

## CIVIL ENGINEERING

### SEMESTER-VII

<b>COURSE CODE</b>	<b>THEORY/LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
ACE1133	Environmental Engineering-II	4	0	0	4
ACE1134	Prestressed Concrete	4	1	0	4
ACE1135	Construction Management	4	0	0	4
ACE1136	Reinforced Concrete Structures-II	4	1	0	4
	<b>Elective- I</b>				
ACE1137	Earthquake Resistant Design	4	0	0	4
ACE1138	Industrial Waste and Waste Water Management	4	0	0	4
ACE1139	Traffic Engineering	4	0	0	4
AEE1124	Renewable Energy Sources	4	0	0	4
AEC1132	Satellite Communication	4	1	0	4
	<b>Elective- II</b>				
ACE1140	Air Pollution and Control	4	0	0	4
ACE1141	Ground Improvement Techniques	4	0	0	4
ACE1142	Advanced Structural Design	4	0	0	4
ACS1114	Software Development Engineering	4	1	0	4
AIT 1114	Data Structures For Engineering Applications	4	1	0	4
ACE1143	<i>Computer Applications in Civil Engg.</i>	0	0	3	2
ACE1144	<i>Environmental Engg. Lab</i>	0	0	3	2
ACE11MP	<i>Industry Oriented Mini-Project*</i>	-		-	2
	<b>Total</b>	<b>24</b>	<b>2+</b>	<b>6</b>	<b>30</b>

\* Mini Project to be carried out during the summer vacation after VI Semester examination

\* Evaluation at the beginning of the VII Semester

## ENVIRONMENTAL ENGINEERING-II

**Course Code : ACE1133**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**AIM :**

To introduce the advanced concepts of Environmental Engineering.

**OBJECTIVE:**

Study of Air Pollution Control, Industrial Waste-Water Treatment, Solid Waste Management, Hazardous Waste Treatment, Noise Pollution Control, Legal aspects.

**UNIT-I**

**AIR POLLUTION & NOISE POLLUTION:** Sources of Air pollution – Air pollutants – Classification – Effects on man, vegetation and materials – Global effects - Noise pollution – Impacts – Measurement and Control.

**UNIT-II**

**CONTROL OF AIR POLLUTION :** Particulates – Gaseous pollutants – MINAS – Air quality standards (without design)

**UNIT-III**

**SPECIAL WATER TREATMENT METHODS:** Reverse Osmosis – Ion Exchange – Ultra filtration – De-flouridation. Nitrification and Denitrification – Removal of Phosphates.

**UNIT-IV**

**INDUSTRIAL WASTE WATER TREATMENT :** Theories of Industrial Waste Water Treatment – Volume Reduction – Strength Reduction – Neutralization – Equalisation – Proportioning.

**UNIT-V**

**SOLID WASTE MANAGEMENT:** Municipal solid wastes – Solid waste characteristics – Generation – Collection – Segregation and Transportation

**UNIT-VI**

**HAZARDOUS WASTE TREATMENT METHODS :** Hazardous wastes – Nuclear, Bio-medical and Chemical wastes. Their treatment methods.

**UNIT-VII**

**ENGINEERED SYSTEM OF WASTE MANAGEMENT:** Engineered system of management (cycle / recycle, energy recovery, treatment & disposal)

**UNIT-VIII**

**LEGAL ASPECTS OF POLLUTION CONTROL :** Legal aspects of Environmental Management – Effluent standards – Air Emission Standards – Water Act – Air Act – Environmental Protection Act – Legal Provisions.

**TEXT BOOKS:**

1. Henry. G. J. and Heinke G.W., Environmental Science and Engineering, Pearson Education, 2<sup>nd</sup> edition, 1996.
2. Howard S. Peavy, Donald R. Rowe, George Tchobanoglous, McGraw-Hill, 1<sup>st</sup> edition, 1985.
3. Dhameja. K. Suresh, Environmental Engineering and Management, S.K. Kataria & Sons, 2<sup>nd</sup> edition 2005.

**REFERENCES:**

1. Walter J. Weber, Physico-Chemical process for waste quality control, Wiley- Interscience, 9<sup>th</sup> edition, 1972.
2. Rao M.N & Rao H.N., Air Pollution and Control, Tata McGraw-Hill, 1<sup>st</sup> Edition 2006.



## PRESTRESSED CONCRETE

**Course Code : ACE 1134**

L	T	P	C
4	1	0	4

### **AIM :**

To study the concept of prestressing, analysis and design of PSC members.

### **OBJECTIVE:**

Understanding the materials used, types of prestressing, prestressing methods, analysis and design of PSC members and deflection criteria.

### **UNIT-I**

**INTRODUCTION :** Historic development – General principles of prestressing -pre-tensioning and post tensioning – Advantages and limitations of prestressed concrete – Materials – High strength concrete and high tensile steel and their characteristics.

### **UNIT-II**

**PRESTRESSING METHODS :** I.S.Code provisions, Methods and Systems of Prestressing; Pre-tensioning and post tensioning methods – Analysis of post tensioning – Different systems of pre-stressing like Hoyer system, Magnel Blaten system, Freyssinet system and Gifford Udall System.

### **UNIT-III**

**LOSSES OF PRESTRESS:** Loss of prestress in pre-tensioned and post-tensioned members due to various causes like elastic shortening of concrete, shrinkage of concrete, creep of concrete, Relaxation of steel, slip in anchorage, bending of member and frictional losses.

### **UNIT-IV**

**ANALYSIS OF SECTIONS FOR FLEXURE :** Analysis of sections for flexure; Elastic analysis of concrete beams prestressed with straight, concentric, eccentric, bent and parabolic tendons.

**UNIT-V****DESIGN OF SECTIONS FOR FLEXURE AND SHEAR :**

Allowable stress, Design criteria as per I.S.Code – Elastic design of simple rectangular and I-section for flexure, shear, and principal stresses – design for shear in beams – Kern – lines, cable profile.

**UNIT-VI**

**ANALYSIS OF END BLOCKS:** Analysis of end Blocks by Guyon's method and Mugnel method, Anchorage zone stress – Approximate method of design – Anchorage zone reinforcement – Transfer of pre-stress in pre-tensioned members.

**UNIT-VII**

**COMPOSITE SECTION :** Introduction – Analysis of stress – Differential shrinkage – General designs considerations.

**UNIT-VIII****DEFLECTIONS OF PRESTRESSED CONCRETE BEAMS:**

Importance of control of deflections – factors influencing deflections – short term deflections of uncracked members prediction of long term deflections.

**TEXT BOOKS:**

1. Krishna Raju N, Prestressed Concrete, Tata Mc.Graw Hill Publications, 4<sup>th</sup> edition, 2007.
2. Rajagopalan. N, Prestressed Concrete, Narosa publications, 2<sup>nd</sup> edition, 2006.

**REFERENCES:**

1. Ramamrutham S., Prestressed Concrete, Dhanpatrai Publications, 4<sup>th</sup> edition, 2006.
2. Lin T.Y. & Ned H. Burns, Design of Prestressed concrete structures, John Wiley & Sons, 3<sup>rd</sup> edition, 2004.
3. All relevant IS Codes



## CONSTRUCTION MANAGEMENT

**Course Code : ACE 1135**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**AIM:**

The course is designed to give introduction to various aspects of construction management.

**OBJECTIVE :**

Overview of construction contracts, construction planning and scheduling including CPM and PERT, quality and safety management and resource management including crashing of activities. The course will also cover aspects of alternate dispute resolutions and labour legislations.

**UNIT-I**

**CONTRACT MANAGEMENT :** Types of contract – contract documents – possible contractual obligations – meaning of specification – tender notice – types – tender documents – earnest money deposit (EMD) and security deposits (SD) – scrutiny and acceptance of a tender – contract agreement – contractual changes and termination of contract – subcontract – rights and duties of sub contractor.

**UNIT-II**

**CONSTRUCTION ORGANIZATION AND SUPERINTENDENCE:**

Forms of business organizations – sole proprietorship – partnership – joint stock company-Co-operative society – state enterprise- delegation of responsibility, personnel requirement and division of work – decentralization – construction supervision and superintendence – pay rolls and records – purchase and delivery of construction material and equipment – percentage completion report – insurance record – project office requirement – organization chart of a small / medium / large construction company (broad outline only)

### UNIT III

#### **PLANNING AND SCHEDULING FOR CIVIL ENGINEERING**

**PROJECT :** Objectives of planning – its advantage to client and engineer – limitations –stages of planning by owner & contractor. Scheduling – definition – its preparation – uses and advantages – classification – methods of scheduling – bar chart – job layout – Gantt chart – work breakdown chart (WBC)

### UNIT-IV

#### **PROJECT MANAGEMENT THROUGH NETWORKS:**

Activity – Event – Dummies – basic assumptions in creating a network – rules for drawing networks – Fulkerson’s rule for numbering the events, PERT – time estimates – earliest expected time – latest allowable occurrence time – slack. Standard deviation, variance.

### UNIT-V

#### **PRECEDENCE NETWORKS:**

Creating network logic, Relationship Types – Finish to Start, Start to Start, Finish to Finish, Start to Finish, critical path method – ES, EF, LS, LF, Floats – significance of critical path

### UNIT-VI

#### **RESOURCE MANAGEMENT :**

Definition – need for resource management – optimum utilization of resources- finance, materials, machinery, human resources – resources planning – resource leveling and it’s objectives” – Time – cost trade off – crashing – need for crashing an activity – methods & tips for crashing – time vs. cost optimization curve – cost slope – its significance in crashing.

### UNIT-VII

#### **QUALITY MANAGEMENT AND SAFETY :**

Importance of quality – elements of quality – quality assurance techniques (inspection, testing, sampling) importance of safety – causes of accidents – role of various parties (designer / employer / worker) in safety management – benefits – approaches to move safety in construction

**UNIT-VIII****CONSTRUCTION DISPUTES AND THEIR SETTLEMENT:**

Introduction – development in disputes – categories of disputes – modes of settlements – Arbitration

**CONSTRUCTION LABOUR AND LEGISLATION :** Need for legislation – Payment of wages Act – Factories Act – Contract labour (Regulation and abolition Act – Employees Provident Fund (EPF) Act.

**TEXTBOOKS:**

1. Sengupta.B, & H.Guha., Construction Management and Planning, Tata Mc. Graw Hill Publishing Company Ltd., New Delhi, 2004.
2. Seetharaman. S, Construction Engineering & Management, Umesh Publications, Nai Sarak, New Delhi, 2006.
3. Sanga Reddy. S, Construction Management, Kumaran Publications, Coimbatore, 2004.

**REFERENCE BOOKS:**

1. Rangwala.S.C., Construction of Structures and Management of Works, Charotar Publishing House, 3<sup>rd</sup> edition, 2000.
2. Mincks and Johnston, Construction Jobsite Management, Narosa Publications, 4<sup>th</sup> edition, Delmar, 1998.
3. Dorsey, Robert, Case Studies in Building Design and Construction, Prentice-Hall, 3<sup>rd</sup> edition, 1999.





## REINFORCED CONCRETE STRUCTURES-II

**Course Code : ACE 1136**

L	T	P	C
4	1	0	4

### **AIM :**

To impart concepts of structural engineering required for design of foundations, retaining walls and water tanks.

### **OBJECTIVE :**

The student shall be able to design and detail various types of structure elements, as per the relevant IS codes.

### **UNIT-I**

**STAIR CASES :** Introduction, types of staircases-design of dog-legged staircase-design of open-newel staircase with quarter space landing-design of stairs with central stringer beam.

