



COIMBATORE INSTITUTE OF TECHNOLOGY

(In ernnaent t Aided Ariioruanaotis I nstitution)
(Affiliated to Anna University, Chennai & Approved by AICTE, New Delhi) Established
in 1956, A Unit of V.Rangasamy Naidu Educational Trust
CIVIL AERODROME POST, COIMBATORE-641 014, TAMILNADU, INDIA

Criteria 1 Curricular Aspects

Key Indicator: 1.3 Curriculum Enrichment

1.3.1 : Institution integriites cross-cutting issues relevant to Professioniil Ethics, Gender, Human Values, Environment and Sustainability and other value framework enshrined in Sustainable Development Goals and National Education Policy - 2020 into the Curriculum

Contents

Courses Related To Environment and Sustainability.	Page 1 to 32
Courses Related To Professional Ethics and Human Values.	Page 33 to 37

**COURSES RELATED TO ENVIRONMENT AND
SUSTAINABILITY**
(Highlighted in Orange)

V SEMESTER

Course Code	Course Name	L	T	P	C	Category
	THEORY					
15CE51	Structural Analysis - I	2	2	0	3	PC
15CE52	Design of Reinforced Concrete Structural Elements	2	2	0	3	PC
15CE53	Mechanics of Soils	3	0	0	3	PC
15CE54	Waste Water Engineering	3	0	0	3	PC
15CE55	Irrigation Engineering	3	0	0	3	PC
	Professional Elective I	3	0	0	3	PE
	PRACTICAL					
15CE56	Highway Engineering Laboratory	0	0	4	2	PC
15CE57	Environmental Engineering Laboratory	0	0	4	2	PC
	TOTAL CREDITS				22	

VI SEMESTER

Course Code	Course Name	L	T	P	C	Category
	THEORY					
15CE61	Structural Analysis - II	2	2	0	3	PC
15CE62	Design of Steel Structures	2	2	0	3	PC
15CE63	Foundation Engineering	3	0	0	3	PC
15CE64	Design of Reinforced Concrete Structures	2	2	0	3	PC
	Professional Elective II	3	0	0	3	PE
	Professional / Open Elective III	3	0	0	3	PE / OE
	PRACTICAL					
15CE65	Quantity Surveying and Project Planning Laboratory	0	0	4	2	PC
15CE66	Soil Mechanics Laboratory	0	0	4	2	PC
15CE67	Mini Project	0	0	4	2	EEC
	TOTAL CREDITS				24	

PROFESSIONAL ELECTIVES (PE)

Course Code	Course Name	L	T	P	C
15CEE01	Advanced Surveying	3	0	0	3
15CEE02	Advanced Concrete Structures	3	0	0	3
15CEE03	Advanced Steel Structures	3	0	0	3
15CEE04	Structural Design and Drawing	2	2	0	3
15CEE05	Health Monitoring of Structures	3	0	0	3
15CEE06	Earthquake Resistant Design of Timber and Masonry Structures	3	0	0	3
15CEE07	Prefabricated Structures	3	0	0	3
15CEE08	Design of Bridges	3	0	0	3
15CEE09	Theory of Plates	3	0	0	3
15CEE10	Finite Element Method	3	0	0	3
15CEE11	Experimental Stress Analysis	3	0	0	3
15CEE12	Optimization in Civil Engineering	3	0	0	3
15CEE13	Smart Materials and Structures	3	0	0	3
15CEE14	Advanced Construction Technology	3	0	0	3
15CEE15	Town Planning and Architecture	3	0	0	3
15CEE16	Construction Equipments and Techniques	3	0	0	3
15CEE17	Valuation of Immovable Properties	3	0	0	3
15CEE18	Professional Practice In Civil Engineering	3	0	0	3
15CEE19	Infrastructure Planning and Management	3	0	0	3
15CEE20	Advanced Foundation Engineering	3	0	0	3
15CEE21	Soil Structure Interaction	3	0	0	3
15CEE22	Remote Sensing and GIS	3	0	0	3
15CEE23	Railway Engineering	3	0	0	3
15CEE24	Tunnel Engineering	3	0	0	3
15CEE25	Airport and Harbour Engineering	3	0	0	3
15CEE26	Pavement Design	3	0	0	3
15CEE27	Hydraulic Structures	3	0	0	3
15CEE28	Engineering Hydrology	3	0	0	3
15CEE29	Water Power Engineering	3	0	0	3
15CEE30	Industrial Wastewater Treatment	3	0	0	3
15CEE31	Air Pollution and Control	3	0	0	3
15CEE32	Theory of Architecture	3	0	0	3
15CEE33	Building Services and Systems Engineering	3	0	0	3
15CEE34	Engineering Risk and Benefit Analysis	3	0	0	3
15CEE35	Disaster Management	3	0	0	3
15CEE36	Renewable Energy Resources	3	0	0	3

Course Code	Course Name	L	T	P	C
15CEE37	Construction Project Management	3	0	0	3
15CEE38	Environmental Impact Assessment	3	0	0	3
15CEE39	Solid and Hazardous Waste Management	3	0	0	3
15CEE40	Principles of Sustainable Development	3	0	0	3
15CEE41	Safety Engineering in Buildings	3	0	0	3
15CEE42	Probability and Statistics	3	0	0	3
15CEE43	Entrepreneurship in Civil Engineering	3	0	0	3

15CE54 - WASTE WATER ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT: THEORY

COURSE OUTCOME

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

- CO1 Recognize the origin and importance of effective conveyance of domestic sewage.
- CO2 Summarize the perspectives of various house drainage systems.
- CO3 Demonstrate not only the physico-chemical and bio-chemical characteristics of domestic sewage, but also deploy the appropriate conventional treatment schemes.
- CO4 Illustrate the employability of appropriate biological treatment schemes.
- CO5 Recognize the current need for membrane technologies in achieving the recycling of treated effluents.

QUANTITY AND CONVEYANCE

Necessity and objectives of sanitary engineering projects - Definitions - systems of sewerage - quantity of sewage - components and design period of sewerage projects- Fluctuations in flow pattern - Estimation of storm runoff -design discharge for separate sewer and combined sewer-Hydraulics of sewers - Self cleansing velocity, non scouring velocity- design of sewer for full flow half flow conditions, use of nomograms for design - sewer and drain section, materials for sewer. (9)

SEWER APPURTENANCES AND HOUSE DRAINAGE SYSTEMS

Sewer appurtenances - sewer joints - sewer excavation, laying and testing of sewers - sewer cleaning and maintenance - necessity of sewage pumping, pumping station -design of pumps and pumping station. House drainage - Sanitary fixtures / fittings - systems of plumbing - General layout of house drainage - street connections. Septic tanks and effluent disposal system - dispersion trench, soak pit and anaerobic up flow filter. (9)

QUALITY OF SEWAGE AND PRIMARY TREATMENT

Characteristics and composition of sewage - physical and chemical analysis - DO, BOD,COD and their significance - cycles of decomposition - Objectives and basic principles of sewage treatment - primary treatment - screens - Grit chamber - principles of sedimentation- sedimentation tank types-surface overflow rate, detention time and Design of primary settling tanks. (9)

BIOLOGICAL TREATMENT OF SEWAGE

Microbiology of wastewater treatment - bacterial growth curve, optimal microbiological growth phase for wastewater treatment - Basic principles of biological treatment -types - suspended and attached growth process - trickling filters- types, comparison and construction, recirculation. Recirculation ratio, operational problems, design of high rate and standard rate filters. - activated sludge process (ASP) -flow diagram- process modification of ASP -aeration - diffuser, mechanical aeration -design of ASP and oxidation ditches - process description of Sequential batch reactor (SBR), Upflow anaerobic sludge blanket reactor (UASB), fluidized bed reactor (FBR), packed bed reactor(PBR) and extended bed reactor (EBR). (9)

SLUDGE DISPOSAL

Membrane filtration- process, classification, characteristics, configuration, operation, fouling and control -types of membrane technologies and their application in wastewater treatment - comparison- electrodialysis- sludge - types and characteristics- sludge thickening - application and types-stabilization, types - anaerobic digestion process, types - design of anaerobic digesters. sludge drying, methods - sludge drying bed - sludge disposal -zones of pollution in lakes - Eutrophication - recycle & reuse of wastewater -disposal of sewage by dilution and land disposal - self purification of streams - oxygen sag curve. (9)

TOTAL : 45

TEXT BOOKS

- Garg S. K., "Environmental Engineering", Vol. I & Vol. II, Khanna Publishers, New Delhi, 1994.
- Metcalf and Eddy, "Wastewater Engineering Treatment, Disposal and Reuse", McGraw-Hill Publishing Co, Indian Edition, New Delhi, 2005.

15CE55 - IRRIGATION ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

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

- CO1 - Compute the demand and the available quantity of water required for irrigating a given crop area
- CO2 - Determine the yield of a well
- CO3 - Produce hydraulic and geometrical design of storage and distribution systems to supply water for a given area
- CO4 - Demonstrate suitable techniques for the construction and maintenance of a reservoir and a canal network
- CO5 - Design, operate and maintain a canal
- CO6 - Plan and develop a procedure to implement an irrigation project given an agricultural command area

WATER AND IRRIGATION

Irrigation - Necessity - Advantages - ill-effects - Types - Methods - Quality of water - Standards - Crops - Seasons - Definitions related to agriculture and irrigation - Rotation of crops - Crop water requirements - Base period - Duty - Delta - Consumptive use - Irrigation Efficiencies - Assessment of irrigation water - Water logging - Causes and effects - Remedies - Drainage - Necessity - Advantages - Types. (9)

HYDROLOGY

Surface hydrology - Precipitation - Types, forms, Measurement - Evaporation - measurement - Infiltration - measurement - Transpiration - Run-off - Hydrograph - Unit Hydrograph for single peaked storm - S-curve technique - Flood Estimation. (9)

GROUND WATER

Occurrence of ground water - aquifer - aquiclude - confined, unconfined and perched aquifer - Ground water yield - specific capacity of a well - measurement of yield of an open well by pumping test and recuperation test - Typical cross sections of types of open and tube wells - Elementary design of open and tube wells using direct discharge equation (without derivation of formula). (9)

CANAL ENGINEERING

Canals - Classification - Distribution network - Cross sectional details - Sedimentation in canals - Silt theories - Design of canals based on silt theories and use of charts - Balancing depth of cutting - Design procedure for fixing longitudinal section - Canal losses - Canal maintenance - Canal lining - types - Design of lined canals. (9)

RESERVOIR PLANNING

Dams - Brief idea about types of dam(detailed study not required) - Reservoir - Types, Investigations for reservoir planning - Selection of site for reservoir - Zones of storage - Capacity - Yield - Mass curve analysis - Capacity for specific demand and yield for given capacity - Fixing reservoir capacity - Economic height of a dam - Reservoir sedimentation and control. (9)

TOTAL : 45

TEXT BOOKS

1. Gang S.K, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi, 2009.
2. Punmia B. C. and Pande B. B. Lal, "Irrigation and Water Power Engineering", Laxmi Publications, New Delhi, 2009.

