Semester I

19MEWE101 SURFACE WATER HYDROLOGY 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- This subject aims at making the students to understand the relevance of various components of hydrologic cycle, which are responsible for spatial and temporal distribution of water availability in any region.
- It has evolved as a science in response to the need to understand the complex water system of the earth and help solve water problems.

Course Outcomes:

At the end of the course,

1. The students obtain the complete knowledge on hydrologic cycle, hydrometeorology and formation of precipitation.
2. The students are able to apply the various methods of field measurements and empirical formulas for estimating the various losses of precipitation, stream flow and runoff.
3. Then apply the knowledge of soil erosion and sedimentation to estimate the life of the reservoir.

UNIT I ATMOSPHERIC WATER SYSTEM 9

Hydrologic cycle – Climate – Weather – Layers in atmosphere – Types and forms of precipitation – Hydro-metrologic measurements – Cyclones – Fronts – Winds – monsoons – Clouds – Requirements for precipitations.

UNIT II HYDROLOGIC PROCESSES 9

Rainfall – Rain gauges – Adequacy of network – Spatial and temporal distribution – frequency and intensity / duration analysis – Consistency – missing data – Abstractions – Infiltration – Evaporation – Interception – Process, estimation and measurement – Depression and detention storages.

UNIT III RUNOFF ESTIMATION 9

Components – Factors affecting runoff – Catchment characteristics – Flow measurements – Stream gauging – Floats, current meters – Venturi, Cut-throat and Parshall flumes – Rating curves – Aquastic Doppler velocity meter – Estimation – SCS and strange table methods – Empirical equations – Rainfall – Runoff models – TANK model – Tank clustered catchments.

UNIT IV HYDROGRAPHS 9

Hydrographs – Base flow – Unit hydrographs with single and multi peaks – S curve hydrograph – Dimensionless unit hydrograph – Synthetic unit hydrograph – Applications.

UNIT V RAINWATER HARVESTING 9

Importance – RWH in rural and urban areas – RWH from building roof and open areas – Direct storage in sumps – Design of RWH structures – Public participations – Case studies

Total Hours 45

SUGGESTED READINGS:

1. Chow V.T., Maidment D.R., Mays L.W , (2010) Applied hydrology, McGraw Hill publications, New York.
2. Ragunath H.M, (2006), Hydrology, Wiley Eastern Ltd., New Delhi.
3. Ven Te Chow, (2013), Hand book of hydrology, McGrawHill publications, New York.
4. Subramanya.K (2000), Hydrology, Tata McGraw Hill Co., New Delhi.

Web Sites:

1. www.springer.com
2. www.nptel.com
3. www.civil.ubc.ca

Semester I

19MEWE102 AIR POLLUTION AND CONTROL 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- In this course, students will learn effects of air pollutants on human beings and environment, what their sources are, and their physical and chemical behavior in the atmosphere.
- Also, you will get exposed to a wide range of control technologies and future trends towards preventing air pollution and the student is expected to know about source inventory and control mechanism.

Course outcomes:

At the end of the course, students will demonstrate the ability to

1. Know all the laws related to water
2. Determine pollution status of in river basin
3. Analyze quality of water through appropriate models.

UNIT I INTRODUCTION 9

Air resource management system - Air quality management - Scales of air pollution problem - Sources and classification of pollutants and their effect on human health vegetation and property - Global implications of air pollution - Meteorology Fundamentals - Atmospheric stability – Micrometeorology - Atmospheric turbulence - mechanical and thermal turbulence - Wind profiles - Atmospheric Diffusion - Atmospheric diffusion theories - Steady-state atmospheric diffusion equation – Plume rise - Diffusion models – Software applications - Ambient air quality and emission standards – Air pollution indices – Indoor Air Pollutants – Models – Air Quality Sampling and Monitoring.

UNIT II CONTROL OF PARTICULATE CONTAMINANTS: 9

Settling chambers - Filters, gravitational, Centrifugal – multiple type cyclones, prediction of collection efficiency, pressure drop, wet collectors, Electrostatic Precipitation theory – ESP design – Operational Considerations – Process Control and Monitoring – Case Studies.