### **UNIT-II**

**COMBINED FOOTINGS :** Introduction – Design of combined rectangular footings – Design of combined trapezoidal footings – MAT foundation – Reinforcement detailing and bar bending schedule need to be prepared.

### **UNIT-III**

**PILE FOUNDATIONS :** Types of piles – Load carrying capacity of piles – Group action in piles – Structural design of RC piles – Design of pile cap for 2 or 3 piles only- Reinforcement detailing and bar bending schedule need to be prepared.

### **UNIT-IV**

**CANTILEVER RETAINING WALLS :** Introduction – Types of retaining walls – Active and passive earth pressure- Design principles of cantilever retaining walls with horizontal back fill – With horizontal back fill and traffic load – With sloping back fill.

**UNIT-V**

**COUNTER FORT RETAINING WALLS:** Design principles of counter fort retaining walls with horizontal back fill – With horizontal back fill and traffic load – With sloping back fill- Reinforcement detailing and bar bending schedule need to be prepared.

**UNIT-VI**

**RECTANGULAR WATER TANKS-I:** Introduction – General design requirements according to Indian standard code of practice – Design of on ground and under ground water tanks- Reinforcement detailing and bar bending schedule need to be prepared.

**UNIT-VII**

**RECTANGULAR WATER TANKS-II :** Introduction – General design requirements according to Indian standard code of practice –Design of over head water tanks- Reinforcement detailing and bar bending schedule need to be prepared.

**UNIT-VIII**

**CIRCULAR WATER TANKS :** Introduction – General design requirements according to Indian standard code of practice – Joints in water tanks – Circular tank with flexible joint between floor and wall – Circular tank with rigid joint between floor and wall – Design of Over head tanks - IS code method for design of circular tanks- Reinforcement detailing and bar bending schedule need to be prepared.

**FINAL EXAMINATION PATTERN:** The end examination pattern should consist of Parts A & B. Part A consists of two questions in design and drawing out of which one question is to be answered. Part B should consist of five questions out of which three are to be answered. Weightage for Part A is 40% and Part B is 60%.

**TEXT BOOKS :**

1. Punmia B.C., Ashok kumar Jain & Aurn Kumar Jain, Reinforced concrete structures volume – I, Laxmi publications Pvt. Ltd., New Delhi, 5<sup>th</sup> edition, 2008.

2. Varghese P.C., Limit State Design of Reinforced Concrete Structures, Prentice hall of India, New Delhi, 3<sup>rd</sup> edition, 2005.

**REFERENCE BOOKS :**

1. Varghese P.C., Advanced Reinforced Concrete Structures, Prentice hall of India, 4<sup>th</sup> edition, 2005.
2. Pillai S.V. and Menon D, Reinforced Concrete design, Tata Mc Graw Hill, 2<sup>nd</sup> edition, 2006.
3. Krishna Raju N, Advanced Reinforced Concrete Design, University Press, 4<sup>th</sup> edition, 2007.
4. Codes: Relevant IS codes.



# EARTHQUAKE RESISTANT DESIGN

## (ELECTIVE-I)

**Course Code : ACE 1137**

L	T	P	C
4	0	0	4

### **AIM :**

To provide the basic knowledge on earthquake resistant design of structures and its detailing.

### **OBJECTIVE:**

At the end of the course, the student shall be able to do the earthquake resistant design and detailing of the buildings.

### **UNIT-I**

**INTRODUCTION TO STRUCTURAL DYNAMICS :** Theory of vibrations – Lumped mass and continuous mass systems – Single Degree of Freedom (SDOF) Systems – Formulation of equations of motion – Un damped and damped free vibration – Damping – Forced vibrations – Response to harmonic excitation – Concept of response spectrum.

### **UNIT-II**

**MULTI-DEGREES OF FREEDOM (MDOF) SYSTEM (limited to 2 DOF):** Formulation of equations of motion – Free vibration – Determination of natural frequencies of vibration and mode shapes – Orthogonal properties of normal modes – Mode superposition method of obtaining response.

### **UNIT-III**

**EARTHQUAKE ANALYSIS :** Introduction – Rigid base excitation – Formulation of equations of motion for SDOF and MDOF Systems – Earthquake response analysis of single and multi-storied buildings – Use of response spectra.

**UNIT-IV**

**CODAL DESIGN PROVISIONS :** Review of the latest Indian seismic code IS:1893 – 2002 (Part-I) provisions for buildings – Earthquake design philosophy – Assumptions – Analysis by seismic coefficient and response spectrum methods – Displacements and drift requirements – Provisions for torsion.

**UNIT-V**

**EARTHQUAKE ENGINEERING :** Engineering Seismology – Earthquake phenomenon – Causes and effects of earthquakes – Faults Structure of earth – Plate Tectonics – Elastic Rebound Theory – Earthquake Terminology – Source, Focus, Epicenter etc – Earthquake size – Magnitude and intensity of earthquakes – Classification of earthquakes – Seismic waves – Seismic zones – Seismic Zoning Map of India – Seismograms and Accelerograms.

**UNIT-VI**

**CODAL DETAILING PROVISIONS :** Review of the latest Indian Seismic codes IS:4326 and IS:13920 Provisions for ductile detailing of R.C buildings – Beam, column and joints.

**UNIT-VII**

**ASEISMIC PLANNING :** Plan Configurations – Torsion Irregularities – Re-entrant corners – Non-parallel systems – Diaphragm Discontinuity – Vertical Discontinuities in load path – Irregularity in strength and stiffness – Mass Irregularities – Vertical Geometric Irregularity – Proximity of Adjacent Buildings.

**UNIT-VIII**

**SHEAR WALLS :** Types – Design of Shear walls as per IS:13920 – Detailing of reinforcements.

**TEXT BOOKS:**

1. Mario Paz, Structural Dynamics - Theory and Computations, Pearson Education 6<sup>th</sup> edition, 2005.

2. Pankaj Agarwal & Manish Shrikhande, Earthquake Resistant Design of Structures, Prentice Hall of India, New Delhi, 5<sup>th</sup> edition, 2009.
3. Jai Krishna A.R, Chandrasekharan A.R, Brijesh Chandra, Elements of Earthquake Engineering, South Asian Publishers, New Delhi, 2<sup>nd</sup> edition, 2001.

**REFERENCES:**

1. Chopra A.K., Dynamics of Structures, Pearson Education, Indian Branch, Delhi, 5<sup>th</sup> edition, 2007.
2. Clough & Penzien, Dynamics of Structures, McGraw Hill, International Edition, 4<sup>th</sup> edition, 2008.
3. IS Codes: IS:1893, IS:4326 and IS:13920, Bureau of Indian Standards, New Delhi.



**INDUSTRIAL WASTE AND  
WASTE WATER MANAGEMENT  
(ELECTIVE-I)**

**Course Code : ACE 1138**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**AIM :**

To gain knowledge in theory and design of Industrial waste water treatment and understand the processes.

**OBJECTIVE:**

Industrial processes –Origin of waste water – various treatment methods code of practices – management.

**UNIT-I**

**INTRODUCTION :** Waste water treatment Primary, Secondary and Tertiary treatment.

**UNIT-II**

**TREATMENT OF INDUSTRIAL WASTE WATER:** Basic Theories of Industrial Waste water Management – Volume reduction – Strength reduction – Neutralization – Equalization and Proportioning- Joint treatment of industrial wastes and domestic sewage – consequent problems.

**UNIT-III**

**EFFLUENT DISPOSAL METHODS :** Industrial waste water discharges into Streams, Lakes and Oceans and problems – Effluent disposal methods.

**UNIT-IV**

**WASTE WATER MINIMISATION :** Recirculation of Industrial Wastes – Use of Municipal Waste Water in Industries – Common Effluent Treatment Plants – Advantages and Suitability - Limitations.

**UNIT-V**

**TREATMENT OF WASTE WATER FROM SPECIFIC INDUSTRIES–I :** Manufacturing Process and Design, Origin of liquid waste from Textiles, Paper and Pulp industries, Special Characteristics, Effects and Treatment methods.

**UNIT-VI**

**TREATMENT OF WASTE WATER FROM SPECIFIC INDUSTRIES–II :** Manufacturing Process and Design, Origin of liquid waste from Fertilizers, Thermal Power Plants and Tanneries, Special Characteristics, Effects and Treatment methods.

**UNIT-VII**

**TREATMENT OF WASTE WATER FROM SPECIFIC INDUSTRIES–III :** Manufacturing Process and Design, Origin of liquid waste from Sugar Mills –Distillers, and Dairy, Special Characteristics, Breweries – Effects and treatment methods.

**UNIT-VIII**

**TREATMENT OF WASTE WATER FROM SPECIFIC INDUSTRIES–IV :** Manufacturing Process and design origin of Steel Plants, Oil Refineries, and Pharmaceutical Plants, Special Characteristics, Effects and Treatment methods.

**TEXT BOOK:**

1. Rao M.N. and Dutta, Waste Water Treatment, Oxford & IBH, New Delhi, 1<sup>st</sup> edition, 1987.

**REFERENCE:**

1. Mark J. Hammer and Mark J. Hammer (Jr), Water and Waste Water technology, Amazon Publications, 6<sup>th</sup> Edition, 2001.





## TRAFFIC ENGINEERING (ELECTIVE-I)

**Course Code : ACE 1139**

L	T	P	C
4	0	0	4

**AIM :**

To introduce the basic concepts of traffic engineering.

**OBJECTIVE:**

Over view of the traffic volume studies, study the traffic controls and regulations, detrimental effect of traffic on environment problems of highway capacity.

**UNIT-I**

**TRAFFIC CHARACTERISTICS:** Basic characteristics of Traffic-Volume, Speed and Density- Relationship among Traffic parameters.

**UNIT-II**

**TRAFFIC MEASUREMENT:** Traffic Volume Studies-Objectives-Types of Volume Studies –Concept of PCU- Data Collection and Presentation – Speed Studies – Types of Speeds- Objectives of Speed Studies- Methods of Conducting speed studies- Data collection and Presentation- Statistical Methods for Analysis of Speed Data.

**UNIT-III**

**HIGHWAY CAPACITY:** Definition of Capacity – Importance of capacity – Factors affecting Capacity- Concept of Level of Service- Different Levels of Service- Concept of Service Volume- Peak Hour Factor.

**UNIT-IV**

**PARKING STUDIES:** Types of parking facilities – Onstreet and Off Street Parking Facilities- Parking Studies- Parking Inventory Study – Parking Survey by Patrolling Method- Analysis of Parking Data and parking characteristics-Multi Story Car Parking Facility-Design standards.

**UNIT-V**

**TRAFFIC CONTROL & REGULATION:** Traffic Problems in Urban areas- Importance of Traffic Control and regulation- Traffic Regulatory Measures- Channelisation- Traffic Signals- Saturation Flow – Signal Design by Webster Method – Signal Phasing and Timing Diagrams.

**UNIT-VI**

**TRAFFIC & ENVIRONMENT :** Detrimental effect of traffic on environment – Air Pollution – Pollutants due to Traffic – Measures to reduce Air Pollution due to Traffic- Noise Pollution – Measures to reduce Noise Pollution.

**UNIT-VII**

**TRAFFIC SIGNS AND ROAD MARKINGS :** Types of Traffic Signs- cautionary, Regulatory and Informative Signs- Specifications- Pavement markings- Types of Markings – Lane markings and Object markings- Standards and Specifications for Road Markings.

**UNIT-VIII**

**HIGHWAY SAFETY :** Problem of Highway Safety – Types of Road accidents- Causes – Engineering Measures to reduce Accidents- Enforcement Measures – Educational Measures- Road Safety Audit- Principles of Road Safety Audit.