REFERENCE BOOKS

1. Michael A.M, "Irrigation - Theory & Practice", Vikas publishing house, New Delhi, 2006.
2. Shama R.K., "Irrigation Engineering & Hydraulic Structures", Oxford and IBH Publishing Company, New Delhi, 2007.

15CE57 - ENVIRONMENTAL ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

ASSESSMENT - PRACTICAL

COURSE OUTCOME

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

CO1 : Ascertain the suitability of water samples for drinking and construction purpose.

CO2 : Ascertain the suitability of wastewater samples as per effluent standards.

CO3 : Select the degree of treatment based on the results of water samples.

CO4 : Select the degree of treatment based on the results of the wastewater samples.

LIST OF EXPERIMENTS

1. Determination of Acidity of the given Water/Wastewater Sample.
2. Determination of Alkalinity of the given Water/Wastewater Sample.
3. Determination of Hardness of the given Water/Wastewater Sample.
4. Estimation of Chlorides in the given Water/Wastewater Sample.
5. Determination of pH, turbidity and specific conductivity of the given Water/Wastewater Sample.
6. Determination of Dissolved Oxygen Content in the given Water/ Wastewater Sample.
7. Assessment of Settleable, Total, Volatile, Fixed, Dissolved and Suspended Solids in Water/Wastewater Sample.
8. Turbidimetric-based Estimation of Sulphates in the given Water/Wastewater Sample.
9. Assessment of Optimum Coagulant Dose (OCD) to treat the given turbid water.
10. Assessment of Available Chlorine in the given Bleaching powder sample and Estimation of Residual Chlorine of the given Polluted Water/Wastewater Sample.
11. Assessment of Biochemical Oxygen Demand (BOD) of the given Water/Wastewater Sample.
12. Assessment of Chemical Oxygen Demand (COD) of the given Water/Wastewater Sample.

REFERENCE BOOK

1. "Environmental Engineering Laboratory manual", Department of Civil Engineering, Coimbatore Institute of Technology.

15CEE29 - WATER POWER ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT - THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

- CO1 : Summarize the sources of energy and the methods of power generation
- CO2 : Demonstrate the types of power plants based on location, availability of water and power demand
- CO3 : Describe the components of water conveyance
- CO4 : Illustrate the operation of tidal power plant
- CO5 : Plan and describe the power house based on environmental impact and economy

WATER POWER

Introduction - Sources of energy - Status of power in world - Hydro Power - Transmission voltages and Hydro power - Estimation of Water Power Potential.

Electrical Load on Hydro Turbines : General - Load curve - Load factor - capacity factor - Utilization factor - Diversity factor - Load duration curve - Firm power - Secondary power - Prediction of load - Illustrative examples. (9)

HYDRO POWER PLANTS

Classification of hydel plants - Run-of-River Plants - General arrangements - Valley dam plants - Diversion canal plants - High head diversion plants - storage and pondages. Pumped storage plants - Types - Advantage - two unit arrangement, Three unit arrangement - Reversible pump turbines - Problems in operation - Efficiency of pumped storage plants. (9)

WATER CONVEYANCE

Fenlock - Types - Design criteria - Anchor Blocks - Valves, Bends and Manifolds - Intakes - Types - Losses - Aeration - Forebays - canals - Tunnels - Water Hammer - Surge tanks. (9)

TIDAL POWER

Tidal Phenomenon - Tidal power - Basic principle - Location - Difficulties - Components - Modes of generation - Constructional aspects - Estimation of energy and power - Regulation of power output - Corrosion control and quality of concrete. (9)

POWER HOUSE PLANNING

Surface power stations - Power House structure - Dimensions - Lighting and ventilations - Design variations - Underground power stations - Location - Types - Advantages - Components - Layout types - Limitations - Environmental impact of Hydel power projects - Introduction to economic analysis of Hydro Power projects. (9)

TOTAL : 45

TEXT BOOK

1. Dandekar M.M. and Sharma K.N., "Water Power Engineering", DandekarVikas Publishing House Pvt Ltd., New Delhi, 1998.

REFERENCE BOOKS

1. Creager W.P. and Justin J.D., "Hydro Electric Hand Book", John Wiley Sons, London, 1981.
2. Desmukh M.M., "Water Power Engineering", Dhanpat Rai Publications, New Delhi, 1977.

15CEE30 - INDUSTRIAL WASTEWATER TREATMENT

L	T	P	C
3	0	0	3

ASSESSMENT - THEORY

COURSE OUTCOME

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

- CO1 Identify the characteristics and available biological treatment of Wastewater from industries and infer the possible impacts on the Environment.
- CO2 Describe the need for Wastewater minimization techniques.
- CO3 Illustrate the importance of Advanced Wastewater Treatment systems.
- CO4 Describe the manufacturing processes of industries.
- CO5 Compare the characteristics of Industrial effluents and treatment processes.
- CO6 Choose the suitable treatment process for the industries based on the characteristics of Wastewater.

INDUSTRIAL WASTEWATER PERSPECTIVES

General characteristics of industrial wastewaters - Objectives and management of industrial wastewaters - Effluent and stream standards for disposal of wastewaters - Sewer ordinance - Effects of untreated and/or partially treated wastewaters on disposal into land, rivers, sea and ocean-zero discharge, effluent treatment - individual and common effluent treatment plant-biological treatability of waste. (9)

WASTEWATER MINIMIZATION AND ADVANCED WASTEWATER TREATMENT

Volume and strength reductions - Reduce, Reuse and Recycle concepts - waste auditing - Objectives, principles and process description of equalization, neutralization, flocculation process, types of aeration system - Chemical oxidation, chemical precipitation, adsorption, membrane filtration process, gas stripping and ion exchange process- evaporators. (9)

CASE STUDIES - 1

Process description, wastewater characteristics and effluent treatment for iron and steel, thermal power plants, sugar and paper and pulp industry. (9)

CASE STUDIES - 2

Process description, wastewater characteristics and effluent treatment for tannery, distilleries, dairy and textiles. (9)

CASE STUDIES - 3

Process description, wastewater characteristics and effluent treatment for oil refineries, pharmaceutical plants, corn starch industry and food processing industry. (9)

TOTAL : 45

TEXT BOOKS

1. Rao, M.N and Datta, A.K. "Waste Water Treatment", Oxford and IBH Publishers Co, New Delhi, 1995.
2. Metcalf and Eddy, "Wastewater Engineering Treatment, Disposal and Reuse", McGraw-Hill Publishing Co, Indian Edition, New Delhi, 2005.

REFERENCE BOOKS

1. Eckenfelder (jr), "Industrial Water Pollution Control", McGraw-Hill Book Co, New York, 2000.
2. Nemerow N. L., "Industrial Water Pollution", Addison - Wesley Publishing Company Inc., USA, 1996.
3. Mahajan S. P. "Pollution Control in process industries", Tata McGraw Hill Publishing Co Ltd., New Delhi, 1989.
4. World Bank Group, "Pollution Prevention and Abatement Handbook - Towards Cleaner Production", World Bank and UNEP, Washington D.C., 1998

15CEE31 - AIR POLLUTION AND CONTROL

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

- CO1 Outline the quality of air and its impact on the environment based on the national air quality standards.
- CO2 Design the effective stack height to disperse the plume generated from industries in a given locality.
- CO3 Demonstrate the procedure for air sampling and reporting the extent of air pollutant in a locality.
- CO4 Interpret the procedure for controlling the air pollution through controlling methods.
- CO5 Evaluate the level of air pollution inside a building based on indoor air quality standards.

CLASSIFICATION AND EFFECTS OF AIR POLLUTION

Sources and classification of air pollutants - major emissions from global sources, importance of Anthropogenic sources - effect on human health, vegetation, animals, property, aesthetic value and visibility- Photochemical smog - green house gases - ozone layer depletion - Ambient Air Quality and Emission standards - Air Pollution Indices - Emission Inventories.

(9)

METEOROLOGY AND SAMPLING

Effects of meteorology on Air Pollution - horizontal atmospheric motion, vertical motion in atmosphere, Atmospheric stability, Temperature Inversion, Wind rose diagram and stack plume patterns- Atmospheric Diffusion Theories - Dispersion models, Plume rise -Design of effective stack height - Air pollution sampling and measurement - Types of pollutant sampling and measurement, ambient air sampling, collection of gaseous air pollutants, collection of particulate pollutants, stack sampling, analysis of air pollutants - sulphur dioxide, nitrogen oxides, carbon monoxide, oxidants and ozone, hydrocarbons, particulate matter.

(9)

CONTROL OF PARTICULATE CONTAMINANTS

Air pollution control methods and equipment - Control methods, source correction methods, Factors affecting Selection of Control Equipment - particulate emission control - working principle, design and application of gravitational settling chambers, cyclone separators, electrostatic precipitators and depth filters.

(9)

CONTROL OF GASEOUS CONTAMINANTS

Factors affecting Selection of Control Equipment - Control of gaseous emissions -Dry methods, wet scrubbing methods, combustion, biological methods - Control of specific gaseous pollutants -Control of sulphur dioxide emission, desulphurisation of flue gases, Control of nitrogen oxides, Modification of operating conditions, effluent gas treatment methods, Carbon monoxide control, control of hydrocarbons-Carbon monoxide poisoning - Hydrogen Sulphide poisoning.

(9)

INDOOR AIR QUALITY MANAGEMENT

Sources, indoor and outdoor concentration - models -simple box model, complex model - control of indoor air Quality- indoor emission - sick building syndrome types - Radon Pollution and its control - Membrane process - UV photolysis - risk related to poor indoor air quality - strategies for creating premium indoor air quality (IAQ) - indoor air quality (IAQ) and green building rating systems - LEED rating system.