UNIT III CONTROL OF GASEOUS CONTAMINANTS: 9

Absorption – principles - description of equipment-packed and plate columns - design and performance equations – Adsorption - principal adsorbents - Equipment descriptions – Design and performance equations – Condensation - design and performance equation – Incineration - Equipment description - design and performance equations - Biological Air Pollution Control Technologies – Bio-Scrubbers, Biofilters – Operational Considerations – Process Control and Monitoring – Case Studies.

UNIT IV EMERGING TRENDS: 9

Process Modification – Automobile Air Pollution and its control – Fuel Modification - Mechanical Particulate Collectors – Entrainment Separation – Internal Combustion Engines – Membrane Process – Ultraviolet Photolysis – High Efficiency Particulate Air Filters – Technical & Economic Feasibility

of selected emerging technologies for Air pollution control – Control of Indoor Air Quality – Radio active pollution and its control.

UNIT V AIR POLLUTION SURVEY 9

Air pollution survey – Air pollution legislation and regulations – Industrial plant location and city planning – Air pollution in Indian cities. Case Studies – cement industry, refineries, fertilizers, paper – sources of pollutants and its controls, cost benefit analysis.

Total Hours: 45

SUGGESTED READINGS:

1. Lawrence K.Wang, Norman C Perelra, Yung-Tse Hung (2004), Air Pollution Control Engineering, Tokyo
2. Noel de Nevers, (2016), Air Pollution Control Engg. McGraw-Hill, New York.
3. Anjaneyulu.Y, (2002), Air Pollution & Control Technologies, Allied Publishers (P) Ltd, India.
4. David H.F Liu, Bela G.Liptak, (2000), Air Pollution, Lewis Publishers.

Web Sites:

1. www.springer.com
2. www.nptel.com

Semester I

19MEWE103 RESEARCH METHODOLOGY AND IPR 2H:2C

Instruction Hours/ Week : L:2 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To introduce concepts of research process in hydrology and water resources and water management.
- To enable students to get basic understanding of scientific research methods.
- To develop capacity to independently analyse and define a research problem.

Course Outcomes:

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

1. Understand research problem formulation.
2. Analyze research related information

Follow research ethics

3. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
4. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
5. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT I RESEARCH PROBLEM

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT II LITERATURE STUDIES

Effective literature studies approaches, analysis Plagiarism, Research ethics,

UNIT III TECHNICAL WRITING

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT IV NATURE OF INTELLECTUAL PROPERTY:

Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT V PATENT RIGHTS:

Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications, **New** Developments in IPR: Administration of Patent System. New

developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

SUGGESTED READINGS:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007. Mayall , "Industrial Design", McGraw Hill, 1992.
5. Niebel , "Product Design", McGraw Hill, 1974.
6. Asimov , "Introduction to Design", Prentice Hall, 1962.
7. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
8. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Semester I

19MEWE1E01 INDUSTRIAL WASTEWATER POLLUTION PREVENTION AND CONTROL 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- This subject is enabling the student to promote understanding of basic and advanced concepts in Industrial pollution aspects and waste water treatment technologies
- Also, to expose the students to different processes used in industries and in research field.

Course Outcomes:

At the end of the course students able to

1. Know about various pollutants which are from various processes in industries and its effects in our environment.
2. Identify the nature of the treatment required.
3. Well known about various treatment methods and waste management.
4. Know in detail about treatment processes.

UNIT I INTRODUCTION 9

Industrial scenario in India– Industrial activity and Environment - Uses of Water by industry – Sources and types of industrial wastewater – Nature and Origin of Pollutants - Industrial wastewater and environmental impacts – Regulatory requirements for treatment of industrial wastewater – Industrial waste survey – Industrial wastewater monitoring and sampling -generation rates, characterization and variables –Toxicity of industrial effluents and Bioassay tests – Major issues on water quality management.

UNIT II INDUSTRIAL POLLUTION PREVENTION 9

Prevention and Control of Industrial Pollution – Benefits and Barriers – Waste management Hierarchy - Source reduction techniques – Pollution Prevention of Assessment - Material balance - Evaluation of Pollution prevention options –Cost benefit analysis – pay back period - Waste minimization Circles.