**TEXT BOOK:**

1. Kadiyali L.K, Traffic Engineering and Transportation planning, Khanna publishers, 3<sup>rd</sup> edition, 2004.
2. Mannering and Kilareski, Highway Engineering and Traffic Analysis, John Wiley Publications, 3<sup>rd</sup> edition, 2007.

**REFERENCES:**

1. Khisty C. J., Transportation Engineering – An Introduction, Prentice Hall, 3<sup>rd</sup> edition, 2010.
2. Partha Chakroborthy, Animesh Das, Principles of Transportation Engineering Prentice Hall of India, 2<sup>nd</sup> edition, 2005.
3. Papacostas C.S., Fundamentals of Transportation Engineering, Prentice Hall( India), 2<sup>nd</sup> Ed, 2005.



## RENEWABLE ENERGY SOURCES

(ELECTIVE – I)

**Course Code: AEE1124**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>1</b>	<b>0</b>	<b>4</b>

**AIM:**

To introduce the importance of renewable energy sources – its generation and advantages.

**OBJECTIVE:**

At the end of the course, the student understands:

- Issues related to conventional energy sources like depletion of fuel its environmental aspects and thus the need of renewable energy sources.
- Solar radiation – its measurement and estimation of energy to be generated, fundamentals of Photovoltaic Cells.
- Basics of Wind energy generation, bio-fuels and fuel cells.

**UNIT-I**

**ENERGY RESOURCES:**

**GENERATION AND ENVIRONMENTAL IMPACT :** Electrical Energy from conventional sources – Thermal plants, Integrated Gassification Combined Cycle Power Generation, Gas Turbine Plant; Nuclear Power- Nuclear Fission and Fusion; Energy reserves of India – Coal, Oil, Natural Gas, Hydro-electric power potential;

Environmental aspects of Electric Energy Generation – Atmospheric pollution, Hydrocarbons, particulates; Thermal Pollution; Hydroelectric Projects; Nuclear Power Generation and Environment – Natural Radiation, Radioactive Pollution; Operational safety in Nuclear Power Safety; Disposal of Nuclear waste; Impact of Renewable Energy Generation of Environment.

**UNIT-II**

**SOLAR RADIATION AND ITS MEASUREMENT:** Solar constant, Spectral distribution of Extraterrestrial Radiation; Terrestrial Solar Radiation; Solar Radiation Geometry; Computation of  $\text{Cos}\theta$  for any location having any orientation; Sunrise, Sunset and Day length; Empirical equation for estimating the availability of solar radiation; Solar Radiation Measurements and data for India.

**UNIT-III**

**SOLAR THERMAL ENERGY COLLECTORS:** Introduction, Flat Plate Collectors, Effect of design parameters on performance – Heat Transport System, Selective surfaces, Number of Covers, Spacing; Laws of Thermal Radiation; Transmissivity of the cover system – Transmittance considering absorption only, Transmittivity-Absorptivity product; Performance analysis of a liquid flat-plate collector; Total loss coefficient and Heat Losses; Solar Concentrating collectors – Types, Thermodynamic limits to concentration, Performance analysis of Cylindrical Parabolic Collector; Compound Parabolic Concentrator – Tracking CPC and Solar swing, Performance analysis of CPC; Solar Thermal Energy Storage.

**UNIT-IV**

**SOLAR PHOTOVOLTAIC SYSTEM** – Introduction, Semi-conductor materials and doping – p-type and n-type semiconductors, Photon energy, Fermi level, p-n junction; Photovoltaic Effect; Efficiency of Solar Cells, Limits to Cell efficiency; Semiconductor materials for Solar Cells, Application of PV systems, PV Hybrid System; Grid Interactive Solar Power System.

**UNIT-V**

**WIND ENERGY:** Introduction, Classification Wind Turbines, Types of Rotors, Terms used in Wind Energy, Aerodynamic Operation of Wind Turbines, Wind Energy Extraction, Extraction of Wind Turbine Power, Wind Characteristics, Mean Wind speed and Energy estimation, Power Density Duration Curve, Wind Power Generation Curve, Modes of Wind Power Generation, Advantages and disadvantages of Wind Energy system, Selection of Optimum Wind Energy Generator, Grid interfacing of a Wind Farm, Methods of Grid connection, Grid system and properties.

**UNIT-VI**

**SMALL HYDROPOWER:** Introduction, Power Equation, Classification of Small Hydropower Stations, Classification of Water Turbines, Specific Speed, Major components of small Hydropower Projects; Low-Head Small Hydro Power Projects.

**UNIT-VII**

**BIOMASS ENERGY:** Introduction, Biomass Resources – Biofuels, Biogas, Producer Gas; Biogas Plants, Energy Recovery from Urban Waste, Power Generation from Landfill Gas, Power Generation from Liquid Waste, Biomass cogeneration.

**Fuel Cells** – Introduction, Principle of operation of an Acidic fuel cell, Fuel Cell types, Advantages of Fuel Cell power plants, Fuel Cell battery-powered Bus System.

**UNIT-VIII**

**GEOTHERMAL ENERGY:** Introduction to Geothermal energy, structure of the Earth's interior, Plate Tectonic Theory; Geothermal Resources – Hydrothermal resource, Vapour-dominated Resource, Geopressured Resource, Magma; Geothermal Power Generation.

**TIDAL ENERGY :** Introduction to Tidal Energy, Tidal characteristics, Tidal Energy Estimation, Energy and Power in a Double Cycle System, Development of a Tidal Power Scheme, Important components of Tidal Power Plant, Advantages and disadvantages of Tidal Power.

**TEXT BOOK:**

1. D.P.Kothari, K.C.Singal and Rakesh Ranjan, “Renewable Energy Sources and Emerging Technologies”, PHI Learning Private Limited, Second Edition, 2009.

**REFERENCE BOOKS:**

1. G.D.Rai, “Non-conventional Energy Sources”, Khanna Publications Limited, 1997.
2. Tiwari and Ghosal, “Renewable Energy Sources”, Narosa Publications, 2005.



## SATELLITE COMMUNICATION

(ELECTIVE-I)

(Common to all branches)

Pre-requisites: None

**Course Code: AEC1132**

L	T	P	C
4	0	0	4

### AIM:

Students will learn Satellite Systems and Communications applications comprehensively and apply this knowledge for understanding the existing Modern Satellite Applications.

### OBJECTIVE:

The flow of the syllabus enables students to understand the subject from basics to advanced technologies on Satellite Communications and get prepared for Industry and will not be needing extensive training on these aspects.

### UNIT-I

**SATELLITE ORBITS** : Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility – eclipse-Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion.

### UNIT-II

**SPACE SEGMENT** : Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command.

### UNIT-III

**EARTH SEGMENT** : Earth Station Technology— Terrestrial Interface, Transmitter and Receiver, Antenna Systems TVRO, MATV, CATV, Test Equipment Measurements on G/T, C/No, EIRP, Antenna Gain.

**UNIT-IV**

**SATELLITE LINK DESIGN :** Satellite uplink and downlink Analysis and Design, link budget, E/N calculation- performance impairments- system noise, inter modulation and interference, Propagation Characteristics and Frequency considerations- System reliability and design lifetime.

**UNIT-V**

**SATELLITE ACCESS :** Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, Assignment Methods, Spread Spectrum communication, compression – encryption.

**UNIT-VI**

**SATELLITE APPLICATIONS-COMMUNICATIONS :** INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Specialized services – E –mail, Video conferencing, Internet.

**UNIT-VII**

**PRINCIPLES OF TV & BROADCASTING :** Gross structure, Image continuity, Scanning, flicker, interlaced scanning, number of scanning lines, Fine structure, Tonal Gradation. Video signal dimensions, Horizontal sync. details, Vertical sync. details, Scanning sequence details, Functions of vertical pulse train, Channel bandwidth, vestigial side band transmission, bandwidth allocations for colour transmission.

**UNIT-VIII**

**SATELLITE APPLICATIONS-BROADCAST :** Direct Broadcast satellites (DBS)- Direct to home Broadcast (DTH), Digital audio broadcast (DAB)- World space services, Business TV(BTV), GRAMSAT.

**TEXT BOOKS:**

1. Tri T. Ha, 'Digital Satellite Communication', 2<sup>nd</sup> edition, McGraw-Hill, 1990.
2. R R Gulati , "Monochrome and colour television", New Age International, 2007.

**REFERENCE BOOKS:**

1. M. Richharia, 'Satellite Communication Systems-Design Principles', Macmillan 2003
2. N.Agarwal, 'Design of Geosynchronous Space Craft, Prentice Hall, 1986.
3. Bruce R. Elbert, 'The Satellite Communication Applications' Hand Book, Artech House Boston London, 1997.
4. Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, 'Satellite Communication Systems Engineering', Prentice Hall/Pearson, 2007.





## AIR POLLUTION AND CONTROL (ELECTIVE-II)

**Course Code : ACE 1140**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

### **AIM :**

To understand atmospheric pollution, to analyse causes and effects, strategic planning for control of air pollution.

### **OBJECTIVE:**

Sources – Air pollutants classification – design and operation of control units. Air Quality Management and legal aspects.

### **UNIT-I**

**INTRODUCTION :** Air Pollution – Definitions, Scope, Significance and Episodes, Air Pollutants – Classifications – Natural and Artificial – Primary and Secondary, Point, Line and Areal Sources of air pollution- Stationary and Mobile sources.

### **UNIT-II**

**EFFECT OF AIR POLLUTANTS :** Effects of Air pollutants on man, material and vegetation: Global effects of air pollution – Green House Effect, Heat Islands, Acid Rains, Ozone Holes etc.

### **UNIT-III**

**THERMODYNAMICS OF AIR POLLUTION :** Thermodynamics and Kinetics of Air-pollution – Applications in the removal of gases like  $\text{SO}_x$ ,  $\text{NO}_x$ , CO, HC etc., air-fuel ratio. Computation and Control of products of combustion.

### **UNIT-IV**

**METEOROLOGY OF AIR POLLUTION :** Meteorology and Plume Dispersion; Properties of Atmosphere; Heat, Pressure, Wind forces, Moisture and Relative Humidity, Influence of Meteorological phenomena on Air Quality-Wind rose diagrams.

**UNIT-V**

**AIR POLLUTION MODELLING :** Lapse Rates, Pressure Systems, Winds and Moisture Plume behavior and Plume Rise Models; Gaussian Model for Plume Dispersion.

**UNIT-VI**

**AIR POLLUTION CONTROL – PARTICULATE MATTER :** Control of particulates – Control at Sources, Process Changes, Equipment modifications, Design operation and control.

Equipments – Settling Chambers, Centrifugal separators, Filters Dry and Wet Scrubbers, Electrostatic precipitators.

**UNIT-VII**

**AIR POLLUTION CONTROL – GASEOUS :** General Methods of Control of  $\text{NO}_x$  and  $\text{SO}_2$  emissions – In plant Control Measures, process changes, dry and wet methods of removal and recycling.

**UNIT-VIII**

**AIR QUALITY MANAGEMENT :** Air Quality Management – Monitoring of SPM, SO;  $\text{NO}_x$  and CO. Emission Standards. Conduct of Air pollution survey.

**TEXT BOOKS:**

1. Rao M.N. and Rao H.V.N., Air Pollution, Tata Mc.Graw Hill Company, 2<sup>nd</sup> Edition, 1998.
2. Wark and Warner, Air pollution, Harper & Row, New York, 3<sup>rd</sup> Edition, 1989.
3. Murali Krishna VSG K, Air pollution, Kushal & Co, Kakinada, 2<sup>nd</sup> Edition.