(9)

TOTAL : 45

TEXT BOOKS

1. Noel de Nevers, "Air Pollution Control Engineering", McGraw Hill, New York, 1995.
2. Lawrence K. Wang, Norman C. Parekh, YungTse Hung, "Air Pollution Control Engineering", Tokyo, 2004.
3. C.S.Rao, "Environmental Pollution Control Engineering", Wiley Eastern Ltd, Delhi.

REFERENCE BOOKS

1. David H.F. Liu, Bela G. Liptak "Air Pollution", Lewis Publishers, 2000.
2. Anjaneyulu. Y, "Air Pollution and Control Technologies", Allied Publishers (P) Ltd, India, 2002.

15CEE35 - DISASTER MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT - THEORY

COURSE OUTCOME

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

- CO1 Identify natural and manmade disasters
- CO2 Explain in detail about causes and effects of natural and manmade disasters.
- CO3 Apply geospatial techniques (including GIS) that can enhance vulnerability assessments
- CO4 Identify and analyse the factors that give rise to differential vulnerabilities and levels of community resilience and suggest necessary mitigation plans
- CO5 Assess and manage these vulnerabilities through disaster planning and policy-making

NATURAL DISASTERS

Cyclones, Floods, Drought and Desertification - Earthquake, Tsunami, Landslides and Avalanche. (9)

MAN MADE DISASTERS

Chemical industrial hazards, major power breakdowns, traffic accidents, Fire, War, Atom bombs, Nuclear disaster- Forest Fire- Oil fire -accident in Mines. (9)

GEOSPATIAL TECHNOLOGY

Remote sensing, GIS and GPS applications in real time disaster monitoring, prevention and rehabilitation- disaster mapping. (9)

RISK ASSESSMENT AND MITIGATION

Hazards, Risks and Vulnerabilities - Disasters in India, Assessment of Disaster Vulnerability of a location and vulnerable groups- Preparedness and Mitigation measures for various Disasters- Mitigation through capacity building -Preparation of Disaster Management Plans. (9)

DISASTER MANAGEMENT

Legislative responsibilities of disaster management- Disaster management act 2005- post disaster recovery & rehabilitation, Relief & Logistics Management; disaster related infrastructure development- Post Disaster, Emergency Support Functions and their coordination mechanism. (9)

TOTAL : 45

TEXT BOOKS

1. Khanna B K, "All You Wanted To Know About Disasters", New India Publishing Agency, New Delhi, 2005.
2. Ramana Murthy, "Disaster Management", Dominant, New Delhi, 2004.
3. Rajdeep Dasgupta, "Disaster Management and Rehabilitation", Mittal Publishers, New Delhi, 2007.

REFERENCES

1. Disaster Management in India- A Status Report- Published by the National Disaster Management Institute, Ministry of Home Affairs, Govt. of India, 2004.
2. Murthy D. B. N., "Disaster Management: Text and Case Studies", Deep and Deep Publications (P) Ltd., New Delhi, 2007.
3. Sunder I. and Sezhayan T., "Disaster Management", Sarup and Sons, New Delhi, 2007.

15CEE36 - RENEWABLE ENERGY RESOURCES

L	T	P	C
3	0	0	3

ASSESSMENT - THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

- CO1 Explain the current energy scenario and future energy usage in India.
- CO2 Explain the concepts of solar energy, wind energy, tidal energy and biomass energy.
- CO3 Compare the energy utilization from wind energy, solar energy, biomass energy and tidal energy.
- CO4 Discuss the challenges and problems associated with the use of energy sources.

ENERGY PERSPECTIVES

Conventional and non conventional energies - Energy and sustainable development - Global energy scenario - Energy scenario in India - Energy consumption pattern in rural and urban regions in India - Energy efficiency and economy - Energy losses and its control - Renewable energy potential mapping - Plant load factor (9)

SOLAR ENERGY PERSPECTIVES

Concept of solar energy - Solar energy to light and to thermal conversions - Total energy and necessary infrastructure - Units and measurement of solar radiation - Temperature dependent collecting devices and their efficacies - Design aspects - Typical applications: heating, cooling, lighting, power generation and cooking. (9)

WIND ENERGY PERSPECTIVES

Wind potential in India - Wind turbines and their types - Merits and demerits - Wind power and appropriate coefficient - Efficiency and performance of wind machines -Energy conversion and storage - Synchronous invertors - Various storage aspects: battery, fly wheel, hydrogen and compressed air. (9)

BIOMASS ENERGY PERSPECTIVES

Biomass potential in India - Gobar gas and producer gas - Characteristics of biomass - Operation and design of biogas plants - Objectives, principles and operational aspect of biogasifiers - Pyrolysis and incineration - Power generation from municipal solid waste and industrial Sludges - Application of biodiesel plants - Fuel cells. (9)

TIDAL ENERGY PERSPECTIVES

Tidal aspects in coastal India - Tidal energy conversion system: mechanical to electrical and thermal to electrical - Tidal force calculation and power generation - conceptualization and potential of geothermal energy - Geothermal vents. (9)

TOTAL : 45

TEXT BOOK

1. Sukathme, S.P, "Solar Energy", Tata McGraw-Hill Book Co., New Delhi, 1993.

REFERENCE BOOKS

1. Raj, G.D., "Solar Energy Utilization", Khanna Publishers, New Delhi, 1993.
2. Angrist, S.W, "Direct Energy Conversion", Allied Publishers Ltd., Boston, 1971.

15CEE39 - SOLID AND HAZARDOUS WASTE MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT - THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

- CO1 : Outline the salient features of solid waste management and handling.
- CO2 : Deduce the source reduction, recycling and reuse techniques of solid waste.
- CO3 : Analyze the collection systems and method of transfer of solid waste.
- CO4 : Describe the processing techniques for solid and hazardous waste.
- CO5 : Select the suitable methods for disposal of solid and hazardous waste.
- CO6 : Interpret the legislation for management, handling and disposal of solid and hazardous waste.

CHARACTERISTICS AND SOURCE REDUCTION OF SOLID WASTE

Definition, sources, and types of solid waste - Composition, physical, chemical and biological Properties of solid wastes - Per capita generation rates - Sampling and characterization of solid waste - Source reduction of wastes - Waste exchange - Recycling and reuses - Salient features of Indian legislations on management and handling of municipal solid wastes. (9)

COLLECTION AND TRANSPORT OF SOLID WASTE

Estimation of solid waste and factors affecting generation rates - On-site handling, storage, and processing- Collection services: municipal and commercial - Industrial services - Collection systems: Hauled-container system (HCS) and stationary container system (SCS) - Vehicle and labour assessment - Assessment of collection route - Transfer and transport - Transfer station location- Means and methods of transfer. (9)

PROCESSING AND DISPOSAL OF SOLID WASTE

Objective of processing - material separation and processing technologies- biological, chemical and thermal conversion technologies- disposal in Landfills: site selection methods and operations, leachate and gas generations and movement and control of gas and leachate techniques - Composting: aerobic and anaerobic - Resource and energy recovery schemes. (9)

HAZARDOUS WASTE CHARACTERIZATION AND MANAGEMENT

Definitions and identifications of hazardous waste - Origin and characterization of hazardous solid waste- Typical hazardous wastes in MSW - Hazardous waste management: minimization, collection, storage, handling, transport, and disposal - design of hazardous waste landfills - TCLP tests - National and International legislation for hazardous waste management - Atomic Energy Regulatory Board -International Atomic Energy Agency - Department of Atomic Energy - Nuclear Power Corporation - Nuclear power plants in India. (9)

NUCLEAR WASTE AND e-WASTE

Sources - classification - effects of nuclear waste- initial treatment of nuclear waste - vitrification, ion exchange, synroc - long term management - above ground disposal, geological disposal, ocean dumping, transmutation, space disposal - reuse of waste - nuclear safety and waste regulation - case study on nuclear disaster - source of e- waste - material composition of e - waste - recycling and recovery - integrated approaches to e - waste recycling - socio economic factors - treatment option - disposal option - e - waste legislation. (9)

TOTAL : 45

TEXT BOOKS

1. Tchobanoglous, G. et al., "Integrated Solid Waste Management", McGraw-Hill Publication., New York, 1993.
2. Ronald E. Hester, Roy M. Harrison "Electronic Waste Management", Royal Society of Chemistry, 2009.

REFERENCE BOOKS

1. Peavy, SH, Rowe, RD and Tchobanoglous, G, "Environmental Engineering", McGraw-Hill Inter Edition, 1985.
2. Charles, A.W., "Hazardous Waste Management", McGraw-Hill Publications, 2002.

15CEE40 - PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

ASSESSMENT - THEORY

COURSE OUTCOME

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

- CO1 : Outline the concepts, components and factors affecting Sustainable development.
- CO2 : Discuss the significance of International summits, conventions and agreements on Sustainable development.
- CO3 : Describe the necessity and importance of Indian and International legal aspects in Sustainability.
- CO4 : Illustrate the socio economic policies and public participation in Sustainable development.
- CO5 : Discuss the role and commitment of developed countries in Sustainable development.
- CO6 : Describe the concepts of Life cycle Assessment and Environmental Standards.

