulation Modeling; Steps In Simulation; Interval Oriented And Event Oriented Simulation; Use Of Random Numbers In Simulation; Random Number Generation Methods; Computing Headways And Arrival Times Based On Random Numbers;

Basic Concepts Of Simulation Modeling Application For Signalised Intersections, Pedestrian Crossings And Transit Scheduling.

### **Learning Outcomes:**

After completion of this unit student will

- Appreciate the steps in simulation process.
- Apply Simulation techniques for traffic analysis.

### **Course Outcomes**

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

- Understand and appreciate the application of statistical distribution for traffic analysis.
- Apply queueing theory for traffic analysis and to understand various queueing systems.
- Analyze pedestrian gap acceptance behavior and to apply underwood's warrants.
- Understand shockwave theory and to analyze the bottleneck situation using shockwave theory.
- Learn simulation technique basics and to apply them for traffic analysis.

### **TEXT BOOKS:**

1. A Monograph , "Traffic Flow Theory": TRB Special Report 165
2. C.S.Papacostas, "Fundamentals Of Transportation Engineering", Prentice Hall India Publication.

### **REFERENCES:**

1. F.L.Mannering & W.P.Kilareski, Principles Of Highway Engineering And Traffic Analysis, John Wiley Publishers.
2. A.D.May, "Traffic Flow Fundamentals", Prentice Hall India Publication
3. Mcshane & Rogers, "Fundamentals Of Traffic Engineering", pearsons Publishers.

**(19A01801e1) DESIGN AND DRAWING OF IRRIGATION STRUCTURES  
PROFESSIONAL ELECTIVE-IV**

**Course Objective:**

To know the design and drawing aspects of

- Sloping glacis weir.
- Tank sluice with tower head
- Type III Syphon aqueduct.
- Surplus weir.
- Trapezoidal notch fall.
- Canal regulator.

Final Examination pattern: Any two questions of the above six designs may be asked out of which the candidate has to answer one question. The duration of examination will be three hours.

**Course Outcomes:**

- On completion of the course, the students will be able to:
- Design and draw the plan and cross section of Sloping glacis weir.
- Design and draw the plan and cross section of Tank sluice with tower head
- Design and draw the plan and cross section of Type III Syphon aqueduct.
- Design and draw the plan and cross section of Surplus weir.
- Design and draw the plan and cross section of Trapezoidal notch fall.
- Design and draw the plan and cross section of Canal regulator.

**TEXT BOOKS:**

1. C.Satyanarayana Murthy, “Design of minor irrigation and canal structures”, Wiley eastern Ltd.
2. S.K.Garg, “Irrigation engineering and Hydraulic structures Standard”

**(19A01801e2) WATER SHED MANAGEMENT**

**Course Objectives:**

This course

- Demonstrates Principles of Watershed Management
- Explains River basin Watershed Management Practices
- Imparts knowledge on conservation of water and its reuses
- Teaches the sustainable watershed approach
- Inculcates the knowledge of rainwater harvesting and GIS applications

**UNIT I**

Principles of Watershed Management: Basics concepts, Hydrology and water availability, Surface water, Groundwater, Conjunctive use, Human influences in the water resources system, Water demand, Integrated water resources system

**Learning Outcomes:**

After completion of this unit student will

- Demonstrates role of principles of watershed management
- Gives an insight into the water demand and human influences on water resources etc.,

**UNIT II**

River basin Watershed Management Practices in Arid and Semi-arid Regions, Watershed management through wells, Management of water supply - Case studies, short term and long term strategic planning

**Learning Outcomes:**

After completion of this unit student will

- Gives the knowledge of watershed management in different regions
- Gives an insight into the case studies, short and long term strategic planning

### **UNIT III**

Conservation of Water: Perspective on recycle and reuse, Waste water reclamation Social Aspects of Watershed Management: Community participation, Private sector participation, Institutional issues, Socio-economy, Integrated development, Water legislation and implementations, Case studies

#### **Learning Outcomes:**

After completion of this unit student will

- Gives the knowledge of conservation of water
- Gives an insight into the aspects of watershed management, water legislation and implementations

### **UNIT IV**

Sustainable Watershed Approach: Sustainable integrated watershed management, natural resources management, agricultural practices, integrated farming, Soil erosion and conservation

#### **Learning Outcomes:**

After completion of this unit student will

- Gives the knowledge on sustainable watershed management approach
- Gives an insight into the agricultural practices, soil erosion and conservation

### **UNIT V**

Water Harvesting: Rainwater management - conservation, storage and effective utilisation of rainwater, Structures for rainwater harvesting, roof catchment system, check dams, aquifer storage Applications of Geographical Information System and Remote Sensing in Watershed Management, Role of Decision Support System in Watershed Management

#### **Learning Outcomes:**

After completion of this unit student will

- Gives the knowledge of rainwater harvesting management
- Gives an insight into the role of GIS in the watershed management



**Course Outcomes:**

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

- Know the basic principles of watershed management.
- Know the river basin management practices
- Understand better different approaches for conservation of water.
- Identify sustainable watershed approach for resources management, prevention of soil erosion etc.,
- Different methods of rainwater harvesting management systems and role of GIS.

**Text Book:**

1. Murthy, J.V.S., “Watershed Management in India”, Wiley Eastern, New Delhi, 1994.

**References:**

1. Murty, J.V.S., “Watershed Management”, New Age Intl., New Delhi 1998.
2. Allam, G.I.Y., “Decision Support System for Integrated Watershed Management”, Colorado State University, 1994.
3. Vir Singh, R., “Watershed Planning and Management”, Yash Publishing House, Bikaner, 2000.
4. American Society of Civil Engineers, Watershed Management, American Soc. of Civil Engineers, New York, 1975

**(19A01801e3) SUSTAINABLE WATER RESOURCES DEVELOPMENT  
PROFESSIONAL ELECTIVE-IV**

**Course Objectives:**

This course

- Demonstrates Role of water in National Development
- Explains Water Resources Systems Analysis
- Imparts on Evaluation and monitoring of water quality and management of water distribution networks
- Teaches different methods for water balancing
- Visualizes Interstate Water Dispute Acts

**UNIT I**

**Introduction:**

Water Resources Potential, Demand and Development -Role of water in National Development - Assessment of Water Resources of the country - River Basins - Hydro-meteorological and Hydrological Data. Assessment of Utilizable flows - Conventional and non-conventional methods - Estimation of Water need- National Water Policy. Conjunctive use of surface and ground water. Future Water Requirements - Scope of development.

**Learning Outcomes:**

After completion of this unit student will

- Demonstrate role of water in national development
- Assess water resources in country
- Estimate future water need

**UNIT II**

Water Resources Planning and Project Formulation- Water Resources Planning - Single and Multipurpose Projects - Project Formulation, Comparison of Alternatives - Cost Benefit Analysis. Cost Allocation among various purposes. Water Resources Systems Analysis - Optimization Approaches.

### **Learning Outcomes:**

After completion of this unit student will

- Understand the planning requirements of a irrigation project.
- Compare alternative methods based on cost aspects
- Optimization of approaches

### **UNIT III**

Environmental Aspects of Integrated water Resources Development -Evaluation and monitoring of water quality and management of water distribution networks for Irrigation, Flood control and Power generation - Catchment Treatment and Watershed Management. Command Area Development - Resettlement and Rehabilitation.

### **Learning Outcomes:**

After completion of this unit student will

- Evaluate and monitor water quality
- Design distribution networks for irrigation flood control and power generation

### **UNIT IV**

Management Strategies for Excess and Deficit Water Balances  
Flood Control & Management - Various methods of Control - Administrative Planning - Management Programs and Flood Cushioning -Structural Methods. Non-structural Methods - Flood forecasting & Warning, Flood plain zoning and Flood proofing. Drought Prone Area Development - Soil Conservation Methods.

### **Learning Outcomes:**

After completion of this unit student will

- Understand the water management strategies
- Explain flood forecasting and planning
- Develop procedure to meet requirements in drought prone area

### **UNIT V**

Riparian Rights and Inter Basin Linking of Rivers - Indian Scenario - Various Proposals and their Status - Dr. K. L. Rao's Proposal, Capt. Dastur's Garland Canal, National Perspective Plan, NWDA Link and Peninsular Rivers Development Component - Overall Benefits and Major

constraints. Water Laws of India - Regulating Authorities - Interstate Water Dispute Acts - River Water Tributes - Cauvery, Krishna Godavari and Vamsadahra Tribunals.