**REFERENCE:**

1. Trivedy R.K and Goel P.K., An introduction to Air pollution, B.S. Publications, 2<sup>nd</sup> Edition 2009.



## **GROUND IMPROVEMENT TECHNIQUES**

### **(ELECTIVE-II)**

**Course Code : ACE 1141**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

#### **AIM :**

To study the various techniques of improving various soils to improve their load carrying capacity.

#### **OBJECTIVE:**

Study of various materials and methods to improve a soil.

#### **UNIT-I**

**DEWATERING :** Methods of de-watering- sumps and interceptor ditches- single, multi stage well points – vacuum well points- Horizontal wells-foundation drains-blanket drains- criteria for selection of fill material around drains –Electro-osmosis .

#### **UNIT-II**

**GROUTING :** Objectives of grouting- grouts and their properties-grouting methods- ascending, descending and stage grouting- hydraulic fracturing in soils and rocks- post grout test.

#### **UNIT-III**

**IN-SITU DENSIFICATION METHODS IN COHESIONLESS SOILS :** Vibration at the ground surface, Impact at the Ground Surface, Vibration at depth, Impact at depth.

#### **UNIT-IV**

**IN –SITU DENSIFICATION METHODS IN COHESIVE SOILS:** Preloading or dewatering, Vertical drains – Sand Drains, Sand wick geodrains – Stone and lime columns – thermal methods.

#### **UNIT-V**

**STABILISATION :** Methods of stabilization-mechanical-cement- lime-

bituminous-chemical stabilization with calcium chloride, sodium silicate and gypsum

### **UNIT-VI**

**REINFORCED EARTH :** Principles – Components of reinforced earth – factors governing design of reinforced earth walls – design principles of reinforced earth walls.

### **UNIT-VII**

**GEOSYNTHETICS :** Geotextiles- Types, Functions and applications – geogrids and geomembranes – functions and applications.

### **UNIT-VIII**

**EXPANSIVE SOILS :** Problems of expansive soils – Mechanism of swelling- tests for identification – methods of determination of swell pressure. Improvement of expansive soils – Foundation techniques in expansive soils – under reamed piles, Sand cushion, CNS technique, granular pile anchor technique, stabilization of expansive soils.

### **TEXT BOOKS:**

1. Hausmann M.R., Engineering Principles of Ground Modification, McGraw-Hill, 3<sup>rd</sup> edition, 1998.
2. Purushotham Raj, Ground Improvement Techniques, Laxmi Publications, 3<sup>rd</sup> edition, 2009.

### **REFERENCES:**

1. Moseley M.P., Ground Improvement, Blackie Academic and Professional, 1<sup>st</sup> edition, 1996.
2. Xanthakos P.P, Abramson, L.W and Bruce, Ground Control and Improvement, D.A John Wiley and Sons, 1<sup>st</sup> edition, 2001.
3. Robert M. Koerner, Designing with Geosynthetics, Prentice Hall, 2<sup>nd</sup> edition, 1992.



## ADVANCED STRUCTURAL DESIGN (ELECTIVE-II)

**Course Code : ACE 1142**

L	T	P	C
4	0	0	4

### AIM :

To impart concepts of structural engineering required for different types of floors, storage structures and bridges.

### OBJECTIVE :

The student shall be able to design and detail flat slabs, grid floors, storage structures and steel bridges as per the relevant IS : codes

### UNIT-I

**FLAT SLABS :** Introduction – Components of flat slab construction- Indian code Recommendations (IS : 456 -2000)- Direct design method – Equivalent frame method – Shear in flat slabs – Detailing of flat slabs- Reinforcement detailing and bar bending schedule need to be prepared.

### UNIT-II

**GRID FLOORS:** Introduction – Analysis and design of grid floors – analysis of rectangular grid floors by Timoshenkos plate theory- Reinforcement detailing and bar bending schedule need to be prepared.

### UNIT-III

**DESIGN OF MULTI-STORIED FRAMES:** Analysis by substitute frame method – Analysis of lateral loads by approximate methods- Reinforcement detailing and bar bending schedule need to be prepared.

### UNIT-IV

**BUNKERS AND SILOS :** Introduction – difference between bunker & silo – concepts of loading and design.

### UNIT-V

**PORTAL FRAMES :** Introduction – Analysis and design of portal frames

**UNIT-VI**

**CHIMNEYS :** Introduction to chimneys – Parts of chimney – Stress in RC shafts due to self weight and wind loads – Stress due to temperature difference – Design of RC chimneys.

**UNIT-VII**

**PLATE GIRDER BRIDGES:** Analysis and design of Plate girder bridges- Detailed drawings must be prepared.

**UNIT-VIII**

**LIGHT GAUGE STEEL STRUCTURES:** Introduction – shapes – definitions – local buckling of plate elements – specifications – design of compression and flexural numbers- Detailed drawings must be prepared.

**FINAL EXAMINATION PATTERN:** The end examination pattern should consists of Parts A & B. Part A consists of two questions in design and drawing out of which one question is to be answered. Part B should consist of three questions out of which two are to be answered. Weightage for Part A is 40% and Part B is 60%.

**TEXT BOOKS:**

1. Varghese P.C., Advanced Reinforced concrete structures, Prentice Hall of India Pvt. Ltd., 6<sup>th</sup> edition, 2005.
2. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, Reinforced concrete structures Vol- 2, Laxmi publications Pvt. Ltd., New Delhi, 5<sup>th</sup> edition, 2007.
3. Duggal S.K., Design of Steel Structures, Mc Graw Hill Publishers, New Delhi, 3<sup>rd</sup> Edition, 2009.

**REFERENCES:**

1. Pillai S.U, and Menon D., Reinforced concrete design, Tata Mc. Graw hill Publishing Company, 2<sup>nd</sup> edition, 2008.
2. Bhavikatti S.S., Advanced RCC Design, New Age International Pvt. Ltd., 4<sup>th</sup> edition.2008.
3. Codes: Relevant IS: codes.



## SOFTWARE DEVELOPMENT ENGINEERING (ELECTIVE- II)

**Course Code: ACS1114**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>1</b>	<b>0</b>	<b>4</b>

### AIM :

- The aim of this course is to provide general background on the Engineering of Software Development process to students in non computer science departments such as civil, chemical, mechanical, electrical engineering, etc.

### OBJECTIVES:

- To provide an understanding of the various processes software engineers may employ in developing contemporary software systems
- To examine all phases of the software development life cycle, from initial planning through implementation and maintenance.
- To develop an understanding of the tools and techniques employed in contemporary software engineering.
- To develop an understanding of the skills required to analyze and design software systems.
- To demonstrate an appreciation of good practices in software engineering.
- To demonstrate the application of software quality concepts.

### UNIT-I

**INTRODUCTION TO SOFTWARE ENGINEERING:** The evolving role of software, Changing Nature of Software, Software Myths.

**A GENERIC VIEW OF PROCESS: SOFTWARE ENGINEERING :** A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), process patterns, process assessment, personal and team process models.

**UNIT-II**

**PROCESS MODELS:** The waterfall model, Incremental process models, Evolutionary process Models, The Unified process, agile methodology.

**SOFTWARE REQUIREMENTS :** Functional and non-functional requirements, user requirements, System requirements, Interface specification, the Software Requirements document.

**UNIT-III**

**REQUIREMENTS ENGINEERING PROCESS :** Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.

**SYSTEM MODELS :** context models, Behavioral models, Data models, object models, structured Methods.

**UNIT-IV**

**DESIGN ENGINEERING :** Design process and Design quality, Design concepts, the design model.

**CREATING AN ARCHITECTURAL DESIGN :** Software Architecture, Data design, Architectural styles and Patterns, Architectural Design.

**UNIT-V**

**OBJECT ORIENTED DESIGN :** Objects and Object classes, An Object Oriented design process, Design Evolution.

**PERFORMING USER INTERFACE DESIGN:** Golden rules, User interface analysis and design, interface Analysis, interface design steps, Design evaluation,

**UNIT-VI**

**TESTING STRATEGIES:** A strategic approach to software testing, the strategies for conventional

Software, Verification Testing and Validation Testing, Different Types of Testing, the art debugging.



**UNIT-VII**

- Client Server Systems - Meaning, Architecture and Design  
Web based Systems - Meaning, Architecture and Design  
Data warehouse System - Meaning, Architecture and Design  
Introduction to RAD Tool ( 3-4 lab sessions included )

**UNIT-VIII**

Write Software Development Specifications that include System Analysis and System design for

- a) A Web Based Application System
- b) A Data warehouse Application system

**TEXT BOOKS:**

1. Rojer S Pressman, Roger S., Software Engineering, A Practitioner's Approach, 7<sup>th</sup> Edition, TMH, 2008.
2. Han, Jiawel and Kamber Micheline, Data Mining – Concepts and Techniques, 2<sup>nd</sup> Edition, Morgan Kaufmann Publishers, 2008.



**DATA STRUCTURES FOR  
ENGINEERING APPLICATIONS**  
(ELECTIVE- II)

**Course Code: AIT1114**

L	T	P	C
4	1	0	4

**AIM :**

To empower students to build efficient software applications with suitable data structures.

**OBJECTIVE :**

To make students understand the software design techniques for solving engineering applications of their discipline

**UNIT-I**

**RECURSION AND LINEAR SEARCH :** Preliminaries of algorithm, Algorithm analysis and complexity, Recursion: Definition, Design Methodology and Implementation of recursive algorithms, Linear and binary recursion, recursive algorithms for factorial function, GCD computation, Fibonacci sequence, Towers of Hanoi.

Chapters 1, 2 from Text Book 1

**UNIT-II**

**SEARCHING TECHNIQUES :** Introduction, Linear Search, Transpose Sequential, Search, Interpolation Search, Binary Search, Fibonacci Search.

Chapter 15 from Text Book 2.

**UNIT-III**

**SORTING TECHNIQUES :** Basic concepts, insertion sort, selection sort, bubble sort, quick sort, merge sort.

Chapter 12 from Text Book 1

**UNIT-IV**

**STACKS :** Basic Stack Operations, Representation of a Stack using

Arrays, Stack Applications: Reversing list, Factorial Calculation, In-fix-to postfix Transformation, Evaluating Arithmetic Expressions.

Chapter 3 from Text Book 1.

#### **UNIT-V**

**QUEUES** : Basic Queues Operations, Representation of a Queue using array, Implementation of Queue Operations using Stack.

Chapter 4 from Text Book 1.

#### **UNIT-VI**

**APPLICATIONS OF QUEUES** : Applications of Queues- Enqueue, Dequeue, Circular Queues, Priority Queues.

Chapter 4 from Text Book 1.

#### **UNIT-VII**

**LINKED LISTS** : Introduction, single linked list, representation of a linked list in memory, Operations on a single linked list, merging two single linked lists into one list, Reversing a single linked list, Circular linked list, Double linked list. Chapter 6 from Text Book 2.

#### **UNIT-VIII**

**TREES** : Basic tree concepts, Binary Trees: Properties, Representation of Binary Trees using arrays and linked lists, operations on a Binary tree, Binary Tree Traversals (recursive), Creation of binary tree from in-order and pre(post)order traversals.

Chapter 8 from Text Book 2.

#### **TEXT BOOKS:**

1. Richard F, Gilberg & Behrouz A. Forouzan, “Data Structures”, 2<sup>nd</sup> Edition, Thomson, 2007.
2. GAV PAI, “Data Structures and Algorithms”, 1<sup>st</sup> Edition, Tata McGraw-Hill, 2010.