CONCEPTS OF SUSTAINABLE DEVELOPMENT

Sustainable development- Evolution of Environmental awareness and Sustainable development, global Sustainable development goals -components and factors affecting Sustainable development-Demographic dynamics and sustainability- Environmental issues and crisis- ozone layer depletion, global warming and climate change -International Environmental summits, conventions and agreements- Action plan for Sustainable development- Transboundary issues - Role of developed and developing countries in sustainable development. (9)

ENVIRONMENTAL ASPECTS

Biodiversity- Types of biodiversity-Threats to biodiversity- Ecological indicators- Ecological foot print- Carbon foot print- Conservation biology- Strategic species concepts- Ecological economics- Environmental impact of agriculture, animal husbandry, fishery and land use- Habitat fragmentation- Desertification- Natural disasters, geological, hydrological, meteorological and health- Nuclear issues. (9)

ECONOMIC ASPECTS

Production, Consumption, Investment and Exchange of Goods and Services Macroeconomic Aggregates, Circular Flow of Income and its Criticism- Methods of Calculating National Income- GNP and GDP- The Goods Market: determination of equilibrium output -Financial Markets: demand for money and interest rates- Goods and Financial markets: IS-LM Model- General Overview of Fiscal and Monetary Policies-relative effectiveness- International Transactions and exchange rates- Market failure & Incomplete markets Externalities -UN Sustainable development policies through trade- World Trade Organization- International monetary fund and World bank. (9)

SOCIAL ASPECTS

Indigenous Knowledge and Natural Resource Management (NRM) -Commodification, marginalization and degradation - Indigenous knowledge and its relevance to sustainable development - Biopiracy and Biopolitics over Traditional Ecological knowledge (TEK) - Environmental Degradation in developing countries - Overview of development - Globalization and the structural adjustments - Governance and welfare state- Development processes and social justice -Social inequality as a global challenge-marginalized/vulnerable groups, indigenous people, resettlement & rehabilitation and development. (9)

STRATEGIES FOR SUSTAINABLE DEVELOPMENT

Economic growth, carrying capacity- Resource depletion and resource protection-Sustainable Management of Forest, Land, water, fishery, agriculture, energy and ecosystem- Natural Disaster management- Cleaner Production, definition, aim, application- Generic process of Cleaner Production Assessment- Life cycle Assessment - definition, necessity and elements- ISO Environmental standards- Environmental Audit. (9)

TOTAL : 45

COIMBATORE INSTITUTE OF TECHNOLOGY
(Government Aided Autonomous Institution Affiliated to Anna University)

DEPARTMENT OF CIVIL ENGINEERING

B.E. CIVIL ENGINEERING-FULL TIME

(III TO VIII SEMESTER)

Curriculum from the Academic Year 2019 - 2020 and onwards

SUBJECTS OF STUDY

Semester III

Course Code	Course Name	L	T	P	C	Category
19CEM31	Differential Equations and Boundary Value Problems	3	1	0	4	BSC
19CE31	Mechanics of Solids	3	1	0	4	ES
19CE32	Engineering Geology	3	0	0	3	PC
19CE33	Mechanics of Fluids	3	0	0	3	PC
19CE34	Surveying	3	0	0	3	PC
19CE35	Water Supply Engineering	3	0	0	3	PC
19HSS01	Science of Creativity and Professional Ethics	1	0	0	1	HSC
19CEL36	Strength of Materials Laboratory	0	0	2	1	PC
19CEL37	Survey Laboratory	0	0	2	1	PC
	One Credit Course	1	0	0	1	EEC
19HOC31	Communication Skills for Engineers I*	0	0	2	1	EEC
	TOTAL CREDITS				25	

Semester IV

Course Code	Course Name	L	T	P	C	Category
19CE41	Construction Technology	3	0	0	3	PC
19CE42	Strength of Materials	3	1	0	4	PC
19CE43	Transportation Engineering	3	0	0	3	PC
19CE44	Applied Hydraulics and Hydraulic Machinery	3	0	0	3	PC
19CE45	Waste Water Engineering	3	0	0	3	PC
19CE46	Professional Practices and Ethics	3	0	0	3	BSC
19CEL47	Hydraulics Laboratory	0	0	2	1	PC
19CEL48	Environmental Engineering Laboratory	0	0	2	1	PC
	One Credit Course	1	0	0	1	EEC
19HOC41	Communication Skills for Engineers II*	0	0	2	1	EEC
	TOTAL CREDITS				23	
	* Not to be counted for GPA. Pass is required					

Semester VII

Course Code	Course Name	L	T	P	C	Category
19CE71	Irrigation Engineering	3	0	0	3	PC
19CE72	Earthquake Resistant Design of Structures	3	0	0	3	PC
19CE73	Construction Management	3	0	0	3	PC
	Elective- V	3	0	0	3	EC
	Elective- VI	3	0	0	3	EC
19CEL74	Computer Applications Laboratory	0	0	2	1	PC
19CEL75	Concrete Laboratory	0	0	2	1	PC
19CE76	Project Work Phase I	0	0	6	3	EEC
	TOTAL CREDITS				20	

Semester VIII

Course Code	Course Name	L	T	P	C	Category
	Elective- VII	3	0	0	3	EC
	Elective-VIII	3	0	0	3	EC
19CE81	Project Work Phase II	0	0	10	5	EEC
	TOTAL CREDITS				11	

* Including first year credits

TOTAL CREDITS = 164*

BSC - Basic Sciences

HSC - Humanities and Social Sciences

ES - Engineering Sciences

PC - Professional Core

PE - Professional Elective

OE - Open Elective

EEC - Employability Enhancement Course

EC - Elective Course - PE / OE

LIST OF ELECTIVES

PROFESSIONAL ELECTIVES

1. STRUCTURAL ENGINEERING

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19CEE01	Design of Concrete Structures	3	0	0	3	PE
2	19CEE02	Advanced Concrete Structures	3	0	0	3	PE
3	19CEE03	Prestressed Concrete Structures	3	0	0	3	PE
4	19CEE04	Design of Bridges	3	0	0	3	PE
5	19CEE05	Advanced Steel Structures	3	0	0	3	PE
6	19CEE06	Advanced Structural Analysis	3	0	0	3	PE
7	19CEE07	Prefabricated Structures	3	0	0	3	PE
8	19CEE08	Advanced Surveying	3	0	0	3	PE
9	19CEE09	Numerical Methods for Civil Engineering	3	0	0	3	PE
10	19CEE10	Finite Element Method	3	0	0	3	PE
11	19CEE11	Industrial Structures	3	0	0	3	PE
12	19CEE12	Smart Materials and Structures	3	0	0	3	PE
13	19CEE13	Safety in Civil Engineering Practice	3	0	0	3	PE
14	19CEE14	Remote Sensing and GIS	3	0	0	3	PE
15	19CEE15	Ground Improvement Techniques	3	0	0	3	PE
16	19CEE16	Design of Deep Foundation	3	0	0	3	PE
17	19CEE17	Earthquake Resistant Design of Masonry and Timber Structures	3	0	0	3	PE
18	19CEE18	Building Services and Maintenance Engineering	3	0	0	3	PE
19	19CEE19	Optimization Techniques in Civil Engineering	3	0	0	3	PE
20	19CEE20	Theory of Architecture	3	0	0	3	PE
21	19CEE21	Green Building Concepts and Practices	3	0	0	3	PE

2. ENVIRONMENTAL ENGINEERING

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19CEE22	Design of Environmental Structures and Drawing	3	0	0	3	PE
2	19CEE23	Air Pollution and Control	3	0	0	3	PE
3	19CEE24	Solid and Hazardous Waste Management	3	0	0	3	PE
4	19CEE25	Environmental Impact Assessment	3	0	0	3	PE
5	19CEE26	Industrial Waste Water Management	3	0	0	3	PE
6	19CEE27	Geo Environmental Engineering	3	0	0	3	PE

COIMBATORE INSTITUTE OF TECHNOLOGY

(Government Aided Autonomous Institution Affiliated to Anna University, Chennai)

LIST OF OPEN ELECTIVES

DEPARTMENT OF CIVIL ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
19CEOED1	Town Planning and Architecture	3	0	0	3	All Branches
19CEOED2	Climate Change and Adaptation	3	0	0	3	All Branches
19CEOED3	Metro Systems and Engineering	3	0	0	3	All Branches
19CEOED4	Renewable Energy Sources	3	0	0	3	All Branches
19CEOED5	Principles of Sustainable Development	3	0	0	3	All Branches
19CEOED6	Disaster Management	3	0	0	3	All Branches

DEPARTMENT OF MECHANICAL ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
19MEOED1	Design of Experiments	3	0	0	3	All branches
19MEOED2	Engineering Optimization	3	0	0	3	All branches
19MEOED3	Engineering Polymers, Composites and Allied Manufacturing Processes	3	0	0	3	Mechanical Chemical & Civil
19MEOED4	Industrial Robotics	3	0	0	3	Mechanical EEE and ECE
19MEOED5	Business Process Re-engineering	3	0	0	3	All branches
19MEOED6	Engineering Economics and Financial Management	3	0	0	3	All branches

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
19EEOED1	Energy Auditing	3	0	0	3	ECE, Mech, Chemical, Civil
19EEOED2	Solar and Wind Energy systems	3	0	0	3	ECE, Mech, Chemical
19EEOED3	Electrical Safety Procedures and Management	3	0	0	3	All Branches
19EEOED4	Energy Efficient Illumination Systems	3	0	0	3	All Branches
19EEOED5	Electric Vehicle Technology	3	0	0	3	All Branches except Civil & Chemical
19EEOED6	Energy Efficiency in Thermal and Electrical Utilities	3	0	0	3	EEE & Mechanical

19CE35 - WATER SUPPLY ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT - THEORY

COURSE OUTCOMES

After successful completion of the course, students will be able to

CO1 : Identify various sources and characteristics of water and analyse the importance and demand for planned water supply system

CO2 : Analyse the need and economic feasibility in the conveyance of potable water from the source using pipes and pumps.

CO3 : Design various conventional treatment system to achieve the potable water quality standards specified.

CO4 : Interpret advanced water treatment system available in current scenario to provide high quality drinking water.

CO5 : Describe the basic requirements of water distribution system and determine the pipe flow rates and pressure heads using pipe network analysis.

SOURCES OF WATER

Importance and need for planned water supply scheme -Design period- Population forecasting methods -Water demand-types and per capita demand, factors affecting per capita demand - Sources of water and their characteristics, Surface and Groundwater - Impounding Reservoir: Mass In-flow curve and analytical methods -Water characterization-physical, chemical and biological - Significance - Drinking Water quality standards (IS, CPHEEO and WHO) (9)

CONVEYANCE FROM THE SOURCE

Intake structures, need and its types -Pipe materials, pipe appurtenances and valves used in transmission of water- laying, jointing and testing of pipes - Hydraulics design of pressure pipes - Pumps, pumping station and capacity of pumps - Selection of pumps. (9)

WATER TREATMENT

Screening - Sedimentation - theory, types of settling, Stokes law - Coagulation - theory, chemicals used, flocculation - Jar test - design of sedimentation tank - Filtration - removal mechanisms, filter media, types, slow sand, rapid sand and pressure filters, filter design - Disinfection - methods. Chlorination - action, factors influencing, free chlorination, combined chlorination. (9)

TERTIARY WATER TREATMENT

Water softening - Desalination - demineralization - Adsorption - Ion exchange- Membrane Systems - Reverse osmosis - Iron and Manganese removal - Defluoridation - Construction and Operation & Maintenance aspects - Recent advances - MBR process. (9)

WATER DISTRIBUTION

Requirements of water distribution and its method - Components - Service reservoirs - Analysis and design of distribution network by equivalent pipe method and Hardy-Cross method of balancing- Leak detection - Corrosion and its control- Principles of design of water supply in buildings - House service connection - Fixtures and fittings, systems of plumbing and types of plumbing - Langelier saturation Index (LSI). (9)

TOTAL : 45

19CE45 - WASTE WATER ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 - Recognize the origin and importance of effective conveyance of domestic sewage.