### **Learning Outcomes:**

After completion of this unit student will

- Understand importance of interlinking of rivers
- Explain water laws of India
- Study interstate water disputes and arrive at feasible solutions

### **Course Outcomes:**

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

- Estimate Water need.
- Develop Water Resources Planning.
- Explain roll of Regulating Authorities.
- Design Catchment Treatment and Watershed Management.
- Understand Rights and Inter Basin Linking of Rivers.

### **TEXT BOOKS:**

1. S K Sharma, “A Textbook Of Irrigation Engineering and Hydraulic Structures”, S. Chand and Company Limited, New Delhi
2. R. L. Linsley & J. B. Fragini, “Water Resource Engineering”: MCgrohly

### **REFERENCES:**

1. P. N. Modi, “Irrigation and Water Resources & Water Power”, Standard Book House.
2. A.S. Gordman, “Principles of Water Resource engineering”:
3. S. K. Garg, “Irrigation engineering and Hydraulic structures”, Standard Book House.
4. Punmia & Lal, “Irrigation and water power engineering”, Laxmi Publications pvt. Ltd., New Delhi.

**(19A01802a)      DISASTER MANGEMENT  
OPEN ELECTIVE-IV**

**Course Objectives:**

The objective of this course is to:

- Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
- Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ.
- Understand the ‘relief system’ and the ‘disaster victim.’
- Describe the three planning strategies useful in mitigation.
- Identify the regulatory controls used in hazard management.
- Describe public awareness and economic incentive possibilities.
- Understand the tools of post-disaster management.

**SYLLABUS**

**UNIT-I:**

Natural Hazards And Disaster Management: Introduction of DM – Inter disciplinary -nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: floods, draughts – Earthquakes – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast – landslides.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the natural hazards and its management
- To understand about the global warming, cyclones and tsunamis

**UNIT-II:**

Man Made Disaster And Their Management Along With Case Study Methods Of The Following: Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrotrism -threat in mega cities, rail and air craft’s accidents, and Emerging infectious diseases & Aids and their management.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the fire hazards and solid waste management
- To understand about the emerging infectious diseases and aids their management.

**UNIT-III:**

Risk and Vulnerability: Building codes and land use planning – social vulnerability – environmental vulnerability – Macroeconomic management and sustainable development, climate change risk rendition – financial management of disaster – related losses.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the regulations of building codes and land use planning related to risk and vulnerability.
- To understand about the financial management of disaster and related losses

**UNIT-IV:**

Role Of Technology In Disaster Managements: Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations- roads and bridges- mitigation programme for earth quakes –flowchart, geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training-transformable indigenous knowledge in disaster reduction.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the technological aspects of disaster management
- To understand about the factors for disaster reduction

**UNIT-V:**

Education and Community Preparedness: Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community based disaster recovery -Community based disaster management and social capital-Designing resilience-building community capacity for action.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To impart the education related to risk reduction in schools and communities

**Course Outcomes:**

Upon the successful completion of this course, the students will be able to:

- Affirm the usefulness of integrating management principles in disaster mitigation work
- Distinguish between the different approaches needed to manage pre- during and post-disaster periods
- Explain the process of risk management
- Relate to risk transfer

**TEXT BOOKS**

1. Rajib shah & R R Krishnamurthy “Disaster Management” – Global Challenges and Local Solutions’ Universities press. (2009),
2. Tushar Bhattacharya, “Disaster Science & Management” Tata McGraw Hill Education Pvt. Ltd., New Delhi.
3. Jagbir Singh “Disaster Management” – Future Challenges and Opportunities’ I K International Publishing House Pvt. Ltd. (2007),

**REFERENCE BOOKS**

1. Harsh. K . Gupta “Disaster Management edited”, Universities press, 2003.

**(19A01802b) GLOBAL WARMING AND CLIMATE CHANGES  
OPEN ELECTIVE-IV**

**Course Objectives:**

The objective of this course is to:

- To know the basics, importance of global warming.
- To know the concepts of mitigation measures against global warming
- To know the impacts of climate changes

**UNIT I**

**EARTH'S CLIMATE SYSTEM:**

Introduction to environment, Ozone, ozone layer and its functions, Ozone depletion and ozone hole, Vienna convention and Montreal protocol, Green house gases and green house effect, Hydrological cycle and Carbon cycle, Global warming and its impacts

**Learning Outcomes:**

After completing this Unit, students will be able to

- To identify the importance of Ozone and effect of green house gases
- To know the effect of global warming

**UNIT II**

**ATMOSPHERE & ITS COMPONENTS:** Atmosphere and its layers-Characteristics of Atmosphere - Structure of Atmosphere - Composition of Atmosphere - Atmospheric stability - Temperature profile of the atmosphere - Temperature inversion and effects of inversion on pollution dispersion.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the layers of atmosphere and their characteristics

**UNIT III**



**IMPACTS OF CLIMATE CHANGE :** Causes of Climate change - Change of Temperature in the environment - Melting of ice and sea level rise - Impacts of Climate Change on various sectors - Projected impacts for different regions, uncertainties in the projected impacts and risk of irreversible changes.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the causes of climate change and its effects on various sectors.

**UNIT IV**

**OBSERVED CHANGES AND ITS CAUSES:** Climate change and Carbon credits-Clean Development Mechanism (CDM), CDM in India - Kyoto Protocol - Intergovernmental Panel on Climate Change (IPCC) - Climate Sensitivity - Montreal Protocol - United Nations Framework Convention on Climate Change (UNFCCC) - Global change in temperature and climate and changes within India

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the causes of climate change and carbon credits, effect of change in temperature and climate on india.

**UNIT V**

**CLIMATE CHANGE AND MITIGATION MEASURES:** CDM and Carbon Trading - Clean Technology, biodiesel, compost, biodegradable plastics - Renewable energy usage as an alternative - Mitigation Technologies and Practices within India and around the world - Non-renewable energy supply to all sectors - Carbon sequestration - International and regional cooperation for waste disposalbiomedical wastes, hazardous wastes, e-wastes, industrial wastes, etc.,

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the clean technology, use of renewable energy, mitigation technologies and their practices.

## **Course Outcomes:**

Upon the successful completion of this course, the students will be able to:

- An ability to apply knowledge of mathematics, science, and engineering
- Design a system, component or process to meet desired needs with in realistic constraints such as economic ,environmental ,social ,political ,ethical ,health and safety , manufacturability and sustainability
- An ability to identify, formulate, and solve engineering problems

## **REFERENCE BOOKS**

1. Dash Sushil Kumar, “Climate Change – An Indian Perspective”, Cambridge University Press India Private limited 2007.
2. Adaptation and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge,2006.
3. Atmospheric Science, J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
4. Jan C. van Dam, Impacts of “Climate Change and Climate Variability on ydrological Regimes”, Cambridge university press ,2003.
5. David Archer, Global Warming: Understanding the Forecast, 2 nd ed. (Wiley, 2011
6. John Houghton, Global Warming: The Complete Briefing, 5th Edition, 2015, Cambridge Univ. Press. Useful

**(19A02802a) IoT APPLICATIONS IN ELECTRICAL ENGINEERING**

**(OE-IV)**

**Course Objectives:**

- To learn about a few applications of Internet of Things
- To distinguish between motion less and motion detectors as IoT applications
- To know about Micro Electro Mechanical Systems (MEMS) fundamentals in design and fabrication process
- To understand about applications of IoT in smart grid
- To introduce the new concept of Internet of Energy for various applications

**UNIT-I:**

**Sensors**

Definitions, Terminology, Classification, Temperature sensors, Thermoresistive, Resistance, temperature detectors, Silicon resistive thermistors, Semiconductor, Piezoelectric, Humidity and moisture sensors. Capacitive, Electrical conductivity, Thermal conductivity, time domain reflectometer, Pressure and Force sensors: Piezoresistive, Capacitive, force, strain and tactile sensors, Strain gauge, Piezoelectric

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about basic principles of sensors and their classification
- To learn about various motion less sensors
- To understand about Piezoelectric sensor applications to detect temperature, pressure etc.
- To understand about Capacitive sensors to detect temperature, force and pressure etc.
- To know about concepts of tactile sensors, for a few applications

**UNIT-II:**

**Occupancy and Motion detectors**

Capacitive occupancy, Inductive and magnetic, potentiometric - Position, displacement and level sensors, Potentiometric, Capacitive, Inductive, magnetic velocity and acceleration sensors, Capacitive, Piezoresistive, piezoelectric cables, Flow sensors, Electromagnetic, Acoustic sensors - Resistive microphones, Piezoelectric, Photo resistors

