

**I Ground Motion during Earthquakes:**

Seismology, Seismic Zoning Map, Characteristics and Study of Strong Motion; Types of Waves: P-, R- and S-waves; Epicenter, Hypocenter, Locating Epicenter; Terminologies - magnitude, intensity and measurement, Record of notable earthquakes

**II Dynamics of Structures:**

Undamped system; Springs in parallel or in series; Newton's laws of motion; D' Alembert's principle; Dynamic equation of motion; Solution of dynamic equation of motion for critically, overdamped and underdamped system; Logarithmic decrement; Free and forced vibration; Response of single D.O.F system to harmonic loading.

**III Time domain solution of dynamic equation of motion and response spectra:**

Central difference method; Newmark's average acceleration method. Construction of response spectrum; Tripartite response spectrum; Response spectrum for elastic design

**IV Free and forced vibration of shear buildings:**

Natural frequency and normal modes; Orthogonality properties of normal modes; Modal superposition method; Response of a shear building to base motion.

**V Philosophy of Earthquake Resistant Design of R C Buildings:**

Concepts; Effect of Vibration on Structures; Basics of Earthquake Resistant Design; Architectural consideration in Design of Buildings to resist earthquakes; strong column-weak beam principle; Ductility consideration in Earthquake Resistant Design;

**VI Earthquake Resistance consideration for R C Buildings as per IS 1893-2002:**

IS 1893-2002 – BIS code provisions; Design Lateral Load – determination on Code Procedure; Infill wall consideration in Seismic Analysis; Mathematical modeling and Stepwise Procedure for Analysis

**VII Seismic Evaluation and Retrofitting of Buildings:**

Provisions for Improving Performance of non-engineered Masonry Construction; Retrofitting Strategies of R C and Masonry Buildings; Practical Approach towards Seismic Evaluation of R C Buildings; Description of Form 6

**References:**

- i. AGARWAL PANKAJ and SHRIKHANDE MANISH : Earthquake Resistant Design of Structures, Prentice-Hall (2006)
- ii. COBURN ANDREW and SPENCER ROBIN : Earthquake Protection, John Wiley
- iii. CHOPRA A. K. : Dynamics of Structures – Theory and Applications to Earthquake Engineering, Prentice Hall
- iv. IS : 1893 - 2002, Indian Standard Criteria for Earthquake Resistant Design of Structures :
- v. Part I – General Provisions and Buildings
- vi. IS : 13920-1993, Indian Standards Guide to Practice for Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces

**I. Irrigation Principles and Practices:**

Introduction, Necessity, Advantages and disadvantages of irrigation, Classification, Methods of irrigation, Soil – water - crop and their relationship, Frequency of irrigation.

**II. Water Requirement of Crop:**

Optimum use of water, Factors affecting water requirement of a crop, Duty, Delta and base period and their relationship, Consumptive use, irrigation efficiency.

**III. Flow Irrigation:**

Classification of canals, Canal alignment, Flow in alluvial channels, Design of channels for maximum permissible velocity, Kennedy's silt theory and design of channels on its basis, Lacey's silt theory and regime equations, Design of channels based on Lacey's equation.

**IV. Flow irrigation (Contd.):**

Canal capacity, Canal losses, Lined channels & their design, Construction and maintenance of irrigation channels, Lift irrigation: Classification, Location, Water lifting arrangement, Yield of wells, Well Troubles.

**V. Diversion Head Works:**

Selection of sites, Constituent parts of weir, Causes of failure of weir on permeable foundation, Bligh's creep theory, Khosla's theory, Cross drainage works: Necessity, Types and their selection, River training works.

**VI. Hydrology:**

Hydrological cycle, precipitation, Measurement analysis, Average depth of rainfall, Factors affecting runoff, Runoff measurements, Mass curves, Flood frequency studies.

**VII. Hydrology (Contd.)**

Hydrograph, Unit hydrograph, Infiltration, Estimation of runoff by infiltration method, Flood routing.