CO2 - Analyse the hydraulic components of sewage and design sewers including sewage pumping stations.

CO3 - Summarize the perspectives of various house drainage systems.

CO4 - Demonstrate the physico-chemical and bio-chemical characteristics of domestic Sewage and also deploy the appropriate conventional treatment schemes.

CO5 - Design sludge digesters and also to justify the effluent disposal standards and sludge disposal.

SEWERAGE SYSTEMS

Introduction - Necessity and objectives of sanitary engineering projects - Definitions - systems of Sanitation - Quantity of sanitary sewage - variation in quantity of sewage - quantity of storm sewage - Characteristics and composition of sewage - effluent standards - Sampling of sewage - Examination of sewage - DO, BOD, COD and their significance - Cycles of decomposition. (9)

DESIGN OF SEWERS

Components and design period - Hydraulics of sewers - Self cleansing velocity, non-scouring velocity - Design of sewers - Sewer appurtenances - Drains and sewer section - Sewer materials and sewer joints - Construction and maintenance of sewer - Pumping of sewage -House drainage - Sanitary fixtures / fittings - systems of plumbing - General layout of house drainage - street connections - Testing of house sewers - Septic tanks and effluent disposal system. (9)

PRIMARY TREATMENT OF SEWAGE

Objectives and basic principles of sewage treatment - Preliminary treatment - screens - Grit chamber - and Skimming tank - Design of Grit chamber - Primary treatment - Principles of sedimentations - Sedimentation tank types - surface overflow rate - detention time and Design of primary settling tanks. (9)

SECONDARY TREATMENT

Basic principles of biological treatment - types - suspended and attached growth process - Activated sludge process (ASP) - flow diagram - process modification of ASP - aeration - diffuser, mechanical aeration - Design of ASP - Trickling filters - types - comparison and construction - recirculation - Recirculation ratio, operational problems - design of high rate and standard rate filters - Process description of Sequential batch reactor (SBR), Upflow anaerobic sludge blanket reactor (UASBR), fluidized bed reactor (FBR), packed bed reactor(PBR) and extended bed reactor (EBR) - Waste stabilisation ponds - Oxidation ponds and Aeration lagoons. (9)

SLUDGE DIGESTION AND DISPOSAL

Sludge disposal - Sludge volume calculation - Sludge characteristics - sludge digestion - Digestion process - stages - Design of sludge digesters - Disposal of digested sludge - Use of lagoons for disposal of raw sludge - Advantages in sludge treatment and disposal - Effluent disposal - Standards for disposal - Disposal methods - Dilution - zones of pollution in lakes - Eutrophication - self-purification of streams - oxygen sag curve - Land disposal. (9)

TOTAL : 45

19CEL48 - ENVIRONMENTAL ENGINEERING LABORATORY

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

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

CO1 : Ascertain the suitability of water samples for drinking and construction purpose.

CO2 : Ascertain the suitability of wastewater samples as per effluent standards.

CO3 : Select the degree of treatment based on the results of water and wastewater samples.

LIST OF EXPERIMENTS

1. Determination of Acidity of the given Water/Wastewater Sample.
2. Determination of Alkalinity of the given Water/Wastewater Sample.
3. Determination of Hardness of the given Water/Wastewater Sample.
4. Estimation of Chlorides in the given Water/Wastewater Sample.
5. Determination of Dissolved Oxygen Content in the given Water/ Wastewater Sample.
6. Assessment of Settleable, Total, Volatile, Fixed, Dissolved and Suspended Solids in Water/Wastewater Sample.
7. Determination of pH and Assessment of Optimum Coagulant Dose (OCD) to treat the given Water/ Wastewater sample.
8. Assessment of Available Chlorine in the given Bleaching powder sample and Estimation of Residual Chlorine of the given Polluted Water/Wastewater Sample.
9. Assessment of Biochemical Oxygen Demand (BOD) of the given Water/Wastewater Sample.
10. Assessment of Chemical Oxygen Demand (COD) of the given Water/Wastewater Sample.

REFERENCES

1. "Environmental Engineering Laboratory manual", Published by the Department of Civil Engineering, Coimbatore Institute of Technology, Coimbatore, 2018.
2. IS 10500, Drinking water Specification, Bureau of Indian Standards, New Delhi, 2012.
3. IS 3025, Methods of sampling and test (physical and chemical) for water and wastewater, Bureau of Indian Standards, New Delhi, 1986.

ONLINE RESOURCES

1. <https://mpfet.ac.in>

19CE71 - IRRIGATION ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT - THEORY

COURSE OUTCOMES

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

CO1 : Compute the demand and the available quantity of water required for irrigating a given crop area

CO2 : Determine the yield of a well

CO3 : Produce hydraulic and geometrical design of storage and distribution systems to supply water for a given area

CO4 : Demonstrate suitable techniques for the construction and maintenance of a reservoir and a canal network

CO5 : Design, operate and maintain a canal

CO6 : Plan and develop a procedure to implement an irrigation project for a given agricultural command area

WATER AND IRRIGATION

Irrigation - Necessity - Advantages - Ill-effects - Types - Methods - Quality of water - Standards - Crops - Seasons - Definitions related to agriculture and Irrigation - Rotation of crops - Crop water requirements - Base period - Duty - Delta - Consumptive use Irrigation Efficiencies - Assessment of Irrigation water - Water logging - Causes and effects - Remedies - Drainage - Necessity Advantages - Types. (9)

HYDROLOGY

Surface hydrology - Precipitation - Types, forms, Measurement - Evaporation measurement - Infiltration - measurement - Transpiration - Run-off - Hydrograph - Unit Hydrograph for single peaked storm-S-curve technique- Flood Estimation. (9)

GROUND WATER

Occurrence of ground water - aquifer - aquiclude - confined, unconfined and perched aquifer - Ground water yield - specific capacity of a well - measurement of yield of an open well by pumping test and recuperation test - Typical cross sections of types of open and tube wells - Elementary design of open and tube wells using direct discharge equation (without derivation of formula). (9)

CANAL ENGINEERING

Canals -Classification - Distribution network - Cross sectional details - Sedimentation in canals - Silt theories - Design of canals based on silt theories and use of charts - Balancing depth of cutting - Design procedure for fixing longitudinal section - Canal losses - Canal maintenance - Canal lining - types - Design of lined canals. (9)

RESERVOIR PLANNING

Dams - Brief idea about types of dam(detailed study not required) - Reservoir - Types, Investigations for reservoir planning - Selection of site for reservoir - Zones of storage - Capacity - Yield - Mass curve analysis - Capacity for specific demand and yield for given capacity - Fixing reservoir capacity Economic height of a dam - Reservoir sedimentation and control (9)

TOTAL : 45

19CEE21 - GREEN BUILDING CONCEPTS AND PRACTICES

L	T	P	C
3	0	0	3

ASSESSMENT - THEORY

COURSE OUTCOMES

After successful completion of the course, student will be able to

CO1 : Outline the basic concept of green building.

CO2 : Assess the different components of the green building.

CO3 : Assimilate the green building rating system.

CO4 : Apply the green building auditing for effective Management.

GREEN BUILDING PERSPECTIVE

Introduction to Green Buildings: Definition of green buildings and sustainable development - Impact of design, construction & maintenance of buildings on our environment and natural resources - Components of Green Building - Operational energy In Building and Life cycle energy - Embodied energy - Opportunities of Green Building - benefits of green buildings towards sustainable development. (9)

SITE SELECTION AND PLANNING

Criteria for site selection- preservation of landscape-minimizing urban heat island effect-maximize comfort by proper orientation of building facades - Rainwater harvesting methods for roof & non-roof, reducing landscape water demand with recycle and reuse of waste water systems. (9)

MATERIAL CONSERVATION AND INDOOR ENVIRONMENTAL QUALITY

Waste reduction during construction -materials with recycled content- local materials selection -material reuse-certified wood - Renewable building materials and furniture - day lighting -air ventilation, exhaust systems - low VOC paints, materials & adhesives -Air conditioning - Indoor air quality - Sick building syndrome -Reasons for poor IAQ- Measures to achieve Acceptable IAQ levels. (9)

GREEN BUILDING RATING SYSTEM

Green Building Initiatives in India - Benefits Experienced In Green Buildings - Indian Green Building Council- - Launch of Green Building Rating Systems - Green Performance rating - requirements of LEED - GRIHA - Energy Conservation Building Code requirements - Concepts of Overall Thermal Transfer Value (OTTV). (9)

CASE STUDY

Case study on Green building Auditing- Energy management - water management - carbon footprint-preliminary Audit and Detailed audit - suggestions. (9)

TOTAL : 45

TEXT BOOKS

1. Kent Peterson, *Standard for the design for High Performance Green Buildings*, IGCC, 2009
2. Tomwoolley and Samklmings, *Green Building Hand Book, Volume 1*, Taylor & Francis 2009.

19CEE23 - AIR POLLUTION AND CONTROL

L	T	P	C
3	0	0	3

ASSESSMENT - THEORY

COURSE OUTCOMES

After successful completion of the course, student will be able to

CO1 : Outline the quality of air and its impact on the environment based on the national air quality standards.

CO2 : Design the effective stack height to disperse the plume generated from industries in a given locality.

CO3 : Demonstrate the procedure for air sampling and reporting the extent of air pollutant in a locality.

CO4 : Interpret the procedure for controlling the air pollution through controlling methods.

CO5 : Evaluate the level of air pollution inside a building based on indoor air quality standards.