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about Capacitive occupancy
- To understand about Motion detectors
- To distinguish between Potentiometric, inductive and capacitive sensors for a few applications
- To learn about a few velocity and acceleration sensors
- To know about various flow sensors

**UNIT-III:****MEMS**

Basic concepts of MEMS design, Beam/diaphragm mechanics, electrostatic actuation and fabrication, Process design of MEMS based sensors and actuators, Touch sensor, Pressure sensor, RF MEMS switches, Electric and Magnetic field sensors

**Learning Outcomes:**

After completing this Unit, students will be able to

- To understand about the basic concept of MEMS
- To know about electrostatic actuation
- To learn about process design of MEMS based sensors
- To learn about process design of MEMS based actuators
- To distinguish between RF switches with respect to electric and magnetic sensors

**UNIT-IV:****IoT for Smart grid**

Driving factors, Generation level, Transmission level, Distribution level, Applications, Metering and monitoring applications, Standardization and interoperability, Smart home

**Learning Outcomes:**

After completing this Unit, students will be able to

- To get exposure fundamental applications of IoT to Smart grid
- To learn about driving factors of IoT in Generation level
- To learn about driving factors of IoT in Transmission level
- To learn about driving factors of IoT in Distribution level
- To distinguish between metering level and monitoring applications
- To get introduced to the concept of Smart home

## **UNIT-V:**

**IoE:** Concept of Internet of Energy, Evaluation of IoE concept, Vision and motivation of IoE, Architecture, Energy routines, information sensing and processing issues, Energy internet as smart grid

### **Learning Outcomes:**

After completing this Unit, students will be able to

- To get exposed the new concept of internet of energy
- To learn about architecture of IoE
- To know about energy routines
- To learn about information sensing and processing issues
- To understand the use of energy internet as smart grid

### **Course Outcomes:**

1. To get exposed to recent trends in few applications of IoT in Electrical Engineering
2. To understand about usage of various types of motionless sensors
3. To understand about usage of various types of motion detectors
4. To get exposed to various applications of IoT in smart grid
5. To get exposed to future working environment with Energy internet

### **TEXT BOOKS:**

1. Jon S. Wilson, “Sensor Technology Hand book”, Newnes Publisher, 2004
2. Tai Ran Hsu, “MEMS and Microsystems: Design and manufacture”, 1<sup>st</sup> Edition, McGrawhill Education, 2017
3. Ersan Kabalci and Yasin Kabalci, “From Smart grid to Internet of Energy”, 1<sup>st</sup> Edition, Academic Press, 2019

### **REFERENCE BOOKS:**

1. Raj Kumar Buyya and Amir Vahid Dastjerdi, “Internet of Things: Principles and Paradigms”, Kindle Edition, Morgan Kaufmann Publisher, 2016
2. Yen Kheng Tan and Mark Wong, “Energy Harvesting Systems for IoT Applications”: Generation, Storage and Power Management, 1<sup>st</sup> Edition, CRC Press, 2019
3. RMD Sundaram Shriram, K. Vasudevan and Abhishek S. Nagarajan, “Internet of Things”, Wiley, 2019

**(19A02802b) SMART ELECTRIC GRID**

**(OE-IV)**

**Course Objectives:**

- To learn about recent trends in grids as smart grid
- To understand about smart grid architecture and technologies
- To know about smart substations
- To learn about smart transmission systems
- To learn about smart distribution systems

**UNIT-I:**

**Introduction to Smart Grid**

Working definitions of Smart Grid and Associated Concepts – Smart Grid Functions – Traditional Power Grid and Smart Grid – New Technologies for Smart Grid – Advantages – Indian Smart Grid – Key Challenges for Smart Grid

**Smart Grid Architecture:** Components and Architecture of Smart Grid Design – Review of the proposed architectures for Smart Grid. The fundamental components of Smart Grid designs – Transmission Automation – Distribution Automation – Renewable Integration

**Learning Outcomes:**

After completing this Unit, students will be able to

- To understand basic definitions and architecture of Smart grid
- To learn about new technologies for smart grid
- To know about fundamental components of smart grid
- To understand key challenges of smart grid
- To understand the need for integration of Renewable energy sources

**UNIT-II:**

**Smart grid Technologies**

Characteristics of Smart grid, Micro grids, Definitions, Drives, benefits, types of Micro grid, building blocks, Renewable energy resources, needs in smart grid, integration impact, integration standards, Load frequency control, reactive power control, case studies and test beds

### **Learning Outcomes:**

After completing this Unit, students will be able to

- To know about basic characteristic features of smart grid technologies
- To understand about definition, types, building blocks of Microgrids
- To know about integration requirements, standards of renewable energy sources in Microgrids
- To understand Load frequency and reactive power control of Microgrid
- To understand about Microgrid through a case study

### **UNIT-III:**

#### **Smart Substations**

Protection, Monitoring and control devices, sensors, SCADA, Master stations, Remote terminal unit, interoperability and IEC 61850, Process level, Bay level, Station level, Benefits, role of substations in smart grid, Volt/VAR control equipment inside substation

### **Learning Outcomes:**

After completing this Unit, students will be able to

- To know about protection, monitor and control devices in Smart substations
- To know about the importance of SCADA in substations
- To understand about interoperability and IEC 61850
- To know about role of substations in Smart grid
- To understand about Volt/VAR control equipment inside substation

### **UNIT-IV:**

#### **Smart Transmission**

Energy Management systems, History, current technology, EMS for the smart grid, Wide Area Monitoring Systems (WAMS), protection & Control (WAMPC), needs in smart grid, Role of WAMPC smart grid, Drivers and benefits, Role of transmission systems in smart grid, Synchro Phasor Measurement Units (PMUs)

### **Learning Outcomes:**

After completing this Unit, students will be able to

- To know about Energy Management Systems in smart transmission systems
- To understand about WAMPC
- To know about role of transmission systems in Smart grid
- To know about Synchro Phasor Measurement units

## **UNIT-V:**

### **Smart Distribution Systems**

DMS, DSCADA, trends in DSCADA and control, current and advanced DMSs, Voltage fluctuations, effect of voltage on customer load, Drivers, objectives and benefits, voltage-VAR control, VAR control equipment on distribution feeders, implementation and optimization, FDIR - Fault Detection Isolation and Service restoration (FDIR), faults, objectives and benefits, equipment, implementation

### **Learning Outcomes:**

After completing this Unit, students will be able to

- To know about DSCADA in Smart Distribution Systems
- To distinguish between current and advanced DMSs
- To know about occurrence of voltage fluctuations
- To understand about VAR control and equipment on distribution feeders
- To know about FDIR objectives and benefits

### **Course Outcomes:**

1. To be able to understand trends in Smart grids
2. To understand the needs and roles of Smart substations
3. To understand the needs and roles of Smart Transmission systems
4. To understand the needs and roles of Smart Distribution systems
5. To distinguish between SCADA and DSCADA systems in practical working environment

### **Text Books:**

1. Stuart Borlase, “Smart Grids - Infrastructure, Technology and Solutions”, 1<sup>st</sup> edition, CRC Press, 2013
2. Gil Masters, “Renewable and Efficient Electric Power System”, 2<sup>nd</sup> edition, Wiley–IEEE Press, 2013.

### **Reference Books:**

1. A.G. Phadke and J.S. Thorp, “Synchronized Phasor Measurements and their Applications”, Springer Edition, 2e, 2017.
2. T. Ackermann, “Wind Power in Power Systems”, Hoboken, NJ, USA, John Wiley, 2e, 2012.



**(19A03802a) ENERGY CONSERVATION AND MANAGEMENT  
OPEN ELECTIVE-IV**

**Course Objective:**

- Familiarize present energy scenario, and energy auditing methods.
- Explain components of electrical systems, lighting systems and improvements in performance.
- Demonstrate different thermal systems, efficiency analysis, and energy conservation methods.
- Train on energy conservation in major utilities.
- Instruct principles of energy management and energy pricing.

**UNIT I**

**Introduction:** Energy – Power – Past & Present Scenario Of World; National Energy Consumption Data – Environmental Aspects Associated With Energy Utilization –Energy Auditing: Need, Types, Methodology And Barriers. Role Of Energy Managers. Instruments For Energy Auditing.