#### **REFERENCES:**

1. Seymour Lipschutz, “Data Structure with C”, 1<sup>st</sup> Edition, TMH, 2009.

2. Debasis, Samanta “Classic Data Structures”, 2<sup>nd</sup> Edition, PHI,2009
3. Horowitz,Sahni, Anderson “Fundamentals of Data Structure in C”, 2<sup>nd</sup> Edition, Freed, University Press, 2009.

Note : A small application may be implemented in software from their respective disciplines at the end of the course.



## COMPUTER APPLICATIONS IN CIVIL ENGINEERING

Course Code : ACE 1143

L	T	P	C
0	0	3	2

### AIM :

To provide basic knowledge on Computer Applications in Civil Engineering.

### OBJECTIVE:

The student must be able to analyse multi-storied frames, earth work calculations, sewer pipe design and slope stabilities, using various civil engineering softwares.

### EXERCISES:

1. Analysis of beams.
2. Analysis of 2D frames for gravity loads.
3. Analysis of 2D frames for lateral loads.
4. Analysis of 3D frames for gravity loads.
5. Analysis of 3D frames for lateral loads
6. Analysis of 3D frames for combined gravity and lateral loads.
7. Analysis of trusses.
8. Determine the fundamental frequency and mode shapes for a given structure.
9. Calculation of area and volume for a given block level survey data and to plot the contours.
10. To design the pipe network for a sewer line.
11. Calculation of earth pressures on retaining wall and assessment of slope stability of a finite slope.
12. Determination of safe bearing capacity of soil using C.

**Note :** At least 8 of the above experiments to be conducted.

**SOFTWARES:**

1. STAAD PRO or Equivalent.
2. SURFER
3. SEWER CAD
4. GEOSLOPE or Equivalent.
5. GEO-5 or Equivalent.
6. TURBO-C compiler.



## ENVIRONMENTAL ENGINEERING LAB

**Course Code : ACE 1144**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

**AIM :**

To gain knowledge for water quality testing in accordance to IS standards.

**OBJECTIVE:**

The student must be able to conduct various tests on water.

**LIST OF EXPERIMENTS**

1. Determination of pH Turbidity
2. Determination and Estimation of Total solids, organic solids inorganic solids, determination of Conductivity of Total dissolved solids.
3. Determination of Alkalinity/Acidity.
4. Determination of Optimum coagulant dose
5. Determination of Chlorides.
6. Determination of Chlorine demand.
7. Determination of Dissolved Oxygen.
8. Determination of B.O.D
9. Determination of C.O.D
11. Determination of Nitrogen.
12. Determination of total Phosphates.

Note : At least 8 of the above experiments are to be conducted.

**TEXT BOOKS:**

1. Standard Methods for Analysis of Water and Waste Water – APHA

**REFERENCES :**

1. Relevant IS Codes and Water & Waste Water Analysis Manual of ICMR or NEERI.
2. Sawyer and Mc. Carty, Chemistry for Environmental Engineering





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***COURSE STRUCTURE &  
SYLLABI FOR VIII SEMESTER***

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## SEMESTER VIII

<b>COURSE CODE</b>	<b>THEORY/LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
ACE1145	Bridge Engineering	4	0	0	4
	<b>Elective-III</b>				
ACE1146	Finite Element Methods	4	0	0	4
ACE1147	Transportation Planning and Design	4	0	0	4
ACE1148	Soil Dynamics & Machine Foundations	4	0	0	4
AEE1140	Electrical Safety Management	4	1	0	4
AEE1141	Engineering Ethics	4	1	0	4
AME1150	Fluid Power Systems	4	0	0	4
ACH1148	Optimization Techniques	4	0	0	4
	<b>Elective-IV</b>				
ACE1149	Advanced Structural Analysis	4	0	0	4
ACE1150	Environmental Impact Assessment & Management	4	0	0	4
ACE1151	Advanced Foundation Engineering	4	0	0	4
ACE1153	Green Buildings and Infrastructure	4	0	0	4
ACE1154	Introduction to Aircraft Structures	4	0	0	4
AEE1142	Design Concepts for Engineers	4	1	0	4
ACE11SM	Seminar	0	0	3	2
ACE11CV	Comprehensive Viva	0	0	0	4
ACE11PW	Project work	0	0	9	12
	<b>Total</b>	<b>12</b>	<b>0+</b>	<b>12</b>	<b>30</b>

## BRIDGE ENGINEERING

**Course Code : ACE 1145**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**AIM :**

To acquire basic knowledge in designing various bridge components.

**OBJECTIVE :**

The student shall be able to design and do the detailing of bridges using relevant IS codes.

**UNIT-I**

**GENERAL CONSIDERATIONS FOR ROAD BRIDGES:**

Introduction – Site selection – Soil exploration for site – Selection of bridge type – Economical span – Number of spans – Determination of HFL – General arrangement drawing.

**UNIT-II**

**STANDARD SPECIFICATIONS FOR ROAD BRIDGES :**

Width of carriageway- Clearances- Loads to be considered- Dead load – I.R.C. standard live loads- Impact effect- Review of I.R.C. loadings- Application of live loads on deck slabs – Wind load – Longitudinal forces- Centrifugal forces- Horizontal forces due to water currents – Buoyancy effect- Earth pressure.

**UNIT-III**

**CULVERTS:** Introduction, analysis and design of box culverts- slab culverts – pipe culverts- Reinforcement detailing and bar bending schedule need to be prepared.

**UNIT-IV**

**REINFORCED CONCRETE T-BEAM BRIDGES :** Introduction – Analysis And Design of T – Beam Girder bridges- Reinforcement detailing and bar bending schedule need to be prepared.

**UNIT-V**

**DESIGN OF SUBSTRUCTURE:** Analysis and Design of Abutments and pier- Reinforcement detailing and bar bending schedule need to be prepared.

**UNIT-VI**

**BRIDGE BEARINGS:** Bearings, forces on bearings, design of elastomeric bearings, basics for selection of bearings, expansion joints, closed joints.

**UNIT-VII**

**BRIDGE FOUNDATIONS :** Types of foundations, well foundation – open well foundation, components of well foundation – pile foundations – designs not included- Reinforcement detailing and bar bending schedule need to be prepared.

**UNIT-VIII**

**DESIGN OF THREE HINGED ARCH BRIDGES :** Introduction- primary loads and stresses- design and detailing- Reinforcement detailing and bar bending schedule need to be prepared.

**FINAL EXAMINATION PATTERN:** The end examination pattern should consist of Parts A & B. Part A consists of two questions in design and drawing out of which one question is to be answered. Part B should consist of three questions out of which two are to be answered. Weightage for Part A is 40% and Part B is 60%.

**TEXT BOOKS :**

1. Johnson victor D, Essentials of Bridge Engineering, Oxford, IBH publishing Co., Ltd., 7<sup>th</sup> edition, 2006.
2. Ponnu Swamy, Bridge Engineering, Mc Graw-Hill Publication, 4<sup>th</sup> edition, 2008.
3. Krishna Raju N., Design of Bridges, Oxford and IBH Publishing Co., Ltd., 4<sup>th</sup> edition, 2008.

**REFERENCES :**

1. Vazirani, Ratvani & Aswani, Design of Concrete Bridges, Khanna Publishers, 5<sup>th</sup> edition, 2006.
2. Jagadish T.R. & M.A. Jayaram, Design of Bridge Structures, 2<sup>nd</sup> edition, 2009.
3. Swami Saran, Analysis and Design of sub-structures, Oxford IBH publishing co ltd., 2<sup>nd</sup> edition, 2006.



## FINITE ELEMENT METHODS

(ELECTIVE - III)

**Course Code : ACE 1146**

L	T	P	C
4	0	0	4

**AIM :**

To impart prerequisites and basic concepts of finite element method as applicable to 1D and 2D structural mechanical problems.

**OBJECTIVE:**

To introduce fundamentals & significance of FEM. To understand the concept of solving 1D, 2D plane stress, plane strain and axi-symmetric bodies by FEM. To understand the concept of Isoparametric formulation.

**UNIT-I**

**PRE-REQUISITES OF FEM – I (Methods of Structural Analysis):**

Classification of Problems in Structural Mechanics, Methods of Structural Analysis – Basic concepts of Strain Energy and Unit Load method, Principle of Virtual Work method, Ritz and Rayleigh-Ritz method.

**UNIT-II**

**PRE-REQUISITES OF FEM – II (Theory of Elasticity) -**

Introduction – Concept of Stress and Strain, Notation, Sign Convention and Assumptions in Theory of Elasticity. Equilibrium Equations, Stress-Strain Relationships, Strain-Displacement Relationships, Strain Compatibility Equations and Stress Compatibility Equations for 1D, 2D, 3D, Plane Stress. Plane Strain and Axisymmetric Problems.

**UNIT-III**

**INTRODUCTION TO FEM :** Limitations of Methods of Structural Analysis, Requirements of an ideal method, Mathematical modeling of Physical problems, Concept of Finite element Method – Derivation of Shape Functions, Weak form development. History, Merits and Demerits and Applications of Finite element Method. Finite element Method based

Softwares. Steps involved in FEM as applicable to Structural Mechanics Problems.

#### **UNIT-IV**

**DESCRITIZATION AND CHOICE OF DISPLACEMENT MODEL** - Descritization – Element Shapes – Factors affecting choice of element shapes, Elements for 1D, 2D, 3D, Plane Stress, Plane Strain and Axi-symmetric Problems, Aspect Ratio. Nodes – Types of nodes, Requirements for location of nodes. Finite Element mesh – Factors affecting Element size/number of elements. Choice of displacement interpolation model – Requirements of an ideal Displacement Interpolation model, Different models and suitability of polynomial, Factors affecting Nature (single/two variable) and Degree of Polynomial to be chosen, Degree of Polynomial and accuracy of solution.

#### **UNIT-V**

**FORMULATION OF ELEMENT STIFFNESS MATRIX, SHAPE FUNCTIONS AND STRAIN DISPLACEMENT MATRIX** - Element Stiffness matrix Equation – Derivation of stiffness matrix based on Principle of Minimization of Total Potential Energy and Principle of Virtual Work. Static Condensation – Necessity. Shape Functions – Characteristics/Properties of shape functions – Methods of Determining shape functions. Assemblage of Element Stiffness Matrices – Methods of Assemblage and Formulation of Structure Stiffness matrix.

#### **UNIT-VI**

**ISO-PARAMETRIC FORMULATION** - Isoparametric, sub-parametric and super parametric Elements, Procedure for Formulation, Shape functions for Isoparametric Elements.

#### **UNIT-VII**

**2D ANALYSIS USING F.E.M** : Stiffness Matrix for a Two noded Truss Element, Three noded Truss Element and Two noded Beam Element in Local, Global (2D), Natural and Generalised Co-ordinate Systems. Stiffness Matrix for a Three noded C.S.T and L.S.T elements, Four noded and Eight noded Rectangular Elements and Four noded Quadrilateral Elements in Global Co-ordinate System.



**UNIT-VIII**

**APPLICATION OF F.E.M TO STRUCTURAL MECHANICS PROBLEMS** - Analysis of 2D –Truss, 2D –Truss with initial Strain/Rise in Temperature, Analysis of Propped Cantilevers, Fixed beams, Continuous beams, Portal Frames and Plates.

**TEXT BOOKS :**

1. Tirupati.R. Chandraputla and Ashok D. Belegundu, Finite Elements Methods in Engineering, Pearson Education Publications, 3<sup>rd</sup> edition, 2002.
2. Bhavakatti S.S., Finite Element Analysis, New Age International Publishers, 2<sup>nd</sup> edition, 2010.
3. David V Hutton, Finite Element Analysis, Tata McGraw Hill, New Delhi, 2<sup>nd</sup> edition, 2003.