CLASSIFICATION AND EFFECTS OF AIR POLLUTION

Sources and classification of air pollutants - major emissions from global sources, importance of Anthropogenic sources - effect on human health, vegetation, animals, property, aesthetic value and visibility- Photochemical smog - green house gases - ozone layer depletion - Ambient Air Quality and Emission standards - Air Pollution Indices - Emission Inventories. (9)

METEOROLOGY AND SAMPLING

Effects of meteorology on Air Pollution - horizontal atmospheric motion, vertical motion in atmosphere, Atmospheric stability, Temperature Inversion, Wind rose diagram and stack plume patterns- Atmospheric Diffusion Theories - Dispersion models, Plume rise -Design of effective stack height - Air pollution sampling and measurement - Types of pollutant sampling and measurement, ambient air sampling, collection of gaseous air pollutants, collection of particulate pollutants, stack sampling, analysis of air pollutants - sulphur dioxide, nitrogen oxides, carbon monoxide, oxidants and ozone, hydrocarbons, particulate matter (9)

CONTROL OF PARTICULATE CONTAMINANTS

Air pollution control methods and equipment - Control methods, source correction methods, Factors affecting Selection of Control Equipment - particulate emission control - working principle, design and application of gravitational settling chambers, cyclone separators, electrostatic precipitators and depth filters. (9)

CONTROL OF GASEOUS CONTAMINANTS

Factors affecting Selection of Control Equipment - Control of gaseous emissions -Dry methods, wet scrubbing methods, combustion, biological methods - Control of specific gaseous pollutants -Control of sulphur dioxide emission, desulphurisation of flue gases, Control of nitrogen oxides, Modification of operating conditions, effluent gas treatment methods, Carbon monoxide control, control of hydrocarbons- Carbon monoxide poisoning - Hydrogen Sulphide poisoning. (9)

INDOOR AIR QUALITY MANAGEMENT

Sources, indoor and outdoor concentration - models -simple box model, complex model - control of Indoor air Quality- Indoor emission - sick building syndrome types - Radon Pollution and its control - Membrane process - UV photolysis - risk related to poor indoor air quality - strategies for creating premium indoor air quality (IAQ) - Indoor air quality (IAQ) and green building rating systems - LEED rating system (9)

TOTAL : 45

19CEE24 - SOLID AND HAZARDOUS WASTE MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT - THEORY

COURSE OUTCOMES

After successful completion of the course, student will be able to

CO1 : Outline the salient features of solid waste management and handling of solid waste.

CO2 : Deduce source reduction, recycling and reuse techniques for solid waste.

CO3 : Analyze the collection systems and methods of transfer of solid waste.

CO4 : Describe the processing techniques for solid and hazardous waste.

CO5 : Select suitable methods for disposal of solid and hazardous waste.

CO6 : Interpret the legislation for management, handling and disposal of solid and hazardous waste.

CHARACTERISTICS AND SOURCE REDUCTION OF SOLID WASTE

Definition, sources, and types of solid waste - Composition, physical, chemical and biological Properties of solid wastes - Per capita generation rates - Sampling and characterization of solid waste - Source reduction of waste - Waste exchange - Recycling and reuses - Salient features of Indian legislations on management and handling of municipal solid wastes. (9)

COLLECTION AND TRANSPORT OF SOLID WASTE

Estimation of solid waste and factors affecting generation rates - On-site handling, storage, and processing- Collection services: municipal and commercial - Industrial services - Collection systems: Hauled-container system (HCS) and stationary container system (SCS) - Vehicle and labour assessment - Assessment of collection route - Transfer and transport-Transfer station location- Means and methods of transfer. (9)

PROCESSING AND DISPOSAL OF SOLID WASTE

Objective of processing - material separation and processing technologies- biological, chemical and thermal conversion technologies- disposal in Landfills: site selection methods and operations, leachate and gas generations and movement and control of gas and leachate techniques - Composting: aerobic and anaerobic - Resource and energy recovery schemes. (9)

HAZARDOUS WASTE CHARACTERIZATION AND MANAGEMENT

Definitions and Identifications of hazardous waste - Origin and characterization of hazardous solid waste- Typical hazardous wastes in MSW - Hazardous waste management: minimization, collection, storage, handling, transport, and disposal - design of hazardous waste landfills - TCLP tests - National and International legislation for hazardous waste management - Atomic Energy Regulatory Board -International Atomic Energy Agency - Department of Atomic Energy - Nuclear Power Corporation - Nuclear power plants in India. (9)

NUCLEAR WASTE AND e-WASTE

Sources - classification - effects of nuclear waste- Initial treatment of nuclear waste - vitrification, ion exchange, synroc - long term management - above ground disposal, geological disposal, ocean dumping, transmutation, space disposal - reuse of waste - nuclear safety and waste regulation - case study on nuclear disaster - source of e- waste - material composition of e - waste - recycling and recovery - Integrated approaches to e - waste recycling - socio economic factors - treatment option - disposal option - e - waste legislation. (9)

TOTAL : 45

19CEE26 - INDUSTRIAL WASTEWATER MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1 : Outline the waste water characteristics and environmental implications of various industrial effluents
- CO2 : Interpret the Wastewater minimization techniques.
- CO3 : Illustrate the importance of Advanced Wastewater Treatment systems.
- CO4 : Interpret the manufacturing processes of industries and compare the characteristics of industrial effluents.
- CO5 : Implement the suitable treatment process for the industries based on the characteristics of Wastewater.

INDUSTRIAL WASTEWATER PERSPECTIVES

General characteristics of industrial wastewaters - Objectives and management of industrial wastewaters - Effluent and stream standards for disposal of wastewaters - Sewer ordinance - Effects of untreated and/or partially treated wastewaters on disposal into land, rivers, sea and ocean-zero Liquid discharge, effluent treatment - Individual and common effluent treatment plant (9)

WASTEWATER MINIMIZATION AND ADVANCED WASTEWATER TREATMENT

Volume and strength reductions - Reduce, Reuse and Recycle concepts - waste auditing - Objectives, principles and process description of equalization, neutralization, floatation process, types of aeration system -Chemical oxidation, chemical precipitation, adsorption, membrane filtration process, gas stripping and ion exchange process- evaporators. (9)

CASE STUDIES -1

Process description, wastewater characteristics and effluent treatment for iron and steel, thermal power plants, sugar, paper and pulp industry. (9)

CASE STUDIES - 2

Process description, wastewater characteristics and effluent treatment for tannery, distilleries, dairy and textiles - Dyeing. (9)

CASE STUDIES - 3

Process description, wastewater characteristics and effluent treatment for oil refineries, pharmaceutical plants, corn-starch industry and food processing industry. (9)

TOTAL : 45

TEXT BOOKS

1. Rao, M.N and Datta, A.K. "Waste Water Treatment", Oxford and IBH Publishers Co, New Delhi, 1995.
2. Metcalf and Eddy, "Wastewater Engineering Treatment, Disposal and Reuse", McGraw-Hill Publishing Co, Indian Edition, New Delhi, 2005.
3. Eckenfelder (Jr), "Industrial Water Pollution Control", McGraw-Hill Book Co, New York, 2000.

19CEOE06 - DISASTER MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After successful completion of the course, student will be able to

- CO1 Identify natural and manmade disasters
- CO2 Explain in detail about causes and effects of natural and manmade disasters
- CO3 Apply geospatial techniques (including GIS) that can enhance vulnerability assessments
- CO4 Identify and analyse the factors that give rise to differential vulnerabilities and levels of community resilience and suggest necessary mitigation plans
- CO5 Assess and manage these vulnerabilities through disaster planning and policymaking

NATURAL DISASTERS

Cyclones, Floods, Drought and Desertification - Earthquake, Tsunami, Landslides and Avalanche. (9)

MAN MADE DISASTERS

Chemical industrial hazards, major power breakdowns, traffic accidents, Fire, War, Atom bombs, Nuclear disaster- Forest Fire- Oil fire -accident in Mines. (9)

GEOSPATIAL TECHNOLOGY

Remote sensing, GIS and GPS applications in real time disaster monitoring, prevention and rehabilitation- disaster mapping. (9)

RISK ASSESSMENT AND MITIGATION

Hazards, Risks and Vulnerabilities - Disasters in India, Assessment of Disaster Vulnerability of a location and vulnerable groups- Preparedness and Mitigation measures for various Disasters- Mitigation through capacity building -Preparation of Disaster Management Plans. (9)

DISASTER MANAGEMENT

Legislative responsibilities of disaster management- Disaster management act 2005- post disaster recovery & rehabilitation, Relief & Logistics Management; disaster related infrastructure development- Post Disaster, Emergency Support Functions and their coordination mechanism - Role of Engineers in Disaster Management. (9)

TOTAL : 45

TEXT BOOKS

1. R. Subramanian, "Disaster Management" Vikas Publishing House Pvt. Ltd, New Delhi, 2018.
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd, 2017.

REFERENCES

1. Disaster Management in India-A Status Report- Published by the National Disaster Management Institute, Ministry of Home Affairs, Govt. of India, 2004
2. Murthy D. B. N., "Disaster Management : Text and Case Studies", Deep and Deep Publications (P) Ltd., New Delhi, 2007.
3. Surtar L and Sezhayan L, "Disaster Management", Sarup and Sons, New Delhi, 2007.
4. Singhal J.P. "Disaster Management", Laxmi Publications, 2010.

19EE0E02 - SOLAR AND WIND ENERGY SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT - THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to:

- CO1 Summarize the solar radiation, measurements and characteristics of solar PV cell.
- CO2 Develop the model of a PV system and its applications.
- CO3 Illustrate the basic types, mechanical characteristics and model of wind turbine.
- CO4 Analyse the electrical characteristics and operation of various wind-driven electrical generators.
- CO5 Utilize various power electronic converters used for hybrid system.