**References:**

- i. Bharat Singh: Irrigation Engineering.
- ii. S. K.Garg: Irrigation Engineering & Hydraulic Structures.
- iii. B.C.Punmia ,Pandey B.B.Lal: Irrigation and water power engineering

## MEE 2157 RENEWABLE SOURCES OF ELECTRICAL ENERGY

### Module – I

**Energy Scenario:** Classification of Energy Sources, Energy resources (Conventional and nonconventional), Energy needs of India, and energy consumption patterns. Worldwide Potentials of these sources. Energy efficiency and energy security. Energy and its environmental impacts. Global environmental concern, Kyoto Protocol, Concept of Clean Development Mechanism (CDM) and Prototype Carbon Funds (PCF). Factors favoring and against renewable energy sources, IRP (6)

### Module – II

**Solar Energy:** Solar thermal Systems: Types of collectors, Collection systems, efficiency calculations, applications. Photo voltaic (PV) technology: Present status, - solar cells , cell technologies, characteristics of PV systems, equivalent circuit, array design , building integrated PV system, its components , sizing and economics. Peak power operation, Solar tracking system, Standalone and grid interactive systems. (8)

### Module – III

**Wind Energy:** Wind speed and power relation, power extracted from wind, wind distribution and wind speed predictions. Wind power systems: system components, Types of Turbine, Turbine rating Choice of generators, turbine rating, electrical load matching, Variable speed operation, maximum power operation, control systems, system design features, stand alone and grid connected operation. (6)

### Module – IV

**Biomass Energy System:** Biomass – various resources, energy contents, technological advancements, conversion of biomass in other form of energy – solid, liquid and gases. Gasifiers, Biomass fired boilers, Cofiring, Generation from municipal solid waste, Issues in harnessing these sources. (3)

### Module – V

**Hydro energy:** Feasibility of small, mini and micro hydel plants scheme layout economics. Tidal and wave energy, Geothermal and Ocean-thermal energy conversion (OTEC) systems – schemes, feasibility and viability. (3)

### Module – VI

**Energy storage and hybrid system configurations:** Energy storage: Battery – types, equivalent circuit, performance characteristics, battery design, charging and charge regulators. Battery management. Fly wheel- energy relations, components, benefits over battery. Fuel Cell energy storage systems. Ultra Capacitors. (4)

### Module – VII

**Grid Integration:** Grid integration with the system: Interface requirements, Stable operation, Transient-safety, Operating limits of voltage, frequency, stability margin, energy storage, and load scheduling. (5)

### Text Books:

1. Renewable energy technologies - R. Ramesh, Narosa Publication.
2. Energy Technology – S. Rao, Parulkar
3. Non-conventional Energy Systems – Mittal, Wheelers Publication.

### Reference Books:

1. Wind and solar systems by Mukund Patel, CRC Press.
2. Solar Photovoltaics for terrestrials, Tapan Bhattacharya.
3. Wind Energy Technology – Njenkins, John Wiley & Sons
4. Solar & Wind energy Technologies – McNeils, Frenkel, Desai, Wiley Eastern.
5. Solar Energy – S.P. Sukhatme, Tata McGraw Hill.
6. Solar Energy – S. Bandopadhyay, Universal Publishing.
7. Guide book for National Certification Examination for EM/EA – Book 1

## **CE 7015 WATERSHED ENGINEERING AND MANAGEMENT**

**3-0-0: 3 Credits**

**I.INTRODUCTION:** Concept of watershed development, objectives of watershed development, need for watershed development in India, integrated and multidisciplinary approach for watershed management.

**II.CHARACTERISTICS OF WATERSHED:** Size, shape, physiography, slope, climate, drainage, landuse, vegetation, geology of soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds.

**III.PRINCIPLES OF EROSION:** Types of erosion, factors affecting erosion, effects of erosion on land fertility and land capability, estimation of soil loss due to erosion, universal soil loss equation.

**MEASURES TO CONTROL EROSION:** Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, rock-fill dams, brushwood dam, gabion.