**REFERENCES :**

1. Robert D.Cook, David S. Malkus and Michael E.Plesha, Concepts and Applications of Finite Element Analysis, John Wiley & Sons, 3<sup>rd</sup> edition, 2001.
2. Krishna Murthy C.S., Finite Element analysis – Theory & Programming, Tata Mc.Graw Hill Publishers, 2<sup>nd</sup> edition, 2005.
3. Seshu P., Text Book of Finite Element analysis, Prentice Hall of India, 3<sup>rd</sup> edition, 2010.



## TRANSPORTATION PLANNING AND DESIGN (ELECTIVE - III)

**Course Code : ACE 1147**

L	T	P	C
4	0	0	4

### AIM :

To introduce the basic concepts of Transportation Planning.

### OBJECTIVE:

Overview of the transportation planning process, concept of travel demand, transportation models and modal split concept.

### 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.

### UNIT-II

**TRANSPORTATION PLANNING PROCESS :** General concept of Trip – Trip Generation – Trip Distribution – Traffic assignment and mode split , Aggregate and disaggregate Models – Direct Demand Models, Sequential and sequential Recursive models.

### UNIT-III

**DATA COLLECTION AND INVENTORIES :** Definition of study area – Zoning principles ; types and sources of Data, Home Interview surveys ; Road side interview surveys; Goods Taxi, IPT surveys ; sampling techniques ; Expansion factors and Accuracy check : Desire line diagram and use.

### UNIT-IV

**TRIP GENERATION MODELS :** Factors governing Trip Generation and Attraction : Multiple linear Regression Models – Category analysis.

**UNIT-V**

**TRIP DISTRIBUTION MODELS METHODS OF TRIP DISTRIBUTION :** Growth Factor Models – Uniform Growth Factor Method ; Average Growth Factor Method ; Fratar Method ; Furness Method ; limitation of Growth Factor Models ; Concept of Gravity Model.

**UNIT-VI**

**TRAFFIC ASSIGNMENT AND MODE SPLIT : PURPOSE OF ASSIGNMENT AND GENERAL PRINCIPLES:** Assignment Techniques – All-or-nothing assignment : Multiple route assignment : Capacity resistant method, minimum path trees ; diversion curves. Factors affecting mode split – Probit logit and Discriminant Analysis.

**UNIT-VII**

**TRANSPORTATION AND ENVIRONMENT :** Detrimental effect of Traffic on Environment : Noise Pollution : Air pollution : Vibrations : Visual Intrusion – Effects and remedial measures.

**UNIT-VIII**

**ECONOMIC EVALUATION OF TRANSPORTATION PLANS :** Costs and benefits of transportation projects ; vehicle operating cost ; time saving, accident costs ; methods of economic evaluation – benefit cost ratio method – net present value method ; internal rate of return method.

**TEXT BOOKS :**

1. Kadiyali L.R., Traffic Engineering and Transportation Planning, Khanna Publishers, Delhi, 8<sup>th</sup> Ed, 2005.
2. Papa Costas C.S., Fundamentals of Transportation Engineering, Prentice Hall, 2<sup>nd</sup> Ed, 2006.

**REFERENCES :**

1. Bruton M.J., Introduction to Transportation Planning, Hutchinson of London, 4<sup>th</sup> Ed, 2009
2. Khisty C.J., Transportation Engineering- An Introduction, Prentice Hall, 3<sup>rd</sup> Ed, 2008.

**SOIL DYNAMICS AND MACHINE  
FOUNDATIONS**  
(ELECTIVE - III)

**Course Code : ACE 1148**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**AIM :**

To study the influence of vibration on soil mass.

**OBJECTIVE:**

Analysis and design of foundation subjected to vibrations.

**UNIT-I**

**THEORY OF VIBRATIONS :** Basic definitions- free and forced vibrations with and without damping for single degree freedom system- Resonance and its effect – magnification – Logarithmic decrement – Transmissibility

**UNIT-II**

**NATURAL FREQUENCY OF FOUNDATION – SOIL SYSTEM:** Barkan's and IS methods – pressure bulb concept – Pauw's Analogy.

**UNIT-III**

**WAVE PROPAGATION :** Elastic waves in Rods – Waves in elastic Half space.

**UNIT-IV**

**DYNAMIC SOIL PROPERTIES :** Field and Laboratory methods of determination – Uphole, Down hole and cross hole methods – Cyclic plate load test – Block vibration test – Determination of Damping factor.

**UNIT-V**

**MACHINE FOUNDATIONS :** Types, Design criteria, permissible amplitudes and bearing pressure.

**UNIT-VI**

**BLOCK FOUNDATION :** Degrees of freedom - analysis under different modes of vibration

**UNIT-VII**

**DESIGN OF FOUNDATIONS FOR RECIPROCATING AND IMPACT MACHINES:** Analysis of Two Degree freedom systems under free and forced vibrations -Principles of Design of Foundations for reciprocating and impact machines as per IS code.

**UNIT-VIII**

**VIBRATION ISOLATION:** Types and methods – Isolating materials and their properties

**TEXT BOOKS:**

- 1) Srinivasulu P. and Vaidyanathan G.V., Handbook of Machine Foundations, Tata McGraw Hill, 2<sup>nd</sup> edition, 1999.
- 2) Shamsheer Prakash, Soil Dynamics, John Wiley publications, 3<sup>rd</sup> edition, 2000.

**REFERENCES:**

- 1) Barkan, Dynamics of Bases and Foundations, McGraw Hill Publishing, 2<sup>nd</sup> edition, 1970.
- 2) Richart, Hall and Woods, Vibration of Soils and Foundations, Prentice Hall, 1<sup>st</sup> Ed, 1981.



## **ELECTRICAL SAFETY MANAGEMENT**

(ELECTIVE – III)

**Course Code: AEE 1140**

L	T	P	C
4	1	0	4

### **AIM :**

To familiarize with the Electrical Safety in hazardous areas and to provide basic precautions in engineering practices.

### **OBJECTIVE:**

To understand various electrical rules and acts, safety precautions in electrical systems

### **UNIT-I**

**INTRODUCTION TO ELECTRICAL SAFETY** : Terms and definitions, objectives of safety and security measures, Hazards associated with electric current, and voltage, who is exposed, principles of electrical safety, Approaches to prevent Accidents, scope of subject electrical safety, Fire prevention and Fire Fighting.

### **UNIT-II**

**ELECTRICAL SHOCKS THEIR PREVENTION AND FIRST AID:** Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark overs, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shops.

First Aid: first principles of actions after electric shocks, Artificial respiration, External Cardiac massage, Control of bleeding, burns and scalds and Heat exhaustion

### **UNIT-III**

**ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL AND AGRICULTURAL INSTALLATIONS** : Wiring and fitting –

Domestic appliances – water tap giving shock – shock from wet wall – fan firing shock – multi-storied building – Temporary installations – Agricultural pump installation – Do’s and Don’ts for safety in the use of domestic electrical appliances.

#### **UNIT-IV**

#### **SAFETY DURING INSTALLATION, TESTING AND COMMISSIONING, OPERATION AND MAINTENANCE:**

Preliminary preparations – safe sequence – risk of plant and equipment – safety documentation – field quality and safety - personal protective equipment – safety clearance notice – safety precautions – safeguards for operator’s safety.

#### **UNIT-V**

**ELECTRICAL SAFETY IN HAZARDOUS AREAS :** Hazardous zones – class 0,1 and 2 – spark, flashovers and corona discharge and functional requirements – Specifications of electrical plants, equipments for hazardous locations – Classification of equipment enclosure for various hazardous gases and vapours – classification of equipment/enclosure for hazardous locations.

#### **UNIT-VI**

**EQUIPMENT EARTHING AND SYSTEM NEUTRAL EARTHING:** Introduction, Distinction between system grounding and Equipment Grounding, Equipment Earthing, Functional Requirement of earthing system, description of a earthing system, , neutral grounding( System Grounding), Types of Grounding, Methods of Earthing Generators Neutrals.

#### **UNIT-VII**

#### **SAFETY MANAGEMENT OF ELECTRICAL SYSTEMS :**

Principles of Safety Management, Management Safety Policy, Safety organization, safety auditing, Motivation to managers, supervisors, employees.

#### **UNIT-VIII**

#### **REVIEW OF IE RULES AND ACTS AND THEIR SIGNIFICANCE :**

Objective and scope – ground clearances and section clearances – standards on electrical safety - safe limits of current, voltage – earthing

of system neutral – Rules regarding first aid and fire fighting facility.

The Electricity ACT, 2003, (Part1, 2, 3,4 & 5)

**TEXT BOOKS:**

1. S. Rao, Prof. H.L. Saluja, “Electrical safety, fire safety Engineering and safety management”, Khanna Publishers. New Delhi, 1988.
2. Pradeep Chaturvedi, “Energy management policy, planning and utilization”, Concept Publishing company, New Delhi, 1997.

**WEB REFERENCE:**

1. [www.apeasternpower.com/downloads/elecact2003.pdf](http://www.apeasternpower.com/downloads/elecact2003.pdf)





## ENGINEERING ETHICS

(ELECTIVE – III)

**Course Code: AEE 1141**

L	T	P	C
4	1	0	4

### AIM & OBJECTIVE:

To bring awareness of the importance of ethics within the engineering profession as the work of engineers can affect public health and safety. Also to bring awareness of what is called moral autonomy which is the ability to think critically and independently about moral issues and apply this moral thinking to situations that arise in the course of professional engineering practice.

### UNIT-I

Introduction. Why ethics? Personal, professional ethics. Origin of ethical thought. Case studies.

### UNIT-II

Professionalism and codes of ethics. Codes of ethics. Professional ethics.

### UNIT-III

Understanding ethical problems. History of ethical thought. Ethical theories.

### UNIT-IV

Ethical problem solving techniques. Analysis of issues in ethical problems. Line diagrams. Flow charts. Conflict problems.

### UNIT-V

Risk, safety and accidents. Safety and risks. Accidents.

### UNIT-VI

The rights and responsibilities of engineers. Professional responsibilities.

### UNIT-VII

Ethics in research and experimentation. Case studies.

**UNIT-VIII**

Doing the right thing. Case studies.

**TEXT BOOK:**

1. Charles B. Fleddermann, Engineering Ethics, Pearson Education, 2<sup>nd</sup> Edition, 2004.

**REFERENCE BOOKS:**

1. Roland Schinzinger & Mik. W. Martin “ Introduction to Engineering Ethics “ Mc GrawHill, Newyork – 2000.
2. Charles E. Harris, JR Michael S.Pritchard and Michel J Rabins. “Engineering Ethics, Concepts & Cases” Wadsworth Publishing Company, Belmont, CA, 2000.



## FLUID POWER SYSTEMS

(ELECTIVE-III)

**Course Code: AME1150**

L	T	P	C
4	0	0	4

### **AIM& OBJECTIVE :**

To provide the student with an in – depth background in the field of fluid power. To provide knowledge related to the operation maintenance and application of fluid power systems.

### **UNIT-I**

**INTRODUCTION TO HYDRAULIC SYSTEMS AND ANCILLARY HYDRAULIC SYSTEMS:** Introduction to Hydraulic Systems, Construction of Hydraulic Reservoir, Gravity type, Spring-loaded and Gas loaded type Accumulators

### **UNIT-II**

**HYDRAULIC PUMPS :** Gear pumps, Vane pumps and Piston pumps, Selection of Hydraulic Pumps

### **UNIT-III**

**HYDRAULIC CONTROL VALVES :** Direction Control Valves, Pressure Control Valves, Flow Control Valves, Servo Valves

### **UNIT-IV**

**HYDRAULIC CYLINDERS AND HYDRAULIC MOTORS :** Hydraulic cylinder operation and cylinder mountings, Hydraulic cylinder and Cushions, Hydraulic Motors operation- Gear, Vane and Piston motors, Hydraulic Motor performance, Hydrostatic Transmissions

### **UNIT-V**

**HYDRAULIC CIRCUITS-I:** Introduction, Control of a Single-Acting Hydraulic Cylinder, Control of a Double Acting Hydraulic Cylinder, Regenerative Circuit, Pump-Unloading Circuit, Double-Pump Hydraulic System, Pressure Intensifier Circuit, Counterbalance Valve Application, Hydraulic Cylinder Sequencing Circuits.

