ENVIRONMENTAL ENGINEERING – I

SYLLABUS:

UNIT–I Introduction: Importance and Necessity of Protected Water Supply systems, Water borne diseases, Flow chart of public water supply system, Role of Environmental Engineer, Agency activities
Water Demand and Quantity Estimation: Estimation of water demand for a town or city, Per capita Demand and factors influencing it - Types of water demands and its variationsfactors affecting water demand, Design Period, Factors affecting the Design period, Population Forecasting.

UNIT-II Sources of Water: Lakes, Rivers, Impounding Reservoirs, comparison of sources with reference to quality, quantity and other considerations- Capacity of storage reservoirs, Mass curve analysis. Groundwater sources of water: Types of water bearing formations, springs, Wells and Infiltration galleries, Yields from infiltration galleries.
Collection and Conveyance of Water: Factors governing the selection of the intake structure, Types of Intakes. Conveyance of Water: Gravity and Pressure conduits, Types of Pipes, Pipe Materials, Pipe joints, Design aspects of pipe lines, laying of pipe lines

UNIT-III Quality and Analysis of Water: Characteristics of water–Physical, Chemical and Biological-Analysis of Water – Physical, Chemical and Biological characteristics. Comparison of sources with reference to quality- I.S. Drinking water quality standards and WHO guidelines for drinking water

UNIT–IV Treatment of Water: Flowchart of water treatment plant, Treatment methods: Theory and Design of Sedimentation, Coagulation, Sedimentation with Coagulation, Filtration

UNIT-V Disinfection: Theory of disinfection-Chlorination and other Disinfection methods, Softening of Water, Removal of color and odours - Iron and manganese removal – Adsorption-fluoridation and deflouridation–aeration–Reverse Osmosis-Iron exchange–Ultra filtration

UNIT–VI Distribution of Water: Requirements- Methods of Distribution system, Layouts of Distribution networks, Pressures in the distribution layouts, Analysis of Distribution networks: Hardy Cross and equivalent pipe methods -Components of Distribution system: valves such as sluice valves, air valves, scour valves and check valves, hydrants, and water meters–Laying and testing of pipe lines- selection of pipe materials, pipe joints

Text Books

1. Environmental Engineering – Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus – Mc-Graw-Hill Book Company, New Delhi, 1985.
2. Elements of Environmental Engineering – K. N. Duggal, S. Chand & Company Ltd., New Delhi, 2012.

References

1.Water Supply Engineering – P. N. Modi.
2.Water Supply Engineering – B. C. Punmia
3.Water Supply and Sanitary Engineering – G. S. Birdie and J. S. Birdie
4.Environmental Engineering, D. Srinivasan, PHI Learning Private Limited, New Delhi,2011.

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ENVIRONMENTAL ENGINEERING – II

SYLLABUS:

UNIT – I: Introduction to Sanitation – Systems of sanitation – relative merits & demerits – collection and conveyance of waste water – sewerage – classification of sewerage systems- Estimation of sewage flow and storm water drainage – fluctuations – types of sewers - Hydraulics of sewers and storm drains– design of sewers – appurtenances in sewerage – cleaning and ventilation of sewers

UNIT – II: Pumping of wastewater: Pumping stations – location – components– types of pumps and their suitability with regard to wastewaters.
House Plumbing: Systems of plumbing-sanitary fittings and other accessories– one pipe and two pipe systems – Design of building drainage

UNIT – III: Sewage characteristics – Sampling and analysis of wastewater - Physical, Chemical and Biological Examination-Measurement of BOD and COD - BOD equations
Treatment of sewage: Primary treatment-Screens-grit chambers-grease traps– floatation– sedimentation – design of preliminary and primary treatment units.

UNIT – IV: Secondary treatment: Aerobic and anaerobic treatment processcomparison.
Suspended growth process: Activated Sludge Process, principles, designs, and operational problems, modifications of Activated Sludge Processes, Oxidation ponds, Aerated Lagoons.
Attached Growth Process: Trickling Filters–mechanism of impurities removal- classification–design-operation and maintenance problems. RBCs, Fluidized bed reactors
UNIT V: Miscellaneous Treatment Methods: Nitrification and Denitrification – Removal of Phosphates –UASB–Membrane reactors-Integrated fixed film reactors. Anaerobic Processes: Septic Tanks and Imhoff tanks- working Principles and Design–Reuse and disposal of septic tank effluent, FAB Reactors.