**Learning Outcomes**

At the end of this unit, the student will be able to

- Infer energy consumption patterns and environmental aspects of energy utilization. (I2)
- Outline energy auditing requirements, tools and methods. (I2)
- Identify the function of energy manager. (I3)

**UNIT II**

**Electrical Systems:** Components Of EB Billing – HT And LT Supply, Transformers, Cable Sizing, Concept Of Capacitors, Power Factor Improvement, Harmonics, Electric Motors – Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types Of Lighting, Efficacy, LED Lighting And Scope Of Economy In Illumination.

**Learning Outcomes**

At the end of this unit, the student will be able to

- Outline components of electricity billing, transmission and distribution. (I2)
- Analyze performance characteristics of transformers, capacitors, and electric motors. (I4)
- Examine power factor improvements, and electric motor efficiency. (I4)
- Evaluate lighting systems. (I4)

### UNIT III

**Thermal Systems:** Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency Computation and Encon Measures. Steam: Distribution & Usage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories.

#### Learning Outcomes

At the end of this unit, the student will be able to

- Determine efficiency of boilers, furnaces and other thermal systems. (15)
- Recommend energy conservation measures in thermal systems. (15)
- Justify steam systems in energy conservation. (14)

### UNIT IV

**Energy Conservation In Major Utilities:** Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration And Air Conditioning Systems – Cooling Towers – D.G. Sets.

#### Learning Outcomes

At the end of this unit, the student will be able to

- Explain energy conservation measures in major utilities. (12)
- Apply performance test criteria for fans, pumps, compressors, hvac systems. (13)
- Assess energy conservation in cooling towers and d.g. sets. (15)

### UNIT V

**Energy Management:** Principles of Energy Management, Energy demand estimation, Organising and Managing Energy Management Programs, Energy pricing.

#### Learning Outcomes

At the end of this unit, the student will be able to

- Describe principles of energy management. (12)
- Assess energy demand and forecast. (15)
- Organize energy management programs. (16)
- Design elements of energy pricing. (16)

## **Course Outcomes:**

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

- Explain energy utilization and energy auditing methods.(12)
- Analyze electrical systems performance of electric motors and lighting systems.(14)
- Examine energy conservation methods in thermal systems.(14)
- Estimate efficiency of major utilities such as fans, pumps, compressed air systems, hvac and d.g. Sets. (14)
- Elaborate principles of energy management, programs, energy demand and energy pricing. (16)

## **TEXT BOOKS:**

1. Energy Manager Training Manual (4 Volumes) Available At [www.energymanagertraining.com](http://www.energymanagertraining.com), A Website Administered By Bureau Of Energy Efficiency (BEE), A Statutory Body Under Ministry Of Power, Government Of India, 2004.

## **REFERENCES:**

1. Witte. L.C., P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation" Hemisphere Publ, Washington, 1988.
2. Callaghn, P.W. "Design And Management For Energy Conservation", Pergamon Press, Oxford, 1981.
3. Dryden. I.G.C., "The Efficient Use Of Energy" Butterworths, London, 1982
4. Murphy. W.R. And G. Mc KAY, "Energy Management", Butterworths, London 1987.
5. Turner, W. C., Doty, S. and Truner, W. C., "Energy Management Hand book", 7th edition, Fairmont Press, 2009.
6. De, B. K., "Energy Management audit & Conservation", 2<sup>nd</sup> Edition, Vrinda Publication, 2010.
7. Smith, C. B., "Energy Management Principles", Pergamon Press, 2007.

**(19A03802b) NON-DESTRUCTIVE TESTING  
OPEN ELECTIVE-IV**

**Course Objectives**

- Introduce basic concepts of non destructive testing.
- Familiarize with characteristics of ultrasonic test, transducers, rejection and effectiveness.
- Describe concept of liquid Penetrant, eddy current and magnetic particle tests, its applications and limitations.
- Explain the principles of infrared and thermal testing, applications and honey comb and sandwich structures case studies.
- Impart NDE and its applications in pressure vessels, casting and welded constructions.

**UNIT I**

**Introduction to non-destructive testing:** Radiographic test, Sources of X and Gamma Rays and their interaction with Matter, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography.

**Learning outcomes:**

At the end of this unit, the student will be able to

- Explain non destructive testing techniques (L2)
- Summarize the basic concepts of Radiographic test ( L2)
- Outline the concepts of sources of X and Gamma Rays ( L2)
- Explain the radiographic techniques ( L2)
- Discuss the safety aspects of industrial radiography. ( L4)

**UNIT II**

**Ultrasonic test:** Principle of Wave Propagation, Reflection, Refraction, Diffraction, Mode Conversion and Attenuation, Sound Field, Piezo-electric Effect , Ultrasonic Transducers and their Characteristics, Ultrasonic Equipment and Variables Affecting Ultrasonic Test, Ultrasonic Testing, Interpretations and Guidelines for Acceptance, Rejection - Effectiveness and Limitations of Ultrasonic Testing.

### **Learning outcomes:**

At the end of this unit, the student will be able to

- Explain the principle of ultrasonic test. ( 12)
- Analyze the performance of wave propagation, reflection, refraction, diffraction and sound field in ultrasonic test. (14 )
- Discuss the characteristics of ultrasonic transducers. (14)
- Outline the limitations of ultrasonic testing. (12 )

### **UNIT III**

**Liquid Penetrant Test:** Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness and Limitations of Liquid Penetrant Testing.

**Eddy Current Test:** Principle of Eddy Current, Eddy Current Test System, Applications of Eddy Current-Testing Effectiveness of Eddy Current Testing.

**Magnetic Particle Test:** Magnetic Materials, Magnetization of Materials, Demagnetization of Materials, Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, Effective Applications and Limitations of the Magnetic Particle Test.

### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Illustrate the procedure of Liquid Penetrant, eddy current and magnetic particle tests.( L2)
- Outline the limitations of Penetrant, eddy current and magnetic particle tests. (L2 )
- Explain the effectiveness of Penetrant, eddy current and magnetic particle tests. ( L2)
- Apply the applications of Magnetic particle test. ( L3)

### **UNIT IV**

**Infrared And Thermal Testing:** Introduction and fundamentals to infrared and thermal testing–Heat transfer –Active and passive techniques –Lock in and pulse thermography–Contact and non contact thermal inspection methods–Heat sensitive paints –Heat sensitive papers –thermally quenched phosphors liquid crystals –techniques for applying liquid crystals –other temperature sensitive coatings –Inspection methods –Infrared radiation and infrared detectors–thermo mechanical behavior of materials–IR imaging in aerospace applications, electronic components, Honey comb and sandwich structures–Case studies.

### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Discuss the fundamentals of thermal testing. (16 )
- Explain the techniques of liquid crystals, active and passive. (12)
- Illustrate thermal inspection methods. ( 12)
- Outline the limitations of thermal testing. (12 )
- Explain the applications of honey comb and sandwich structures. (12)

### **UNIT V**

**Industrial Applications of NDE:** Span of NDE Activities Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries, Offshore Gas and Petroleum Projects, Coal Mining Industry, NDE of pressure vessels, castings, welded constructions

### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Illustrate applications of NDE. ( L2)
- Explain the applications of Railways, Nuclear and chemical industries. ( L2)
- Outline the limitations and disadvantages of NDE. (L2 )
- Explain the applications of NDA of pressure vessels, casting and welding constructions ( L2)

### **Course Outcomes**

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

- Explain various methods of non-destructive testing. (13)
- Apply relevant non-destructive testing method different applications. (13)
- Explain the applications of railways, nuclear and chemical industries. ( 12)
- Outline the limitations and disadvantages of nde. (12 )
- Explain the applications of nda of pressure vessels, casting and welding constructions ( 12)

**TEXT BOOKS:**

1. J Prasad, GCK Nair , “Non destructive test and evaluation of Materials”, Tata mcgraw-Hill Education Publishers, 2008.
2. Josef Krautkrämer, Herbert Krautkrämer, “Ultrasonic testing of materials”, 3<sup>rd</sup> edition, Springer-Verlag, 1983.
3. X. P. V. Maldague, “Non destructive evaluation of materials by infrared thermography”, 1<sup>st</sup> edition, Springer-Verlag, 1993.