**UNIT- VI**

**HYDRAULIC CIRCUITS-II :** Cylinder Synchronizing Circuits, Fail Safe Circuits, Speed control of a Hydraulic Cylinder, Speed control of a Hydraulic Motor, Hydraulic Motor Braking System, Hydrostatic Transmission System, Accumulators and Accumulator Circuits, Mechanical-Hydraulic Servo System.

**UNIT-VII**

**PNEUMATIC CIRCUITS AND APPLICATIONS :** Introduction to Pneumatics, Basic Pneumatic Circuits and applications.

**UNIT-VIII****MAINTENANCE AND TROUBLE SHOOTING OF HYDRAULIC & PNEUMATIC CIRCUITS AND COMPONENTS:**

Oxidation and Corrosion of Hydraulic Fluids, Maintaining and Depositing of Fluids, Wear of moving parts due to solid particle contamination of the fluid, Problems caused by gases in Hydraulic Fluids, Troubleshooting of Hydraulic System, Common problems in Pneumatic

Systems, Troubleshooting of Pneumatic Systems

**TEXT BOOKS:**

1. Anthony Esposito, Fluid Power with Applications, PHI, New Delhi, 1<sup>st</sup> Edition, 2005
2. Andrew Parr, Hydraulics and Pneumatics, Jaico Publishing house, 9<sup>th</sup> Edition, 2005

**REFERENCES:**

1. S.R.Majumdar, Oil Hydraulic Systems , Tata McGraw Hill, 1<sup>st</sup> Edition ,2002
2. S.R.Majumdar, Pneumatic Systems , Tata McGraw Hill, 1<sup>st</sup> Edition, 2002

**WEB REFERENCES :**

1. [www.pneumatics.com](http://www.pneumatics.com)
2. [www.fluidpower.com](http://www.fluidpower.com).



## OPTIMIZATION TECHNIQUES

(ELECTIVE-III)

**Course Code: ACH1148**

L	T	P	C
4	0	0	4

50 Hours of theory + 10 Hours of Lab Practice on MATLAB OPTIMIZATION Toolbox.

### AIM & OBJECTIVES:

This course is concerned with formulating the optimization problems and solving them. Advanced topics on Evolutionary Optimization are also treated. MATLAB optimization Toolbox is used to solve large scale optimization problems.

### UNIT-I

**INTRODUCTION TO PROCESS OPTIMIZATION:** Formulation of various process optimization problems and their classification, constrained and unconstrained optimization. Classification of points in the 2D space.

Basic concepts of optimization: Convex Set, Convex functions, necessary and sufficient conditions for stationary points. Calculating Gradient of a function and Hessian matrix. Identifying minima and maxima points.

### UNIT-II

**LINEAR PROGRAMMING:** SIMPLEX algorithm, duality in Linear programming.

### UNIT-III

**TRANSPORTATION PROBLEM:** Solution of Balanced problems using East-West Rule.

### UNIT-IV

**UNCONSTRAINED OPTIMIZATION:** Optimality Criteria, Unidirectional search, Powell's Conjugate direction method, Gradient based method: Cauchy's steepest Descent method; Newton's method.

**UNIT-V**

**CONSTRAINED OPTIMIZATION:** Kuhn-Tucker conditions, Transformation methods: Penalty function method, method of multipliers.

**UNIT-VI**

**DISCRETE OPTIMIZATION:** Enumeration techniques and Branch and Bound method to solve discrete optimization problem.

**UNIT-VII**

**GENETIC ALGORITHMS:** Working principles, differences between GA and traditional methods. Various operators like crossover and mutation.

**SIMULATED ANNEALING.** Metropolis Algorithm. (Qualitative treatment of GA and SA only).

**UNIT-VIII**

**MULTIOBJECTIVE OPTIMIZATION (MOO):** Different methods to solve MOO like Utility function method and bounded function method. Solving 2D MOO problems graphically and identifying the Pareto set.

**TEXT BOOKS:**

1. Kalyanmoy D, "Optimization for Engineering Design", Prentice Hall of India, 2<sup>nd</sup> Edition, 2005.
2. Rao S.S, "Engineering Optimization-Theory & Practises", New Age International Publishers, New Delhi, 3<sup>rd</sup> Edition, 1996.

**REFERENCE:**

1. Reklaitis, G.V., Ravindran, A., and Ragdell, "Engineering Optimization-Methods and Application", K.M., John Wiley, New York, 2<sup>nd</sup> Edition, 2006.



## ADVANCED STRUCTURAL ANALYSIS (ELECTIVE - IV)

**Course Code : ACE1149**

L	T	P	C
4	0	0	4

**AIM :**

To impart knowledge on advanced structural analysis.

**OBJECTIVE:**

The student shall be able to analyse structures by matrix methods.

**UNIT-I**

**MOMENT DISTRIBUTION METHOD :** Application to the analysis of portal frames with inclined legs, gable frames

**UNIT-II**

**STRAIN ENERGY METHOD :** Application to the analysis of continuous beams and simple portal frames.

**UNIT-III**

**INFLUENCE LINES:** Influence line diagrams for Reaction, Shearing force and Bending moment in case of determinate beams and Influence line diagrams for member forces in determinate trusses – application of influence line diagrams.

**UNIT-IV**

**ARCHES :** Analysis Two hinged and Three hinged arches using influence lines.

**UNIT-V**

**FLEXIBILITY METHOD:** Introduction to the structural analysis by flexibility concept using Matrix approach and application to frames simple grids and trusses.

**UNIT-VI**

**STIFFNESS METHOD:** Introduction to the structural analysis by

stiffness concept using Matrix approach and application to frames simple grids and trusses.

### **UNIT-VII**

**BEAMS ON ELASTIC FOUNDATION:** Introduction – Sub grade modulus and stiffness – Analysis of simple beams resting on semi infinite elastic medium and estimation of shear force and Bending moment.

### **UNIT-VIII**

**PLASTIC ANALYSIS:** Introduction – Idealized stress – Strain diagram – shape factors for various sections – Moment curvature relationship – ultimate moment – Plastic hinge – lower and upper bound theorems – ultimate strength of fixed and continuous beams.

### **TEXT BOOKS:**

1. Pandit and Gupta, Matrix Methods of Structural Analysis, Tata Mc.Graw Hill, 2<sup>nd</sup> edition, 2000.
2. Vazirani and Ratwani., Analysis of structures Vol. I & II, Khanna publications, 4<sup>th</sup> edition, 2009.

### **REFERENCES:**

1. Prakash Rao D.S., Structural Analysis, Sagar books, 3<sup>rd</sup> edition, 2008.
2. Bhavi Katti S.S, Structural Analysis Vol. I & II, Vikas Publications, 4<sup>th</sup> edition, 2010.





## ENVIRONMENTAL IMPACT ASSESSMENT & MANAGEMENT (ELECTIVE - IV)

**Course Code : ACE1150**

L	T	P	C
4	0	0	4

### **AIM :**

To acquire the knowledge and skills for the preparation of E.I.A for various developmental activities.

### **OBJECTIVE:**

It is mandatory requirement to include E.I.A for all projects. After studying the course / subject, the student should be able to plan for an E.I.A. study and suggest EMP.

### **UNIT-I**

**INTRODUCTION:** Environment and its interaction with human activities. Environmental Imbalances, Basic concept of EIA, Elements of EIA, - Environmental attributes, Indicators Screening and Scoping of Environmental Impact Statement (E I S).

### **UNIT-II**

**ENVIRONMENTAL SETTING :** Environmental Inventory, Environmental Indicators – Parameters, Indicators for terrestrial subsystems, Indicators for aquatic subsystems, Socio-economic indicators, Indicators for health and nutrition.

### **UNIT-III**

**E I A METHODOLOGIES:** Important consideration for choosing a methodology, categorization of methodologies Review Criteria Environmental Management Plan (E M P). Step by Step procedure of preparing an E.I.A.

### **UNIT-IV**

**PREDICTION AND ASSESSMENT OF IMPACTS ON THE AIR ENVIRONMENT :** Impacts on the surface water environment, on vegetation and wild life.

**UNIT-V**

**PREDICTION AND ASSESSMENT OF IMPACTS ON SOIL AND GROUND WATER ENVIRONMENT :** Impacts on the Biological Environment, on the Socio-Economic Environment.

**UNIT-VI**

**PREDICTION AND ASSESSMENT OF IMPACTS ON THE CULTURAL ENVIRONMENT :** Definite Methods for evaluation of alternatives, Public participation.

**UNIT-VII**

**ENVIRONMENTAL AUDIT :** Environmental legislation, Objectives of Environmental Audit, Types, Audit Protocol, Evaluation of Audit data and preparation of audit report.

**UNIT-VIII**

**IMPACT ASSESSMENT :** Preparation of Impact Assessment for some industries and case studies – Standard and mandatory requirements. Environmental risk analysis – Definition of Risk. Fault Tree analysis, Consequence Analysis – Cost – Benefit analysis – Life cycle assessment, Resource Balance – Energy balance & Management Review.

**TEXT BOOKS:**

1. Jain, R.K., Urban L.V., Stracy, G.S., Environmental Impact Analysis, Vau Nostrand Reinhold Co, New York, 2<sup>nd</sup> Ed., 2004.
2. Anjaneyulu, Vall Manickam, Environmental Impact Assessment Methodologies, B.S.Publications, Sultanbazar, Hyderabad, 1<sup>st</sup> Ed., 2007.

**REFERENCES:**

1. Ran, J.G. & Wooten, D.C., Environmental Impact Assessment”, Mc Graw Hill Pub. Co. Ltd, New York, 2<sup>nd</sup> Edition, 2008.
2. UNESCO, Methodologies, Guidelines for the Integrated Environmental Evaluation of Water Resources Development, UNESCO/UNEP, Paris, 1987.

## ADVANCED FOUNDATION ENGINEERING (ELECTIVE - IV)

**Course Code : ACE1151**

L	T	P	C
4	0	0	4

**AIM :**

To study the various foundations systems for structures such as tall towers, bridges etc.

**OBJECTIVE:**

Analysis and design of foundations for structures such as tall towers, bridges and design of temporary retaining structures.

**UNIT-I**

**FOUNDATION DESIGN BASICS-I :** Depth, spacing of footings, erosion problems, water table effects, foundations on sands, silts, clays, landfills (qualitative treatment only)

**UNIT-II**

**FOUNDATION DESIGN BASICS –II :** Introduction to design of spread footings, rectangular footings, eccentrically loaded spread footings, basics of beams on elastic foundation and ring foundations.

**UNIT-III**

**MAT FOUNDATIONS :** Types, bearing capacity, settlements, subgrade reaction, design guidelines

**UNIT-IV**

**DEEP FOUNDATIONS- III :** Stresses during pile driving, tension piles, negative skin friction, under-reamed piles.

**UNIT-V**

**DEEP FOUNDATIONS- IV :** Guidelines for design of pile caps, batter piles, laterally loaded piles- ultimate capacity of laterally loaded piles.