SOLAR RADIATION AND SOLAR CELL FUNDAMENTALS

Basic characteristics of sunlight - solar spectrum - insolation specifics- irradiance and irradiation pyrometer - solar energy statistics- Solar PV cell - I-V characteristics -P-V characteristics- fill factor. Modeling of solar cell- maximum power point tracking. (9)

SPV SYSTEM PERFORMANCE AND APPLICATIONS

PV module - blocking diode and by-pass diodes- composite characteristics of PV module - PV array - solar cell array design concepts - Peak power operation-System components. PV- powered fan-PV fan with battery backup - PV-powered pumping system - PV powered lighting systems - grid - connected PV systems. (9)

WIND ENERGY FUNDAMENTALS AND COMPONENTS

Wind source-wind statistics-energy in the wind- Basic principle of wind energy conversion - nature of wind - power in the wind -turbine power characteristics- parts of wind turbines- braking systems-lower-Maximum power operation. (9)

WIND TURBINE TYPES AND CONTROL

Classification of WECS - Generating Systems - DC generator, Synchronous generator, induction generator, Doubly fed Induction generator, Direct-driven generator- generator control - load control. (9)

SYSTEM INTEGRATION

Energy storage-Power electronic converters for interfacing wind electric generators - power quality issues- Hybrid system: wind - diesel systems, wind-solar systems. (9)

TOTAL : 45

TEXT BOOKS

1. S N Bhadra, S Banerjee and D Kastha, "Wind Electrical Systems", Oxford University Press, 1st Edition, 2005.
2. Chetan Singh Solanki, "Solar Photovoltaic's: Fundamentals, Technologies and Applications" PHI Learning Publications, 3rd Edition, 2015.

REFERENCES

1. Roger A. Messenger and Jerry Ventre, "Photovoltaic systems engineering", Taylor and Francis Group Publications, 2020.

Semester III

Course Code	Course Name	L	T	P	C	CY
	Program Elective - V	3	0	0	3	PE
	Program Elective - VI	3	0	0	3	PE
	Open Elective / Professional Elective - VII	3	0	0	3	OE
	One Credit Course	1	0	0	1	EEC
19MCE31	Practical Training	0	0	0	2	EEC
	TOTAL CREDITS				12	

Semester IV

Course Code	Course Name	L	T	P	C	CY
19MCE41	Project Work and Viva Voce	0	0	36	18	EEC
	TOTAL CREDITS				18	

Total number of credits : 71

LIST OF OPEN ELECTIVES

Course Code	Course Name	L	T	P	C	CY
19MCEOED1	Disaster Management	3	0	0	3	OE
19MCEOED2	Energy Efficient Building	3	0	0	3	OE
19MCMOE01	Landscaping and Architecture	3	0	0	3	OE
19MENOE01	Climate Change and Adaptation	3	0	0	3	OE

LIST OF ONE CREDIT COURSES

Course Code	Course Name	L	T	P	C	CY
19MCOC01	Practical Geotechnical Engineering	1	0	0	1	EEC
19MCOC02	Green Buildings	1	0	0	1	EEC
19MCOC03	Geoinformatics Laboratory	1	0	0	1	EEC
19MCOC04	Sustainable Architecture	1	0	0	1	EEC

19MENOE01- CLIMATE CHANGE AND ADAPTATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1 Understand earth's climate system and the concept of global warming
- CO2 Infer the causes for climate change on the earth's surface
- CO3 Comprehend the impact of climate change on society
- CO4 Apply the various climate change adaptation and mitigation measures
- CO5 Evaluate the role of clean technology in climate change adaptation

EARTH'S CLIMATE SYSTEM

Introduction - weather and climate - Climate in the spotlight-The Earth's Climate Machine - Climate Classification - Global wind systems - Trade Wind Systems - Trade Winds and the Hadley Cell - Cloud formation and Monsoon Rains - Storms, Hurricanes and Tornado - The Hydrological Cycle - Global Ocean Circulation - El Nino - LA Nino effect - Solar Radiation - The Earth's Natural Green House Effect - Green House Gases and Global Warming (9)

OBSERVED CHANGES AND ITS CAUSES

Observation of Climate Change - Changes in pattern of temperature, precipitation and sea level rise - Observed effects of Climate Changes - Drivers of Climate Change - Climate Sensitivity and Feedbacks - The Montreal Protocol - UNFCCC - IPCC - Evidences of Changes in Climate and Environment - on a Global Scale and in India - Climate Change modeling. (9)

IMPACTS OF CLIMATE CHANGE

Impacts of Climate Change on various sectors - Agriculture, Forestry and Ecosystem - Water resources - Human Health - Industry, Settlement and Society - Methods and Scenarios - Projected Impacts for different regions - Uncertainties in the Projected Impacts of Climate Change - Risk of irreversible changes. (9)

CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES

Adaptation Strategy/options in various sectors - Water - Agriculture - Infrastructure and Settlement including coastal zones. Human Health - Tourism - Transport - Energy - Key Mitigation Technologies and practices - Energy supply - Transport - Buildings - Industry - Agriculture - Forestry - Carbon sequestration - Carbon Capture and Storage (CCS) - Waste (MSW & Biowaste, Biomedical, Industrial waste - International and Regional co-operation. (9)

CLEAN TECHNOLOGY AND ENERGY

Clean Development Mechanism - Carbon Trading - Examples of future Clean Technology - Biodiesel - Natural Compost - Eco-friendly Plastic - Alternate Energy - Hydrogen - Bio-fuels - Solar Energy - Wind - Hydroelectric Power. (9)

Total : 45

TEXT BOOKS

1. Dash Sushil Kumar, "Climate Change - An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.
2. IPCC Fifth Assessment Report.
3. Jan C. van Dam, "Impacts of Climate Change and Climate Variability on Hydrological Regimes", IHE, The Netherlands, October, 2009.

19MCOC02 - GREEN BUILDINGS

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1 Acquire knowledge about energy impact in buildings
- CO2 Identify different energy analysis method and standards
- CO3 Understand energy quality management in buildings

INTRODUCTION

Life Cycle impacts of materials and products - sustainable design concepts - strategies of design for the Environment -The sun-earth relationship and the energy balance on the earth's surface, climate, wind - Solar radiation and solar temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings - Thermal properties of building materials. (5)

ENERGY EFFICIENT BUILDINGS

Passive cooling and day lighting - Active solar and photovoltaic- Building energy analysis methods- Building energy simulation- Building energy efficiency standards- Lighting system design- Lighting economics and aesthetics- Impacts of lighting efficiency - Energy audit and energy targeting- Technological options for energy management. (5)

INDOOR ENVIRONMENTAL QUALITY MANAGEMENT

Psychometry- Comfort conditions- Thermal comfort- Ventilation and air quality-Air conditioning requirement- Visual perception- Illumination requirement-Auditory requirement- Energy management options- Air conditioning systems- Energy conservation in pumps- Fans and blowers- Refrigerating machines - Heat rejection equipment- Energy efficient motors- Insulation. (5)

Total : 15

TEXTBOOKS

1. Nibert, C. "Sustainable Construction: Green Building Design and Delivery", John Wiley & Sons, 2016
2. Edward G Pita, "An Energy Approach: Air-conditioning Principles and Systems", Pearson Education, 2018

REFERENCES

1. Colin Paton, "The New Eco-Architecture", Spon Press, 2002.
2. Energy Conservation Building Codes: www.bec-india.nic.in
3. Lever More G J, "Building Energy Management Systems", E and FN Spon, London, 2000.
4. Ganesan T P, "Energy Conservation in Buildings", ISTE Professional Center, Chennai, 1999.
5. John Little and Randall Thomas, "Design with Energy: The Conservation and Use of Energy in Buildings", Cambridge University Press, 1984.

ELECTIVE COURSES

PROFESSIONAL ELECTIVE COURSE : STREAM

I. ELECTRICAL MACHINES AND CONTROL (EMC)

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19EEEE01	Design of Electrical Machines	3	0	0	3	EC
2	19EEEE02	Special Electrical Machines	3	0	0	3	EC
3	19EEEE03	Modeling and Analysis of Electrical Machines	3	0	0	3	EC
4	19EEEE04	Digital Control Systems	3	0	0	3	EC
5	19EEEE05	Systems Theory	3	0	0	3	EC
6	19EEEE06	Embedded control of electric drives	3	0	0	3	EC
7	19EEEE07	Robust Control	3	0	0	3	EC

II. POWER AND ENERGY (PE)

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19EEEE08	Power Quality	3	0	0	3	EC
2	19EEEE09	Advanced Power Electronics	3	0	0	3	EC
3	19EEEE10	Power and Energy Management	3	0	0	3	EC
4	19EEEE11	Energy Storage Technology	3	0	0	3	EC
5	19EEEE12	Utilization and Conservation of Electrical Energy	3	0	0	3	EC
6	19EEEE13	Electrical Safety	3	0	0	3	EC
7	19EEEE14	Energy Efficient Lighting Systems	3	0	0	3	EC
8	19EEEE15	Power System Design	3	0	0	3	EC
9	19EEEE16	High Voltage Transmission Systems	3	0	0	3	EC
10	19EEEE17	Deregulated Power System	3	0	0	3	EC
11	19EEEE18	Electric Vehicles	3	0	0	3	EC
12	19EEEE19	Energy Audit In Thermal & Electrical Utilities	3	0	0	3	EC
13	19EEEE41	Switched Mode Power Conversion	3	0	0	3	EC
14	19EEEE42	Utilization of Solar Energy	3	0	0	3	EC

III. ELECTRONIC DESIGN (ED)

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19EEEE20	Real Time Embedded Systems	3	0	0	3	EC
2	19EEEE21	VLSI Design	3	0	0	3	EC
3	19EEEE22	FPGA based System Design	3	0	0	3	EC
4	19EEEE23	Robotics and Control	3	0	0	3	EC
5	19EEEE24	Digital Consumer technology	3	0	0	3	EC
6	19EEEE25	Electronic Product Design	3	0	0	3	EC
7	19EEEE26	Medical Electronics	3	0	0	3	EC
8	19EEEE27	Analog and Digital Communication	3	0	0	3	EC
9	19EEEE28	Multimedia system	3	0	0	3	EC
10	19EEEE29	Automation, Renewable Energy & FPGA Laboratory	0	0	6	3	EC
11	19EEEE43	Wearable Sensors	3	0	0	3	EC

19EEE42 - UTILIZATION OF SOLAR ENERGY

L	T	P	C
3	0	0	3

ASSESSMENT - THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 : Infer the solar thermal energy system for thermal energy collection and storage and its use in the buildings.

CO2 : Design the solar PV system for the given applications and to explain the data monitoring system.

CO3 : Interpret and analyze the applications of solar thermal energy system.

CO4 : Interpret and analyze the applications of solar PV system.

CO5 : Identify the factors involved in economic analysis and explain about E-waste management.