UNIT – VI: Bio-solids (Sludge) management: Characteristics-SVI, handling and treatment of sludge-thickening – anaerobic digestion of sludge, Sludge Drying Beds. Centrifuge.
Disposal of sewage: Methods of disposal – disposal into water bodies-Oxygen Sag Curve-Disposal into sea, disposal on land- sewage sickness.

Text Books

1. Wastewater Engineering Treatment and Reuse, Metcalf & Eddy, Tata McGraw-Hill edition.
2. Industrial Water and Wastewater Management, K.V.S.G. Murali Krishna.
3. Elements of Environmental Engineering, K. N. Duggal, S. Chand & Company Ltd. New Delhi, 2012.

References

4. Environmental Engineering, Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus – Mc-Graw-Hill Book Company, New Delhi, 1985
5. Wastewater Treatment for Pollution Control and Reuse, Soli. J Arceivala, Sham R Asolekar, Mc-GrawHill, NewDelhi; 3rd Edition
6. Environmental Engineering –II: Sewage disposal and Air Pollution Engineering, Garg, S. K., Khanna Publishers
7. Sewage treatment and disposal, P. N. Modi & Sethi.
8. Environmental Engineering, Ruth F. Weiner and Robin Matthews – 4th Edition Elsevier, 2003
Environmental Engineering, D. Srinivasan, PHI Learning Private Limited, New Delhi, 2011.

Environmental Studies

Course Learning Objectives :

The objectives of the course is to impart

- Overall understanding of the natural resources.
- Basic understanding of the ecosystem and its diversity.
- Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities.
- An understanding of the environmental impact of developmental activities.
- Awareness on the social issues, environmental legislation and global treaties.

Course Outcomes :

The student should have knowledge on

- The natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources.
- The concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web.
- The biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity.
- Various attributes of the pollution and their impacts and measures to reduce or control the pollution along with waste management practices.
- Social issues both rural and urban environment and the possible means to combat the challenges.
- The environmental legislations of India and the first global initiative towards sustainable development.
- About environmental assessment and the stages involved in EIA and the environmental audit.

UNIT – I

Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance – Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, acid rains, ozone layer depletion, population growth and explosion, effects. Role of information Technology in Environment and human health.

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem. – Producers, consumers and decomposers. – Energy flow in the ecosystem – Ecological succession. – Food chains, food webs and ecological pyramids. – Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

UNIT – II

Natural Resources: Natural resources and associated problems Forest resources – Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people. Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT – III

Biodiversity and its conservation: Definition: genetic, species and ecosystem diversity-classification – Value of biodiversity: consumptive use, productive use, social-Biodiversity at national and local levels. India as a mega-diversity nation – Hot-sports of biodiversity – Threats to **biodiversity**: habitat loss, man-wildlife conflicts. – Endangered and endemic species of India – Conservation of biodiversity: conservation of biodiversity.

UNIT – IV

Environmental Pollution: Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. – Pollution case studies.

Solid Waste Management: Sources, classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products.

UNIT – V

Social Issues and the Environment: Urban problems related to energy – Water conservation, rain water harvesting-Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Environmental Protection Act -Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act - Wildlife Protection Act -Forest Conservation Act-Issues involved in enforcement of environmental legislation. – Public awareness.

UNIT – VI

Environmental Management: Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Ecotourism The student should submit a report individually on any issues related to Environmental Studies course and make a power point presentation.

Text Books

- Environmental Studies by R. Rajagopalan, 2nd Edition, 2011, Oxford University Press.
- A Textbook of Environmental Studies by Shaashi Chawla, TMH, New Delhi.
- Environmental Studies by P.N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai.
- Reference
- Text Book of Environmental Studies by Deeshita Dave & P. UdayaBhaskar, Cengage Learning.
- Environmental Studies by K.V.S.G. Murali Krishna, VGS Publishers, Vijayawada.
- Environmental Studies by Benny Joseph, Tata McGraw Hill Co, New Delhi.
- Environmental Studies by Piyush Malaviya, Pratibha Singh, Anoop singh: Acme Learning, New Delhi.

Green Engineering Systems

Course Objective:
The course aims to highlight the significance of alternative sources of energy, green energy systems and processes and provides the theory and working principles of probable sources of renewable and green energy systems that are environmental friendly.

UNIT-I : INTRODUCTION: SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems. Photo voltaic energy conversion – types of PV cells, I-V characteristics.
SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT – II : SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.
WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

UNIT – III : BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.
GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.
OCEAN ENERGY: OTEC, Principles of utilization, setting of OTEC plants,thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT –IV ENERGY EFFICIENT SYSTEMS:
(A) ELECTRICAL SYSTEMS: Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning), demand site management.
(B) MECHANICAL SYSTEMS: Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, Environmental friendly and Energy efficient compressors and pumps.