**UNIT-VI**

**DEEP FOUNDATIONS -V :** Drilled piers – uses, load carrying capacity, settlements.

**UNIT-VII**

**PILE FOUNDATIONS :** Cantilever sheet piles and anchored bulkheads, Earth pressure diagram Determination of Depth of embedment in sands and clays – Timbering of trenches- Earth pressure diagrams – Forces in struts.

**UNIT-VIII**

**COFFER DAMS :** Stability, bearing capacity, settlements (qualitative treatment only).

**TEXT BOOKS:**

1. Das, B.M., Principles of Foundation Engineering, PWS Publishing, Singapore, 4<sup>th</sup> edition, 1999.
2. Bowles, J.E., Foundation Analysis and Design, McGraw- Hill International, 4<sup>th</sup> edition, 1988.

**REFERENCES :**

1. Venkataramaiah C., Geotechnical Engineering, New Age International Pvt.Ltd, Publishers, 5<sup>th</sup> edition, 2009.
2. Swami Saran, Analysis and Design of Substructures, Oxford & IBH Publishing Company Pvt.Ltd, 3<sup>rd</sup> Ed, 2009.
3. Gopal Ranjan & ASR Rao, Basics and Applied Soil Mechanics, New Age International Pvt.Ltd, Publishers, 4<sup>th</sup> Edition, 2002.



## **GREEN BUILDINGS AND INFRASTRUCTURE**

### **(ELECTIVE - IV)**

<b>Course Code : ACE 1153</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Pre-requisites: None</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

#### **AIM:**

To impart knowledge regarding environmental sustainability and environmentally responsible green buildings.

#### **OBJECTIVE:**

The student must be able to develop skills to promote eco friendly characteristics in the area of buildings and identify crucial technologies, facilities and applications that help in developing green buildings.

#### **UNIT-I**

**INTRODUCTION :** Introduction to Green Buildings.

#### **UNIT-II**

**MACRO- ENVIRONMENT :** Elements of climate, weather, Water cycle, Carbon cycle, Environmental quality, Deforestation, climatic change, Ozone depletion and implications.

#### **UNIT-III**

**MICRO-ENVIRONMENT :** Natural environment vis-à-vis built in environment. Living environment characteristics and components of Urban Ecosystem, solar radiation, heat flow, air-movement, Land use, drainage and sanitation.

#### **UNIT-IV**

**CONCEPTS OF GREEN FIELD DEVELOPMENT :** Brown field development, environmental impact and ecological balance, FAR, layouts, sustainable Site development, vegetation, landscape elements, alternative services and technologies, rain water harvesting, on site sewerage retention, treatment, recycle and reuse.

**UNIT -V**

**BUILDING RESOURCES :** Passive energy system Design, Building envelope, orientation and components of building fabric and shading, High rise buildings, modular building Construction of curtain walls, Sourcing and recycling of building materials, alternative calcareous, metallic and non metallic, materials

**UNIT-VI**

**BUILDING INFRASTRUCTURE:** Active Energy Systems in buildings, Utilities and services, building automation. electro-mechanical systems, lifts and transportation, captive power plant and equipment, operation & maintenance

**UNIT-VII**

**INDOOR AIR QUALITY :** Fresh air requirements standards, Sick Building Syndrome and pollutants.

**UNIT-VIII**

**BUILDING RATING SYSTEMS :** Building auditing, points system, components, and weight age, agencies and institutions, GBC, TERI etc, green buildings in the contexts of Indian sub continent.

**TEXT BOOKS :**

1. Koenigsberger, O.H., Manual of Tropical Housing and Building, Orient Longman publishers, Chennai, 1<sup>st</sup> Ed., 2003.
2. Odum, P. Eugene., Ecology and Environments, Oxford and IBH Publishers, New Delhi, 2<sup>nd</sup> edition, 2005.

**REFERENCES:**

1. Greening Building – Green Congress, US.(web).
2. HSMI. Sustainable Building Technology – HUDCO, HSMI (Human Settlement Management Institution, New Delhi.



## **INTRODUCTION TO AIRCRAFT STRUCTURES** (ELECTIVE - IV)

**Course Code : ACE1154**

**L T P C**

**Pre-requisites: None**

**4 0 0 4**

### **AIM:**

To impart knowledge on the materials and analysis of Aircraft structures.

### **OBJECTIVE:**

To acquire fundamentals of structural analysis, properties of various materials used, concepts of air worthiness and certifications.

### **UNIT-I**

#### **OVERVIEW OF THE AIRCRAFT DESIGN PROCESS:**

Introduction, Phases of Aircraft Design, Aircraft Conceptual Design Process, Conceptual Stage, Preliminary Design, Detailed Design, Design Methodologies

### **UNIT-II**

#### **FUNDAMENTALS OF STRUCTURAL ANALYSIS :**

Review of Hooke's Law, Principal stresses, Equilibrium and Compatibility, Determinate Structures, St Venant's Principle, Conservation of Energy, Stress Transformation, Stress Strain Relations

### **UNIT-III**

#### **INTRODUCTION TO AIRCRAFT STRUCTURES :**

Types of Structural members of Fuselage and wing section Ribs, Spars, Frames, Stringers, Longerons, Splices, Sectional Properties of structural members and their loads, Types of structural joints, Type of Loads on structural joints

### **UNIT-IV**

#### **AIRCRAFT LOADS :**

Aerodynamic Loads, Inertial Loads, Loads due to engine, Actuator Loads, Maneuver Loads, VN diagrams, Gust Loads, Ground Loads, Ground conditions, Miscellaneous Loads

**UNIT-V**

**AIRCRAFT MATERIALS AND MANUFACTURING PROCESSES :** Material selection criteria, Aluminum Alloys, Titanium Alloys, Steel Alloys, Magnesium Alloys, copper Alloys, Nimonic Alloys, Non Metallic Materials, Composite Materials, Use of Advanced materials Smart materials, Manufacturing of A/C structural members, Overview of Types of manufacturing processes for Composites, Sheet metal Fabrication ,Machining, Welding, Superplastic Forming And Diffusion Bonding

**UNIT-VI**

**STRUCTURAL ANALYSIS OF AIRCRAFT STRUCTURES :** Theory of Plates- Analysis of plates for bending, stresses due to bending, Plate deflection under different end conditions, Strain energy due to bending of circular, rectangular plates, Plate buckling, Compression buckling, shear buckling, Buckling due to in plane bending moments, Analysis of stiffened panels in buckling, Rectangular plate buckling, Analysis of Stiffened panels in Post buckling, Post buckling under shear. **Sample Exercises.**

Theory of Shells-Analysis of Shell Panels for Buckling, Compression loading, Shear Loading / Shell Shear Factor, Circumferential Buckling Stress, **sample exercises**

Theory of Beams-Symmetric Beams in Pure Bending, Deflection of beams, Unsymmetrical Beams in Bending, Plastic Bending of beams, Shear Stresses due to Bending in Thin Walled Beams, Bending of Open Section Beams, Bending of Closed Section Beams, Shear Stresses due to Torsion in Thin Walled Beams. **Sample Exercises.**

Theory of Torsion- Shafts of Non-Circular Sections, Torsion in Closed Section Beams, Torsion in Open Section Beams, Multi Cell Sections, **Sample Exercises.**

**UNIT-VII**

**AIRWORTHINESS AND AIRCRAFT CERTIFICATION :** Definition, Airworthiness Regulations, Regulatory Bodies, Type certification, General Requirements, Requirements Related to Aircraft Design Covers, Performance and Flight Requirements, Airframe Requirements, Landing



Requirements, Fatigue and Failsafe requirements, Emergency Provisions, Emergency Landing requirements

### **UNIT-VIII**

**AIRCRAFT STRUCTURAL REPAIR :** Types of Structural damage, Nonconformance, Rework, Repair, Allowable damage Limit, Repairable Damage Limit, Overview of ADL Analysis, Types of Repair, Repair Considerations and best practices

#### **TEXT BOOKS :**

1. Aircraft Design-A Conceptual Approach by Daniel P.Raymer, AIAA education series,6<sup>th</sup> Edition
2. Airframe Structural Design by Michael Niu, Conmilit Press, 1988,2<sup>nd</sup> Edition
3. Airframe Stress Analysis and Sizing by Michael Niu, Conmilit Press, 1999,3<sup>rd</sup> Edition
4. The Elements of Aircraft Preliminary Design – Roger D. Schaufele, Aries Publications, 2000
5. Aircraft Structural Maintenance by Dale Hurst, Avotek publishers, 2<sup>nd</sup> Edition, 2006
6. Aircraft Maintenance & Repair by Frank Delp, Michael J. Kroes & William A. Watkins, Glencoe &McGraw-Hill,6<sup>th</sup> Edition,1993
7. An Introduction to Aircraft Certification; A Guide to Understanding Jaa, Easa and FAA by Filippo De Florio, Butterworth-Heinemann

#### **WEB RESOURCES :**

1. <http://www.aero.org/>
2. [http://www.rl.af.mil/rrs/resources/griffiss\\_aeroclub/aircraft.html](http://www.rl.af.mil/rrs/resources/griffiss_aeroclub/aircraft.html)
3. [http://en.wikipedia.org/wiki/Tesla\\_turbine](http://en.wikipedia.org/wiki/Tesla_turbine)
4. <http://ameslib.arc.nasa.gov/randt/1999/aero/aero.html>
5. [http://www.ctas.arc.nasa.gov/project\\_description/pas.html](http://www.ctas.arc.nasa.gov/project_description/pas.html)
6. [http://www.moog.com/noq/\\_acoverview\\_\\_c463/](http://www.moog.com/noq/_acoverview__c463/)

7. <http://www.dcmr.cranfield.ac.uk/aerextra/e339.htm>
8. <http://www.aeromech.usyd.edu.au/structures/as/acs1-p4.htm>
9. <http://www.av8n.com/how/htm/xref.html>
10. <http://www.aviation-history.com/video.html>



## DESIGN CONCEPTS FOR ENGINEERS

### (ELECTIVE – IV)

**Course Code: AEE1142**

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#### **AIM & OBJECTIVE:**

To teach the principles of design, and how they apply to engineering design projects and future job activities. It teaches the design process, rather than the technical details of any one engineering field. Basic design principles of, and design tools, are introduced.

#### **UNIT-I**

What is engineering? Definition. Various fields of engineering. Engineering professional bodies.

#### **UNIT-II**

What is design? Difference between analysis, design, and replication. Good design versus bad design. The design cycle. Overall objectives.

#### **UNIT-III**

Modeling and analysis. Gathering information. Build document and test. Revise. Informal brain storming. Examples.

#### **UNIT-IV**

Project management and team work skills. Working in a team. Building a team. Job description. Team meetings. Working with other teams.

#### **UNIT-V**

Time line. Pert. Documentation. Logbook. Technical reports. Electronic documentation. Case studies.

#### **UNIT-VI**

Engineering tools. Estimation. Significant figures. Plots. Prototyping. Reverse engineering. Computer analysis.

**UNIT-VII**

The human machine interface. How people interact with machines. Ergonomics. Societies view of engineering. Learning from mistakes. Role of failure. Case studies.

**UNIT-VIII**

Learning to speak, write, and make presentations. Importance of good communication. Preparing for meetings. Preparing a formal presentation. Technical papers. Proposals. Instructional manuals.

**TEXT BOOK:**

1. Design Concepts for Engineers Mark .N Horenstien, Prentice Hall, 4<sup>th</sup> Edition, 2009.

**REFERENCE BOOK:**

1. Balbir S. Dillon, “Advanced Design Concepts for Engineers”, Technology Publishing Company, 1<sup>st</sup> Edition, 1998.