**REFERENCES:**

1. Gary L. Workman, Patrick O. Moore, Doron Kishoni, “Non-destructive, Hand Book, Ultrasonic Testing”, 3<sup>rd</sup> edition, Amer Society for Nondestructive, 2007.
2. ASTM Standards, Vol 3.01, Metals and alloys

**Social Relevant Projects**

1. Solid waste conversion into energy (Gasification)
2. Plastic waste into fuel.
3. Bio-gas digester.
4. Development of mechanisms for farmers.
5. Smart irrigation for saving water.
6. Mechanized water segregation.
7. Applications of solar technologies for rural purpose.
8. Power generation from wind turbine.
9. Applications of drones for agriculture.
10. Solar drying.

**(19A04802a) INTRODUCTION TO IMAGE PROCESSING**

**OPEN ELECTIVE-IV**

**Course Objectives:**

- To interpret fundamental concepts of digital image processing.
- To exemplify image enhancement.
- To interpret fundamental concepts of color image processing.
- To assess image compression techniques for digital images.
- To summarize segmentation for digital images.

**UNIT-I:**

**INTRODUCTION TO DIGITAL IMAGE PROCESSING**

**Introduction:** Digital image representation, Fundamental steps in image processing, Elements of digital image processing, Elements of visual perception, Simple image model, Sampling and Quantization, Basic relationships between pixels, Image transformations.

**Applications:** Medical imaging, Robot vision, Character recognition, Remote sensing.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the fundamental concepts of image processing, Sampling process and basis relationships between pixels (L1)
- Explain the elements of Digital Image Processing (L2)

**UNIT-II:**

**IMAGE ENHANCEMENT**

Need for image enhancement, Point processing, Histogram processing, Spatial filtering- Smoothing and Sharpening.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the need for enhancement process (L1)



- Explain the terminology involved in enhancement process (L2)

### **UNIT-III:**

#### **COLOR IMAGE PROCESSING**

Colour fundamentals, Colour models, Color transformations, Pseudo colour image processing, Full colour image processing.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the need for enhancement process (L1)
- Explain the terminology involved in enhancement process (L2)

### **UNIT-IV:**

#### **IMAGE COMPRESSION**

Redundancies, Fidelity criteria, Image compression model, Lossless compression: Huffman coding, Arithmetic coding. Lossy compression: Lossy Predictive Coding, JPEG Compression Standard.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the need for image compression (L1)
- Explain the image compression and various types of compression techniques (L2)

### **UNIT-V:**

#### **IMAGE SEGMENTATION**

Detection of discontinuities: point, line and edge detection, Edge linking and Boundary detections: Local Processing, Global processing via Hough transform, Thresholding, Region oriented segmentation: Region growing, Region splitting and merging.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the principle of image segmentation and its importance (L1)
- Explain the image compression and various types of compression techniques (L2)

- Analyze the various terminologies involved in image segmentation like edge, boundary detection etc. (L3)

#### **Course Outcomes:**

- Interpret fundamental concepts of digital and color image processing.
- Exemplify image enhancement.
- Analyze the various terminologies involved in image segmentation like edge, boundary detection etc. Assess image compression techniques for digital images.
- Summarize segmentation techniques for digital images.

#### **TEXT BOOKS:**

1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, 3<sup>rd</sup> Edition, Pearson Education, 2011.

#### **REFERENCE BOOKS:**

1. S Jayaraman, S Esakkirajan and T Veerakumar, “Digital Image Processing”, TMH, 2011.
2. S. Sridhar, “Digital Image Processing”, 2<sup>nd</sup> Edition, Oxford Publishers, 2016.

**(19A04802b) PRINCIPLES OF CELLULAR AND MOBILE COMMUNICATIONS**  
**OPEN ELECTIVE-IV**

**Course Objectives:**

- To understand the concepts and operation of cellular systems.
- To apply the concepts of cellular systems to solve engineering problems.
- To analyse cellular systems for meaningful conclusions.
- To evaluate suitability of a cellular system in real time applications.
- To design cellular patterns based on frequency reuse factor.

**UNIT-I:**

**Introduction to Cellular Mobile Systems**

Why cellular mobile communication systems? A basic cellular system, Evolution of mobile radio communications, Performance criteria, Characteristics of mobile radio environment, Operation of cellular systems. Examples for analog and digital cellular systems.

**Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concepts and operation of cellular systems (L1).
- Analyze the characteristics of mobile radio environment (L3).

**UNIT-II:**

**Cellular Radio System Design**

General description of the problem, Concept of frequency reuse channels, Cochannel interference reduction, Desired C/I ratio, Cell splitting and sectoring.

**Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concept of frequency reuse and cochannel interference in cellular systems (L1).
- Apply the concept of cellular systems to solve engineering problems (L2).
- Analyze the design problems of cellular systems (L3).
- Design of cellular patterns based frequency reuse factor (L5).

### **UNIT-III:**

#### **Handoffs and Dropped Calls**

Why handoffs and types of handoffs, Initiation of handoff, Delaying a handoff, Forced handoffs, Queuing of handoffs, Power-difference handoffs, Mobile assisted handoff and soft handoff, Cell-site handoff, Intersystem handoff. Introduction to dropped call rate.

#### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand why handoff is required (L1).
- Apply handoff techniques to solve engineering problems (L2).
- Compare various types of handoffs (L3).

### **UNIT-IV:**

#### **Multiple Access Techniques for Wireless Communications**

Introduction, Frequency Division Multiple Access, Time Division Multiple Access, Code Division Multiple Access and Space Division Multiple Access.

#### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand various types of multiple access techniques (L1).
- Apply the concept of multiple access to solve engineering problems (L2).
- Compare various types of multiple access techniques (L3).

### **UNIT-V:**

#### **Digital Cellular Systems**

Global System for Mobile Systems, Time Division Multiple Access Systems, Code Division Multiple Access Systems. Examples for 2G, 3G and 4G systems. Introduction to 5G system.

#### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand operation of various types of digital cellular systems (L1).
- Compare various types of digital cellular systems (L3).
- Evaluate suitability of a cellular system in real time applications (L4).

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

### **Course Outcomes:**

At the end of the course, the student should be able to

- Understand the concepts and operation of cellular systems (L1)
- Apply the concepts of cellular systems to solve engineering problems (L2).
- Analyse cellular systems for meaningful conclusions, Evaluate suitability of a cellular system in real time applications (L3).
- Design cellular patterns based on frequency reuse factor (L4).

### **TEXT BOOKS:**

2. William C. Y. Lee, “Mobile Cellular Telecommunications”, 2<sup>nd</sup> Edition, McGraw-Hill International, 1995.
3. Theodore S. Rappaport, “Wireless Communications – Principles and Practice”, 2<sup>nd</sup> Edition, PHI, 2004.

### **REFERENCES:**

3. Aditya K. Jagannatham “Principles of Modern Wireless Communications Systems – Theory and Practice”, McGraw-Hill International, 2015.

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### **Blooms’ Learning levels:**

L1: Remembering and Understanding

L2: Applying

L3: Analyzing, Evaluating

L4: Designing, Creating

**(19A04802c) INDUSTRIAL ELECTRONICS  
OPEN ELECTIVE-IV**

**Course Objectives:**

This course will enable students to:

- Describe semi-conductor devices (such as PN junction diode & Transistor) and their switching characteristics.
- Understand the characteristics of AC to DC converters.
- Understand about the practical applications Electronics in industries
- Describe the Ultrasonics and its application.

**UNIT I**

Scope of industrial Electronics, Semiconductors, Merits of semiconductors, crystalline structure, Intrinsic semiconductors, Extrinsic semiconductors, current flow in semiconductor, Open-circuited p-n junction, Diode resistance, Zener diode, Photoconductors and junction photo diodes, Photo voltaic effect, Light emitting diodes(LED).

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the importance of Electronics and semiconductor devices in industry, operation of semiconductor devices (L1)
- Describe the working of semiconductor diodes (L1)

**UNIT II**

Introduction, The junction transistor, Conventions for polarities of voltages and currents, Open circuited transistor, Transistor biased in the active region, Current components in transistors, Currents in a transistor, Emitter efficiency, Transport factor and transistor- $\alpha$ , Dynamic emitter resistance, Transistor as an amplifier, Transistor construction, Lettersymbols for semiconductor Devices, Characteristic curves of junction transistor in common configuration, static characteristic curves of PNP junction transistor in common emitter configuration, The transistor in common collector Configuration.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the working of Transistor and its different configurations (L1)
- Describe the working of CE, CC, CB configurations (L1)

### UNIT III

**AC to DC converters-** Introduction, Classification of Rectifiers, Half wave Rectifiers, Fullwave Rectifiers, Comparison of Half wave and full wave rectifiers, Bridge Rectifiers, Bridge Rectifier meter, Voltage multiplying Rectifier circuits, Capacitor filter, LC Filter, Metal Rectifiers, Regulated Power Supplies, Classification of Voltage Regulators, Short period Accuracy of Regulators, Long period Accuracy of Voltage Regulator, Principle of automatic voltage Regulator, Simple D.C. Voltage stabilizer using Zener diode, D.C. Voltage Regulators, Series Voltage Regulators, Complete series voltage regulator circuit, Simple series voltage regulator.