SOLAR THERMAL ENERGY SYSTEM

Solar collectors: Liquid flat plate collectors, Concentrating collectors, advantages and disadvantages and comparison - Thermal energy storage: Sensible heat storage and latent heat storage - solar pond - Solar heating of buildings: Principle and system components - Solar cooling of buildings: Principle and system components - Solar pond: Principle of operation, applications of solar ponds - Basic concepts of energy efficient buildings 9

SOLAR PHOTOVOLTAIC ENERGY SYSTEM

Design aspects of solar PV installation: Technical and general requirements of solar PV module, Main components of solar PV system: Solar panel, Batteries (types, parameters and factors affecting battery performance, Charge controllers, Converter requirements) - Installation practices of solar panel -sizing of wires - Electrical safety standards and requirements - Data monitoring system; Remote monitoring - On-site monitoring 10

SOLAR THERMAL APPLICATIONS

Principle of operation: Solar furnace, Solar Distillation, Solar Water Heating, Solar Air Heating and solar pumping system - Industrial process heat: Types and choice of solar collectors, examples for industrial applications - Solar green house concepts 10

SOLAR PV APPLICATIONS

Home Lighting Systems - Street lighting systems - Battery Charging Stations - PV powered water pumping system - PV powered refrigeration system - Military uses - Solar lanterns - Solar energy utilization in space - MNRE schemes for grid connected and off-grid applications 9

ECONOMIC ANALYSIS AND E-WASTE HANDLING

Initial cost - Annual cost - Annual savings - Cumulative savings - Life cycle savings - Payback period - Present worth factor - operation and maintenance cost - Economic Analysis Methods.

E-waste - Indian Scenario - Health and environmental hazards - Recycling concepts of E-waste - E waste generation and handling of solar power plants 7

TOTAL : 45

**COURSES RELATED TO PROFESSIONAL
ETHICS AND HUMAN VALUES**

(Highlighted in Blue)

IV. COMPUTER AND COMMUNICATION (CC)

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19EEE30	Computer Architecture and Parallel Processing	3	0	0	3	EC
2	19EEE31	Multi Core Architecture	3	0	0	3	EC
3	19EEE32	Data Communication Networks	3	0	0	3	EC
4	19EEE33	Fog Computing	3	0	0	3	EC
5	19EEE34	Internet of Things	3	0	0	3	EC
6	19EEE35	Data Analytics	3	0	0	3	EC
7	19EEE36	Virtual Instrumentation	3	0	0	3	EC
8	19EEE37	Cyber Physical Systems	3	0	0	3	EC
9	19EEE38	Intelligent Techniques for Electrical Engineers	3	0	0	3	EC
10	19EEE39	Industrial Automation	3	0	0	3	EC
11	19EEE40	Deep Learning	3	0	0	3	EC

BS - BASIC SCIENCES

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19FYM12	Calculus and Numerical Methods	3	1	0	4	BS
2	19FYP13	Engineering Physics	3	0	0	3	BS
3	19FYC11	Engineering Chemistry	3	0	0	3	BS
4	19PL11	Physics Laboratory-I	0	0	1	0.5	BS
5	19CL11	Chemistry Laboratory-I	0	0	1	0.5	BS
6	19FYM22	Vector Calculus, Linear Algebra and Partial Differential Equations	3	1	0	4	BS
7	19PL21	Physics Laboratory-II	0	0	1	0.5	BS
8	19CL21	Chemistry Laboratory-II	0	0	1	0.5	BS
9	19MEL12	Engineering Practices Laboratory	0	0	2	1	BS
10	19EEM31	Transforms, Probability and Random Variables	3	0	0	3	BS
TOTAL CREDITS						20	

HS - HUMANITIES AND SOCIAL SCIENCES

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19FYE11	Technical English	1	0	2	2	HS
2	19FYE21	Language Elective	1	0	2	2	HS
3	19FYC21	Environmental Science and Engineering	1	0	0	1	HS
4	19HSS01	Science of Creativity and Professional Ethics	1	0	0	1	HS
TOTAL CREDITS						6	

DEPARTMENT OF HUMANITIES

Course Code	Course Name	L	T	P	C	Eligible Branches
19HOE01	Principles of Management	3	0	0	3	Common to all branches
19HOE02	Current Trends in Indian Economy	3	0	0	3	Common to all branches
19HOE03	Monetary Economics	3	0	0	3	Common to all branches
19HOE04	English for Academic Purposes	3	0	0	3	Common to all branches
19HOE05	English for Competitive Exams	3	0	0	3	Common to all branches
19HOE06	Life and Literature	3	0	0	3	Common to all branches

19HSS01 - SCIENCE OF CREATIVITY AND PROFESSIONAL ETHICS

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

After successful completion of course, students will be able to:

CO1 : Understand the principles of karma yoga, duty consciousness and evolution of the universe.

CO2 : Analyze the benefits of yoga and meditation.

CO3 : Understand the benefits of harmony, introspection and examine human values for sustained growth in career and life.

LIFE FORCE, CONCIIOUSNESS AND EVOLUTION OF UNIVERSE

Science of Creativity and Personality Development - Principles of Karma Yoga - Duty Consciousness - Law of Nature - Life Force -Potentiality of the Life Force - Consciousness - Pancha Thanmatras - Blomagnetism. Evolution of the Universe: Creation Theory - Evolution Theory - Evolution of Living Beings: Absolute Space and Force - Seven Constituent Layers In the Body. (6)

YOGA AND ITS BENEFITS

Simple and Safe yoga - Upa yoga Practices : Yoga for peace, health, joy, love, well-being and success. Physical exercise - Meditation - Seven centers of meditation - benefits - effect of good vibrations - cause and effect system. (3)

HARMONY IN LIFE, INTROSPECTION AND HUMAN VALUES

Harmony in Life : Self, family, society and nature - Introspection : Analysis of thought, Moralization of desire, Neutralization of anger, Eradication of worries and Self realization.

Morals, Values and Ethics - Integrity - Work ethics - Service learning - Virtues - Respect for others - Valuing time - Co-operation -Commitment - Empathy - Self confidence - Challenges in work place - Impact of cyber space on Individual. (6)

TOTAL: 15

TEXT BOOKS

1. Yogiraj Vethathri Maharishi, "Karma Yoga - The Holistic Unity", Vethathri Publications 4th Edition, 2009.
2. R.S.Naagarazan, "A Textbook on Professional Ethics and Human Values", New Age International Publishers, New Delhi, 2011.

REFERENCES

1. Sadhguru, "Body the Greatest Gadget and Mind Is your Business", Diamond Pocket Books Pvt. Ltd, Isha Foundations, 2013.
2. Swami Vivekananda and Swami Nikhilananda, "Karma Yoga and Bhakti Yoga", 2nd Edition, Ramakrishna Vivekananda Publications, 2008.

19HOE06 - LIFE AND LITERATURE

L	T	P	C
3	0	0	3

COURSE OUTCOMES

- CO1 Compose an essay on the prose/poem
- CO2 Analyse the poem and write a critical appreciation of it
- CO3 Read the story and find the moral values implied in the stories
- CO4 Write a review of the fiction

Unit - 1 : Prose

- The Postmaster by Rabindranath Tagore
- Snapshot of a Dog by J.G. Thurber
- On the Rule of the Road by A.G. Gardiner
- The Village Schoolmaster by Oliver Goldsmith
- Incident of the French Camp by Robert Browning (13)

Unit - 2 : Poems

- Stopping By Woods on a Snowy Evening by Robert Frost
- The Ballad of Father Gilligan by W.B. Yeats (9)

Unit - 3 : Short stories

- The Model Millionaire by Oscar Wilde
- The Ant and the Grasshopper by W. Somerset Maugham
- The Doll's House by Katherine Mansfield, Biography
- Albert Einstein and Steve Jobs (11)

Unit - 4 : Fiction

- The Old Man and the Sea by Ernest Hemmingway
- The Scarlet Pimpernel by Baroness Emma Orczy
- Practice in creative writing, review writing (13)

TOTAL : 45

REFERENCES

1. Xavier, ed. *An Anthology of Popular Essays and Poems*. Macmillan: New Delhi, 2009.
2. Kumara Pillai, ed. *A Book of Modern Short Stories*. Macmillan: New Delhi, 2009.
3. Colleen and Darius Krishnaraj, ed. *Convergence, A Book of Short Stories*. Macmillan: New Delhi, 2009.
4. Ernest Hemmingway *The Old Man and the Sea*. Arrow: Warwickshire, 2000.
5. Baroness Emma Orczy. *The Scarlet Pimpernel*. Hutchinson : 1995.

23MBAL28 - RURAL COMMUNITY ENGAGEMENT

ASSESSMENT: PRACTICAL

L T P

COURSE OUTCOME

Upon completion of the course students will be able to

CO1: Understand the social, economic, political and cultural framework of the rural society.

CO2: Address the challenges with suitable solutions in the identified rural issues.

CO3: Engage in rural community development programmes.

CO4: Create community awareness on health and hygiene and disaster management.

CO5: Gain knowledge on establishing professional intervention.

COURSE CONTENT

1. Dynamics of Rural Society: Social, Economic, political and cultural **(3)**
2. Community Goal setting: Inner Engineering **(3)**
3. Participatory Learning and social mapping: Approaches and methods, community project proposal and project management, concept and steps, Thematic maps **(6)**
4. Village development including aspects and process of preparation of village disaster management plan **(3)**
5. Resource Mapping: Natural and Human resource mapping and management **(3)**
6. Rural Institutions: Engagement with school/ street/ Health centre / Panchayat / SHGs **(3)**
7. Community Awareness: Health & Hygiene/ Rights/ Policies & Programmes / Corruption **(3)**
8. Disaster Management: Disaster Preparedness - Risk reduction, Rehabilitation - Physical and Psychological aspects **(3)**
9. Professional Intervention- Partnership with Public, Private and Non-governmental organizations **(3)**

TOTAL: 30

TEXTBOOKS

1. Common core curriculum for Rural Engagement, National council of Rural Institutes, MHRD, GOI.
2. Katarsingh and Anil Shishodia, Rural Development: Principles, Policies and Management, Sage Publications, 2016.
3. A Azeez & S.M.J Akhtar, Rural Development in India, Kalpaz publications, 2016
4. Transforming Rural India, Ministry of Rural Development, GOI.