UNIT-V : ENERGY EFFICIENT PROCESSES: Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmental friendly machining, vegetable based cutting fluids, alternate casting and joining techniques, zero waste manufacturing.

UNIT – VI : GREEN BUILDINGS: Definition, features and benefits. Sustainable site selection and planning of buildings for maximum comfort. Environmental friendly building materials like bamboo, timber, rammed earth, hollow blocks, lime & lime pozzolana cement, agro materials and industrial waste, Ferro cement and Ferro-concrete, alternate roofing systems, paints to reduce heat gain of the buildings. Energy management.

TEXT BOOKS

- Sukhatme S.P. and J.K.Nayak, Solar Energy – Principles of Thermal Collection and Storage, TMH.
- Khan B.H., Non-Conventional Energy Resources, Tata McGraw Hill, New Delhi, 2006.
- Green Manufacturing Processes and Systems, Edited by J. Paulo Davim, Springer 2013.

REFERENCES

- Alternative Building Materials and Technologies / K.S Jagadeesh, B.V Venkata Rama Reddy and K.S Nanjunda Ra.
- Principles of Solar Energy / Frank Krieth& John F Kreider.
- Non-Conventional Energy / Ashok V Desai /Wiley Eastern.
- Renewable Energy Technologies /Ramesh & Kumar /Narosa
- Renewable Energy Technologies/ G.D Roy

Intellectual Property Rights and Patents

UNIT I

Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics – Types of Intellectual Property – Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement – Regulatory – Over use or Misuse of Intellectual Property Rights – Compliance and Liability Issues.

UNIT II

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law –Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of performers – Copyright Formalities and Registration – Limitations – Infringement of Copyright – International Copyright Law- Semiconductor Chip Protection Act.

UNIT III

Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Owners' 'p and Transfer – Patent Application Process and Granting of Patent – Patent Infringement anc Litigation – International Patent Law – Double Patenting – Patent Searching – Patent Cc peration Treaty – New developments in Patent Law- Invention Developers and Promote .

UNIT IV

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law.

UNIT V

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law.

UNIT VI

Introduction to Cyber Law – Information Technology Act – Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy – International aspects of Computer and Online Crime.

REFERENCE BOOKS

- Deborah E.Bouchoux: "Intellectual Property". Cengage learning, New Delhi
- Kompal Bansal & Parishit Bansal "Fundamentals of IPR for Engineers", BS Publications (Press)
- Cyber Law. Texts & Cases, South-Western's Special Topics Collections
- Prabhuddha Ganguli: ' Intellectual Property Rights" Tata Mc-Graw – Hill, New Delhi

- Richard Stim: "Intellectual Property", Cengage Learning, New Delhi.
- R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi.
- M. Ashok Kumar and Mohd. Iqbal Ali: "Intellectual Property Right" Serials Pub.

Professional Ethics and Human Values

UNIT I : Human Values

Morals, Values and Ethics – Integrity – Work Ethics – Service Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality- Character.

UNIT II : Engineering Ethics

The History of Ethics-Purposes for Engineering Ethics-Engineering Ethics- Consensus and Controversy –Professional and Professionalism –Professional Roles to be played by an Engineer –Self Interest, Customs and Religion-Uses of Ethical Theories-Professional Ethics-Types of Inquiry – Engineering and Ethics-Kohlberg's Theory – Gilligan's Argument –Heinz's Dilemma.

UNIT III : Engineering as Social Experimentation

Comparison with Standard Experiments – Knowledge gained – Conscientiousness – Relevant Information – Learning from the Past – Engineers as Managers, Consultants, and Leaders – Accountability – Role of Codes – Codes and Experimental Nature of Engineering.

UNIT IV : Engineers' Responsibility for Safety and Risk

Safety and Risk, Concept of Safety – Types of Risks – Voluntary v/s Involuntary Risk- Short term v/s Long term Consequences- Expected Probability- Reversible Effects- Threshold Levels for Risk- Delayed v/s Immediate Risk- Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

UNIT V : Engineers' Responsibilities and Rights

Collegiality-Techniques for Achieving Collegiality –Two Senses of Loyalty- obligations of Loyalty-misguided Loyalty – professionalism and Loyalty- Professional Rights –Professional Responsibilities – confidential and proprietary information-Conflict of Interest-solving conflict problems – Self- interest, Customs and Religion- Ethical egoism-Collective bargaining-Confidentiality-Acceptance of Bribes/Gifts-when is a Gift and a Bribe- examples of Gifts v/s Bribes-problem solving-interests in other companies- Occupational Crimes-industrial espionage-price fixing-endangering lives- Whistle Blowing-types of whistle blowing-when should it be attempted- preventing whistle blowing.