### UNIT IV

**Resistance welding controls:** Introduction, Resistance welding process, Basic Circuit for A.C. resistance welding, Types of Resistance welding, Electronic welding control used in Resistance welding, Energy storage welding. **Induction heating:** Principle of induction heating, Theory of Induction heating merits of induction heating, Application of induction heating, High frequency power source of induction heating. **Dielectric heating:** Principle of dielectric heating, theory of dielectric heating, dielectric properties of typical materials, electrodes used in dielectric heating, method of coupling of electrodes to the R.F. generator, Thermal losses in Dielectric heating, Applications.

#### Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the principle of operation of Resistance welding, Induction heating and Dielectric heating (L1)
- Apply the process of Resistance welding, Induction heating and Dielectric heating in the industry (L2)

### UNIT V:

**Ultrasonics:** Introduction, Generation of Ultrasonic waves, Application of Ultrasonic waves, Ultrasonic stroboscope, ultrasonic as means of communication, ultrasonic flaw detection, Optical image on non-homogeneities, ultrasonic study of structure of matter, Dispersive study of structure of matter, Dispersive and colloidal effect of Ultrasonic, Coagulating action of Ultrasonic, separation of mixtures by ultrasonic waves, cutting and machining of hard materials by ultrasonic vibrations, Degassing of liquids by ultrasonic waves, Physio-chemical effects of ultrasonics, chemical effects of ultrasonics, Thermal effects of Ultrasonics, soldering and welding by ultrasonics, Ultrasonic Drying

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the principle of operation of Ultrasonics and its applications (L1)
- Analyze the thermal effects of Ultrasonics, soldering and welding by ultrasonics, Ultrasonic Drying in the industry (L3)

**Course Outcome:**

- Understand the semi-conductor devices and their switching characteristics.
- Apply the Ultrasonic waves with different applications
- Analyze the thermal effects of Ultrasonics, soldering and welding by ultrasonics, Ultrasonic Drying in the industry, Interpret the characteristics of AC to DC converters,
- Develop the practical applications Electronics in industries.

**TEXT BOOKS:**

1. G. K. Mithal, “Industrial Electronics”, Khanna Publishers, Delhi, 2000.
2. J.Gnanavadivel, R.Dhanasekaran, P.Maruthupandi, “Industrial Electronics”, Anuradha Publications, 2011.

**REFERENCE BOOKS:**

1. F. D. Petruzulla, “Industrial Electronics”, McGraw Hill, Singapore, 1996.
2. M. H. Rashid, “power Electronics Circuits, Devices and Application”, PHI, 3<sup>rd</sup> edition, 2004.
3. G. M. Chute and R. D. Chute, “Electronics in Industry”, McGraw Hill Ltd, Tokyo, 1995.



(19A04802d) **ELECTRONIC INSTRUMENTATION**  
**OPEN ELECTIVE-IV**

**Course Objectives:**

**This course will enable students to:**

- To introduce various measuring instruments and their functionality
- To teach various measurement metrics for performance analysis
- To explain principles of operation and working of different electronic instruments
- To familiarize the characteristics, operations, calibrations and applications of the different oscilloscopes and signal generators.
- To provide exposure to different types of transducers

**UNIT – I**

**Measurement and Error:** Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations. (Text 2)

**Ammeters:** DC Ammeter, Multi-range Ammeter, The Ayrton Shunt or Universal Shunt, Requirements of Shunt, Extending of Ammeter Ranges, RF Ammeter (Thermocouple), Limitations of Thermocouple. (Text 1)

**Voltmeters and Multi-meters:** Introduction, Basic Meter as a DC Voltmeter, DC Voltmeter, Multi range Voltmeter, Extending Voltmeter Ranges, Loading, AC Voltmeter using Rectifiers. True RMS Voltmeter, Multi-meter. (Text 1)

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the importance of measurement system (L1)
- Examine the characteristics of different Instruments (L2)
- Illustrate different types of errors that may occur in instruments during measurements (L2)

**UNIT – II**

**Digital Voltmeters:** Introduction, RAMP technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly used principles of ADC, Successive Approximations, - Digit, Resolution and Sensitivity of Digital Meters, General Specifications of DVM, (Text 1)

**Digital Instruments:** Introduction, Digital Multi-meters, Digital Frequency Meter, Digital Measurement of Time, Universal Counter, Digital Tachometer, Digital pH Meter, Digital Phase Meter, Digital Capacitance Meter, (Text 1)

### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain working of digital measuring Instruments (L2)
- Compare the various measuring techniques for measuring voltage (L4)

### **UNIT – III**

**Oscilloscopes:** Introduction, Basic principles, CRT features, Block diagram of Oscilloscope, Simple CRO, Vertical Amplifier, Horizontal Deflecting System, Sweep or Time Base Generator, Measurement of Frequency by Lissajous Method, Digital Storage Oscilloscope. (Text 1)

**Signal Generators:** Introduction, Fixed and Variable AF Oscillator, Standard Signal Generator, Laboratory Type Signal Generator, AF sine and Square Wave Generator, Function Generator, (Text 1)

### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Describe functions of basic building of CRO (L1)
- Measure parameters viz. Amplitude, frequency and time period using CRO (L2)
- Classify signal generators and describe its characteristics (L2)

### **UNIT – 4**

**Measuring Instruments:** Field Strength Meter, Stroboscope, Phase Meter, Q Meter, Megger. (Text 1)

**Bridges:** Introduction, Wheatstone's bridge, Kelvin's Bridge; AC bridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell's bridge, Wien's bridge. (Text 1)

### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Describe function of various measuring Instruments. (L1)
- Describe how unknown capacitance and inductance can be measured using bridges (L1)
- Select appropriate bridge for measuring R, L and C parameters (L2)

### **UNIT – 5**

**Transducers:** Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, LVDT, Piezoelectric transducer, Photo cell, Photo voltaic cell, Semiconductor photo diode and transistor. (Text 1)

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the importance of transducer (L1)
- Illustrate different measuring techniques in transducers to measure physical quantities.(L2)
- Select the appropriate transducer for the measurement of physical parameters (L2)

**Course outcomes:**

- Learn different types of errors in measurement, calibration process and standards, various methods for measurement of non-electrical quantities, Understand the different methods for measurement of various electrical quantities.
- Familiarize the dynamics of instrument systems, various passive and active transducers
- Compare the various measuring techniques for measuring voltage (L4)

**TEXT BOOKS:**

- H. S. Kalsi, “Electronic Instrumentation”, McGraw Hill, 3rd Edition, 2012, ISBN:9780070702066.
- A. D. Helfrick and W.D. Cooper, “Modern Electronic Instrumentation and Measuring Techniques”, Pearson, 1st Edition, 2015, ISBN: 9789332556065.

**REFERENCE BOOKS:**

- David A. Bell, “Electronic Instrumentation & Measurements”, Oxford University Press PHI 2nd Edition, 2006 ISBN 81-203-2360-2.
- A. K. Sawhney, “Electronics and Electrical Measurements”, Dhanpat Rai & Sons. ISBN - 81-7700-016-0

(19A05802a)) BLOCKCHAIN TECHNOLOGY

**Course Objectives:**

This course is designed to:

- Understand the philosophy of Blockchain and the cutting edge technology behind its functions
- Illustrate how to setup Ethereum tools
- Explain the key vocabulary and concepts used in Blockchain for Business

**UNIT-I**

**Blockchain concepts:** Blockchain, Blockchain application example: Escrow, Blockchain stack, from web 2.0 to the next generation decentralized web, domain specific Blockchain application, Blockchain benefits and challenges.

**Blockchain application templates:** Blockchain application components, design methodology for Blockchain applications, Blockchain applications templates

**Learning Outcomes:**

After completing this Unit, students will be able to

- Outline the benefits and challenges of Block chain(L2)
- Design the Blockchain applications(L6)

**UNIT-II**

**Setting up Ethereum development tools:** Ethereum clients,Ethereum languages, TestRPC, Mist Ethereumwalle, meta mask, web3 JavaScript API, truffle.