**IV.WATER HARVESTING:** Rainwater harvesting, catchment harvesting, harvesting structures, soil moisture conservation, check dams, artificial recharge, farm ponds, percolation tanks.

**V.LAND MANAGEMENT:** Land use and land capability classification, management of forest, agricultural, grassland and wild land, reclamation of saline and alkaline soils.

**VI.ECOSYSTEM MANAGEMENT:** Role of ecosystem, crop husbandry, soil enrichment, inter, mixed and strip cropping, cropping pattern, sustainable agriculture, bio-mass management, dry land agriculture, Silvi pasture, horticulture, soil forestry and afforestation.

**VII.Planning of watershed management activities, peoples participation, preparation of action plan, administrative requirements.**

### **TEXT BOOKS:**

- i. Watershed Management by JVS Murthy – New Age International Publishers.
- ii. Water Resource Engineering by R.Awurbs and WP James – Prentice Hall Publishers.

### **REFERENCES:**

- i. Watershed Management by VVN Murthy – Kalyani Publications.
- ii. Irrigation and Water Management by D.K. Majumdar – Prentice Hall of India.

MODULE-1

Introduction to business ethics, ethical principles in life, utilitarianism justice and fairness

MODULE-2

Social responsibility of business organisations

MODULE-3

Introduction to corporate governance

MODULE-4

Ethics of consumer protection, relevance of ethics in marketplace

MODULE-5

.Business and its internal constituencies, employee issues

MODULE-6

Indian value system and its utility in present context

Module-7

Roles and responsibilities of an individual in the present social context.

TEXT BOOKS:

1. Business Ethics concept and cases: Valesquez -TMH Publication
2. Human Values-A.N. Tripathi-New age Publication
3. Ethics in Management and Indian ethos-BiswanathGhosh-vikas publication
4. Ethics in Management-aryakumar-Anne books Pvt. limited

## **CE 8011 DAM AND WATER POWER ENGINEERING 3-0-0: 3 Credits**

### **I. Reservoir Regulation:**

Fundamentals of dam and reservoir. Reservoir yield, Rule curve, Determination of reservoir capacity by analytical and mass curve methods. Reservoir sedimentation.

### **II. Earth Dams:**

Selection of sites, Types of earth dams, Factor of safety, Slope stability with & without seepage forces, Construction details for homogeneous and non-homogeneous sections.

### **III. Gravity Dams:**

Forces on gravity dams including earthquake Stress analysis, Overflow & Non-overflow sections, Uplift forces consideration, Drainage of dam etc., Stability checks, Joints.

### **IV. Arch Dams, Buttress and Other Dams:**

Constant radius & constant angle section factor of safety, Advantages, etc.

### **V. Water Power Development:**

Definition of base load, peak load, load curve base load plant, peak load plant, load factor, capacity factor, utilization factor, gross head, net head, firm power, secondary power, storage, pondage, pondage factor, estimation of power demand-long and short term type, estimation of power, based on discharge and head, run off-river plants-high and low head plants, dam power plants, diversion canal plants, inter-basin diversion plants, tidal plants and pumped storage plants.

### **VI. Surge Tank:**

Simple surge tank, restricted orifice tank and differential tank. Surges in rectangular and non-rectangular sections, Surges for partial and complete closure of turbine. Rigid water column theory for concrete pipes, Elastic water column theory, Graphical and numerical methods to solve water hammer problems.

### **VII. Economical Design of Penstocks:**

Economical velocity and economical diameter, Material cost and power cost analysis to determine the diameter.

Design of hydraulics passages like Scroll cases, Draft tubes, Installation of turbines, Materials of constructions etc.

### **Book References:**

1. JUSTIN, CREAGER and HINDS: Hydro-Electric Engineering Handbook.
2. DANDEKAR M. M. and SHARMA K. N.: Water Power Engineering.
3. PUNMIA B. C., PANDEY and LAL B. B. : Irrigation and Water Power Engineering