UNIT VI : Global Issues

Globalization- Cross-culture Issues-Environmental Ethics-Computer Ethics- computers as the instrument of Unethical behaviour-computers as the object of Unethical Acts-autonomous computers-computer codes of Ethics- Weapons Development-Ethics and Research-Analysing Ethical Problems in Research-Intellectual Property Rights.

Text Books

- "Engineering Ethics & Human Values" by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009.
- "Professional Ethics and Morals" by Prof.A.R.Aryasri, Dharanikota Suyodhana-Maruthi Publications.

- "Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M. Jayakumaran- Laxmi Publications
- "Professional Ethics and Human Values" by Prof. D.R. Kiran.
- "Indian Culture, Values and Professional Ethics" by PSR Murthy- BS Publication.
- "Ethics in Engineering" by Mike W. Martin and Roland Schinzinger – Tata McGraw-Hill – 2003.
- "Engineering Ethics" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.

Renewable Energy Sources and Systems

Learning Objectives

- To study the solar radiation data, extra terrestrial radiation, radiation on earth's surface.
- To study solar thermal collections.
- To study solar photo voltaic systems.
- To study maximum power point techniques in solar pv and wind.
- To study wind energy conversion systems, Betz coefficient, tip speed ratio.
- To study basic principle and working of hydro, tidal, biomass, fuel cell and geothermal systems.

UNIT–I

Fundamentals of Energy Systems : Energy conservation principle – Energy scenario (world and India) – Solar radiation: Outside earth's atmosphere – Earth surface – Analysis of solar radiation data – Geometry – Radiation on tilted surfaces – Numerical problems.

UNIT–II

Solar Thermal Systems : Liquid flat plate collections: Performance analysis – Transmissivity Absorptivity product collector efficiency factor – Collector heat removal factor – Numerical problems. Introduction to solar air heaters – Concentrating collectors and solar pond.

UNIT–III

Solar Photovoltaic Systems : Balance of systems – IV characteristics – System design: storage sizing – PV system sizing – Maximum power point techniques: Perturb and observe (P&O) technique – Hill climbing technique.

UNIT–IV

Wind Energy : Wind patterns – Types of turbines – Kinetic energy of wind – Betz coefficient – Tip–speed ratio – Efficiency – Power output of wind turbine – Selection of generator(synchronous, induction) – Maximum power point tracking.

UNIT–V

Hydro and Tidal power systems Basic working principle – Classification of hydro systems: Large, small, micro – measurement of head and flow – Energy equation – Types of turbines – Numerical problems. Tidal power – Basics – Kinetic energy equation – Numerical problems – Wave power – Basics – Kinetic energy equation.

UNIT–VI

Biomass, fuel cells and geothermal systems : Biomass Energy: Fuel classification – Pyrolysis – Direct combustion of heat – Different digesters and sizing. Fuel cell: Classification – Efficiency – VI characteristics. Geothermal: Classification – Dry rock and acquifer – Energy analysis.

Learning Outcomes

Student should be able to

- Analyze solar radiation data, extraterrestrial radiation, radiation on earth's surface.
- Design solar thermal collections.
- Design solar photo voltaic systems.
- Develop maximum power point techniques in solar PV and wind.
- Explain wind energy conversion systems, Betz coefficient, tip speed ratio.
- Explain basic principle and working of hydro, tidal, biomass, fuel cell and geothermal systems.

Text Books

- Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, TMH, New Delhi, 3rd Edition.
- Renewable Energy Resources, John Twidell and Tony Weir, Taylor and Francis -second edition, 2013.
- Energy Science: Principles, Technologies and Impacts, John Andrews and Nick Jelly, Oxford.

Reference Books

- Renewable Energy- Edited by Godfrey Boyle-oxford university, press, 3rd edition, 2013.
- Handbook of renewable technology Ahmed and Zobaa, Ramesh C Bansal, World scientific, Singapore.
- Renewable Energy Technologies /Ramesh & Kumar /Narosa.
- Renewable energy technologies – A practical guide for beginners – Chetong Singh Solanki, PHI.
- Non conventional energy source –B.H. Khan- TMH-2nd edition.

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