**Ethereum Accounts:** Ethereum Accounts, keypairs, working with EOA Accounts, working with contract accounts.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Illustrate the use of Ethereum development tools(L2)
- Create Ethereum accounts and work with them (L6)

**UNIT-III**

**Smart contracts:** Smart contract, structure of a contract, setting up and interacting with a contract using Geth client, setting up and interacting with a contract using Mist Wallet

**Learning Outcomes:**

After completing this Unit, students will be able to

- Make use of smart contracts(L3)
- Distinguish setting up and interacting with a contract using Geth client and Mist Wallet.(L4)

**UNIT-IV**

**Smart contracts (continued):** Smart contract examples, Smart contract patterns.

**Decentralized Applications:** implementing Dapps, case studies,

**Learning Outcomes:**

After completing this Unit, students will be able to

- Illustrate the Smart contract examples and patterns(L2)
- Develop Decentralized applications.(L6)

**UNIT-V**

**Mining:** Consensus on Block chain network, mining, Block validation, state storage in Ethereum.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Define Consensus on Blockchain network(L1)
- Demonstrate State Storage in Ethereum(L2)

**Course outcomes:**

Upon completion of the course, the students should be able to:

- Create customized blockchain solutions (L6)
- Make use of the specific mechanics of Ethereum(L3)
- Experiment with Smart contracts (L3)
- Develop Enterprise applications using Blockchain(L6)

**Text book:**

1. Arshadeepbahga, Vijay madiseti, “Blockchain Applications A hands-on approach”, VPT 2017.
2. Chandramouli Subramanian, Asha A George, Abhilash K A and MeenaKarthikeyan, “Blockchain Technology”, Universty Press, 2021

**References:**

1. Imran Bashir, “Mastering Blockchain” Packt Publishing Ltd, March 2017.
2. Melanie swan, “Blokchain blueprint for a new economy”, O'REILLY

**Course Objectives:**

This course is designed to:

- Translate user requirements into the overall architecture
- Implement new systems and manage the projects
- Write optimized front end code using HTML and JavaScript
- Monitor the performance of web applications & its infrastructure
- Design and implement Robust and Scalable Front End Applications

**UNIT I**

Introduction to Web: Internet and World Wide Web, Domain name service, Protocols: HTTP, FTP, SMTP. Html5 concepts, CSS3, Anatomy of a web page. XML: Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX Approaches.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Summarize the protocols related to Internet & WWW(L2)
- Compare and contrast XML and HTML(L5)

**UNIT II**

JavaScript: The Basic of JavaScript: Objects, Primitives Operations and Expressions, Control Statements, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions. Angular Java Script Angular JS Expressions: ARRAY, Objects, \$eval, Strings, Angular JS Form Validation & Form Submission, Single Page Application development using Angular JS.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Illustrate the importance of JavaScript(L2)
- Develop applications using Angular JS(L6)

**UNIT III**

Node.js: Introduction, Advantages, Node.js Process Model, Node JS Modules. Express.js: Introduction to Express Framework, Introduction to Nodejs , What is Nodejs, Getting Started with Express, Your first Express App, Express Routing,

Implementing MVC in Express, Middleware, Using Template Engines, Error Handling , API Handling , Debugging, Developing Template Engines, Using Process Managers, Security & Deployment.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Explain the Node JS modules(L2)
- Make use of MVC in Express(L3)

### **UNIT IV**

RESTful Web Services: Using the Uniform Interface, Designing URIs, Web Linking, Conditional Requests. React Js: Welcome to React, Obstacles and Roadblocks, React's Future, Keeping Up with the Changes, Working with the Files, Pure React, Page Setup, The Virtual DOM, React Elements, ReactDOM, Children, Constructing Elements with Data, React Components, DOM Rendering, Factories.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Outline the RESTful Web Services(L2)
- Assess the future of React Js(L5)

### **UNIT V**

Mongo DB: Introduction, Architecture, Features, Examples, Database Creation & Collection in Mongo DB. Deploying Applications: Web hosting & Domains, Deployment Using Cloud Platforms.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Explain the features and architecture of Mongo DB (L2)
- Create and collect Database in MongoDB(L6)

### **Course Outcomes**

After the completion of the course, student will be able to

- List the Basic Concepts of Web & Markup Languages(L1)
- Develop web Applications using Scripting Languages & Frameworks(L6)
- Make use of Express JS and Node JS frameworks(L3)
- Illustrate the uses of web services concepts like restful, react js (L2)
- Deploying applications using Cloud Platforms (L6)



**Text Books:**

- 1) Programming the World Wide Web, Robert W Sebesta, 7ed, Pearson.
- 2) Web Technologies, Uttam K Roy, Oxford
- 3) Pro Mean Stack Development, ELadElrom, Apress
- 4) Restful Web Services Cookbook, Subbu Allamraju, O'Reilly
- 5) JavaScript & jQuery the missing manual, David sawyer mcfarland, O'Reilly
- 6) Web Hosting for Dummies, Peter Pollock, John Wiley Brand

**Reference Books:**

- 1) Ruby on Rails up and Running, Lightning fast Web development, Bruce Tate, Curt Hibbs, Oreilly (2006).
- 2) Programming Perl, 4ed, Tom Christiansen, Jonathan Orwant, Oreilly (2012).
- 3) Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
- 4) An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning.
- 5) Express.JS Guide, The Comprehensive Book on Express.js, Azat Mardan, Lean Publishing.

**e-Resources:**

- 1) <http://www.upriss.org.uk/perl/PerlCourse.html>

**(19A27802a) FOOD PLANT UTILITIES & SERVICES**  
**OPEN ELECTIVE - IV**

**PREAMBLE**

This subject focuses on different utilities like water, steam, electricity and its properties, production of consumption of these sources in the food plant.

**OBJECTIVES**

- To give brief idea about the utilities that are required/used in food industry and their sources and importance.

**UNIT – I**

Introduction Classification of various utilities and services in food industry. Water use in Food Processing Industry Water supply system: Pumps of different types, operational aspects, piping system for fresh water, chilled water etc., fittings and control, water requirement for cleaning and processing, water quality, water purification and softening Unit

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Water use in Food Processing Industry
- Water supply system: Pumps of different types, operational aspects, piping system for fresh water, chilled water etc.,
- fittings and control, water requirement for cleaning and processing,
- water quality, water purification and softening Unit

**UNIT – II**

Water use in food processing: Different types of water requirements in food processing plants, types of water use, waste water sources, water wastage minimization, water loadings per unit mass of raw material. Water conservation: Water and waste water management, economic use of water, water filtration and recirculation.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Different types of water requirements in food processing plants,
- types of water use, waste water sources, water wastage minimization,
- water loadings per unit mass of raw material
- Water and waste water management, economic use of water,
- water filtration and recirculation

### **UNIT – III**

Steam uses in Food Industry Steam uses in food industry: Food processing operations in which steam is used, temperature, pressure and quantity of steam required in various food processing operations Steam generation system: Components of a boiler system, fuels used in boilers, energy analysis for a steam generation system, heat loss from boiler system, boiler design consideration.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Food processing operations in which steam is used
- Temperature, pressure and quantity of steam required in various food processing operations
- Components of a boiler system, fuels used in boilers, energy analysis for a steam generation system
- Heat loss from boiler system, boiler design consideration.

### **UNIT – IV**

Waste-Heat Recovery in Food Processing Facilities Quantity and quality of waste heat in food processing facilities, waste heat utilization, heat exchangers for waste heat recovery, heat pumps for waste heat recovery. Waste Disposal and its Utilization Industrial waste, sewage, influent, effluent, sludge, dissolved oxygen, biological oxygen demand, chemical oxygen demand.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Waste-heat recovery in food processing facilities
- Quantity and quality of waste heat in food processing facilities,

- Waste heat utilization, heat exchangers for waste heat recovery, heat pumps for waste heat recovery.
- Waste disposal and its utilization industrial waste, sewage, influent, effluent, sludge,
- Dissolved oxygen, biological oxygen demand, chemical oxygen demand

## **UNIT – V**

Planning and Design of Service Facilities in Food Industry Estimation of utilities requirements: Lighting, ventilation, drainage, CIP system, dust removal, fire protection etc. Maintenance of facilities: Design and installation of piping system, codes for building, electricity, boiler room, plumbing and pipe colouring, maintenance of the service facilities. Services required in offices, laboratories, locker and toilet facilities, canteen, parking lots and roads, loading docks, garage, repair and maintenance shop, ware houses etc.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Planning and Design of Service Facilities in Food Industry Estimation of utilities requirements: Lighting, ventilation, drainage, etc.
- Maintenance of facilities: Design and installation of piping system, codes for building, electricity, plumbing, maintenance of the service facilities.
- Services required in offices, laboratories, locker and toilet facilities, canteen, parking lots and roads, repair and maintenance shop, ware houses etc

### **Course Outcomes**

By end of the course, students will understand the following

- Various utilities and services used in food industry and its applications in food industry namely water, steam, electricity and etc.

### **TEXT BOOKS**

1. Lijun Wang. “Energy Efficiency and Management in Food Processing Facilities”. CRC Press. 2008,
2. M. E. Casper. “Energy-saving Techniques for the Food Industry”. Noyes Data Corporation. 1977,

## REFERENCES

1. P.L. Ballaney, "Thermal Engineering in SI Units", 23<sup>rd</sup> Edition, Khanna Publishers, Delhi, 2003.
2. C.P. Arora. "Refrigeration and Air Conditioning". 3<sup>rd</sup> Edition, Tata McGraw Hill Publishing Co. Ltd. New Delhi. 2008,
3. W. E. Whitman, "A Survey of Water Use in the Food Industry", S. D. Holdsworth. Published by British Food Manufacturing Industries Research Association.
4. Chilton's Food Engineering. 1979, Chilton Co Publishers.

**(19A27802b) NUTRACEUTICALS AND FUNCTIONAL FOODS**

**OPEN ELECTIVE – IV**

**PREAMBLE**

This course will cover the classification, brief history and the impact of nutraceuticals and functional foods on health and disease prevention. Nutraceuticals to be covered in the course include isoprenoids, isoflavones, flavanoids, carotenoids, lycopene, garlic, omega 3 fatty acids, sphingolipids, vitamin E and antioxidants, herbal products in foods. Also marketing issues related to functional foods and nutraceuticals as well as stability testing will be reviewed.

**Course Objectives:**

- To understand the interrelationship between nutraceuticals and health maintenance.
- Cite the evidence supporting the efficacy and safety of nutraceutical and functional food products
- To explain the metabolic consequences of nutraceuticals and functional foods.
- Describe the physiologic and biochemical changes associated with consumption of nutraceuticals

**UNIT – I**

Introduction, definition, Modification in the definition of nutraceuticals. Classification of nutraceuticals, Nutraceuticals market scenario, formulation considerations. Challenges for Nutraceuticals.

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Classification of nutraceuticals,
- Nutraceuticals market scenario and formulation considerations.
- Challenges for Nutraceuticals.

## **UNIT – II**

Nutraceuticals value of spices and seasoning – Turmeric, Mustard, Chilli, Cumin, Fenugreek, Black Cumin, Fennel, Asafoetida, Garlic, Ginger, Onion, Clove, Cardamom etc., Nutraceuticals from Fruits And Vegetables – Mango, Apple, Grapes, Bel, Banana, Broccoli, Tomato, Bitter Melon, Bitter Orange etc.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Nutraceuticals value of spices and seasoning – Turmeric, Mustard, Chilli, Etc.
- Nutraceuticals from Fruits and Vegetables – Mango, Apple, Grapes, Tomato etc.

## **UNIT – III**

Omega -3 fatty acids from fish- Typical properties, structural formula, functional category. CLA- typical properties, structural formula, functional category. Application in Nutraceuticals. Calcium, chromium, copper, iodine, iron, magnesium, Zn- mechanism of action, bioavailability, uses and deficiency, dietary sources.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Properties of Omega -3 fatty acids from fish and structures
- Application in Nutraceuticals. Calcium, iodine, iron, Zn- mechanism of action, bioavailability, uses and deficiency, dietary sources.

## **UNIT – IV**

Definition, classification – Type of classification (Probiotics, probiotics and synbiotics: Taxonomy and important features of probiotic microorganisms. Health effects of probiotics including mechanism of action. Probiotics in various foods: fermented milk products, non-milk products etc. Prebiotics. Definition, chemistry, sources, metabolism and bioavailability, effect of processing, physiological effects, effects on human health and potential applications in risk reduction of diseases, perspective for food applications for the following: Non-digestible carbohydrates/oligosaccharides: Dietary fibre, Resistant starch, Gums.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Probiotics, probiotics and synbiotics: important features of probiotic microorganisms.

- Non-digestible carbohydrates/oligosaccharides: Dietary fibre and etc.

## **UNIT – V**

Phytosterol, Fatty Acids, Carotenoids, Anthocyanins, Carotenoids, Amino Acids, Water Soluble Vitamins, Free radical biology and antioxidant activity of nutraceuticals. Regulations of Nutraceuticals and Functional Foods in India and rest of the world.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Phytosterol, Fatty Acids, Carotenoids, Anthocyanins, Free radical biology and antioxidant activity of nutraceuticals.
- Regulations of Nutraceuticals and Functional Foods in India and rest of the world.

### **Course Outcomes**

- Students will get know the nutraceuticals and its active components in different foods, regulations on nutraceuticals in India.

## **TEXT BOOKS**

1. “Handbook of Nutraceuticals and Functional Foods. Yashwant Pathak, Vol. 1. (Ingredients, formulations, and applications)” CRC Press 2005.
2. “Handbook of Nutraceuticals and Functional Foods”. Robert Wildman, 2<sup>nd</sup> Edition. CRC Press 2001.

## **REFERENCES**

1. B. Shrilakshmi, “Dietetics”, 5<sup>th</sup> Edition, New Age International (P) Ltd., New Delhi, 2005.
2. A. E. Bender, “Nutrition and Dietetic Foods”, Chem. Pub. Co. New York, 2<sup>nd</sup> Edition, 2004.
3. P. S. Howe, “Basic Nutrition in Health and Disease”, 2<sup>nd</sup> Edition, W. B. Saunders Company, London, 2003.
4. Kramer, “Nutraceuticals in Health and Disease Prevention”, Hoppe and Packer, Marcel Dekker, Inc., NY 2001.
5. Bao and Fenwick, “Phytochemicals in Health and Disease”, Marcel Decker, Inc. NY 2004.



**(19A54802a) MATHEMATICAL MODELING & SIMULATION**

**OPEN ELECTIVE-IV**

**Course Objective:**

This course focuses on what is needed to build simulation software environments, and not just building simulations using preexisting packages.

**UNIT-I:**

Simulation Basics-Handling Stepped and Event-based Time in Simulations-Discrete versus Continuous Modeling-Numerical Techniques-Sources and Propagation of Error

**Learning Outcomes:**

Students will be able to

- Understand computer simulation technologies and techniques.

**UNIT-II**

Dynamical, Finite State, and Complex Model Simulations-Graph or Network Transitions Based Simulations-Actor Based Simulations-Mesh Based Simulations-Hybrid Simulations

**Learning Outcomes:**

Students will be able to

- Implement and test a variety of simulation and data analysis.

**UNIT-III**

Converting to Parallel and Distributed Simulations-Partitioning the Data-Partitioning the Algorithms-Handling Inter-partition Dependencies

**Learning Outcomes:**

Students will be able to

- Understand concepts of modeling layers of society's critical infrastructure networks.
- Understand partitioning the data.

## **UNIT-IV**

Probability and Statistics for Simulations and Analysis-Introduction to Queues and Random Noise-Random Variates Generation-Sensitivity Analysis

### **Learning Outcomes:**

Students will be able to

- Understand Queues and Random noise.
- Understand sensitivity analysis.

## **UNIT-V**

Simulations Results Analysis and Viewing Tools-Display Forms: Tables, Graphs, and Multidimensional Visualization-Terminals, X and MS Windows, and Web Interfaces-Validation of Model Results

### **Learning Outcomes:**

Students will be able to

- Build tools to view and control simulations and their results.

### **Course Outcomes:**

After the completion of course, student will be able to

- Understand basic Model Forms.
- Understand basic Simulation Approaches.
- Evaluate handling Stepped and Event-based Time in Simulations.
- Distinguish Discrete versus Continuous Modeling.
- Apply Numerical Techniques.
- Calculate Sources and Propagation of Error.

### **TEXT BOOKS:**

1. JN Kapur, "Mathematical modelling", Newage publishers
2. Kai Velten, "Mathematical Modeling and Simulation: Introduction for Scientists and Engineers" Wiley Publishers.