UNIT III INDUSTRIAL WASTEWATER TREATMENT 9

Equalization - Neutralization – Oil separation – Flotation – Precipitation – Heavy metal Removal– Aerobic and anaerobic biological treatment – Sequencing batch reactors – High Rate reactors - Chemical oxidation – Ozonation – carbon adsorption – Photo-catalysis – Wet Air Oxidation – Evaporation – Ion Exchange – Membrane Technologies – Nutrient removal.- Treatability studies.

UNIT IV WASTEWATER REUSE AND RESIDUAL MANAGEMENT 9

Individual and Common Effluent Treatment Plants – Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse – Industrial reuse, Present status and issues - Disposal on water and land – Residuals of industrial wastewater treatment – Quantification and characteristics of Sludge – Thickening, digestion, conditioning, dewatering and disposal of sludge – Management of RO rejects.

UNIT V CASE STUDIES **9**

Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – metal finishing – Oil Refining – Pharmaceuticals – Sugar and Distiller

Total Hours: 45

SUGGESTED READINGS:

1. Eckenfelder, W.W, (2000), Industrial Water Pollution Control, Mc-Graw Hill.
2. Nelson Leonard Nemerow, (2000). Industrial waste treatment contemporary practice and vision for the future, Elsevier, Singapore
3. Frank Woodard, (2011). Industrial waste treatment Handbook, Butterworth Heinemann, New Delhi.
4. World Bank and UNEP (2008). Pollution Prevention and Abatement Handbook – Towards Cleaner Production, Washington D.C.
5. Pollution Prevention: - Fundamentals and Practice (2000), Mc-Graw Hill International, Boston

Web sites.

1. www.springer.com
2. www.nptel.com
3. www.wikipedia.com
4. www.civil.ubc.ca
5. www.aboutcivil.com

Semester I

19MEWE1E02 SOIL POLLUTION ENGINEERING 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- The student acquires the knowledge on problem associated with soil contamination, safety disposal of waste and remediates the contaminated soils by different techniques to protect the environment.

Course Outcomes:

At the end of the course students able to

1. Know about composition and properties of various types of soil.
2. Know about various ground improvement techniques.
3. Understand contaminant transport in soil and various remedial techniques.

UNIT I PHYSICS AND CHEMISTRY OF SOIL 9

Soil formation – composition – soil fabric – mass-volume relationship – Index properties and soil classification – hydraulic and consolidation characteristics – Chemical properties – soil pH – Surface charge and point of zero charge – Anion and Cation exchange capacity of clays– Specific surface area- bonding in clays-soil pollution-factors governing soil-pollutant interaction.

UNIT II INORGANIC AND ORGANIC GEOCHEMISTRY 9

Inorganic geochemistry – Metal contamination – Distribution of metals in soils – Geochemical processes controlling the distribution of metals in soils – Chemical analysis of metal in soil – Organic geochemistry – Organic contamination – Distribution of NAPLs in soils – Process controlling the distribution of NAPLs in soil – Chemical analysis of NAPLs in soils.

UNITIII CONTAMINANTFATEANDTRANSPORTINSOIL 9

Transport processes – advection – diffusion – dispersion – chemical mass transfer processes – sorption and desorption – precipitation and dissolution – oxidation and reduction – acid base reaction – complexation – ion exchange – volatilization – hydrolysis – biological process-microbial transformation of heavy metals.

UNIT IV GROUND IMPROVEMENT TECHNIQUES IN WASTE MANAGEMENT 9

Role of Ground Improvement-Drainage and Ground Water Lowering-Electro osmotic Methods-Diaphragm walls-Thermal and Freezing methods - Insitu Densification - Deep Compaction - Dynamic Compaction -Blasting Sand piles pre-loading with sand drains-Stone Columns Lime piles-Earth reinforcement -rock bolts Cables and guniting Geotextiles as reinforcement Filtration. Drainage and Erosion control.

UNIT V SOIL REMEDIATION TECHNOLOGIES 9

Contaminated site characterization – Containment – Soil vapour extraction - Soil washing – Solidification and Stabilization – Electro-kinetic remediation – Thermal desorption – Vitrification – In-situ and Ex-situ Bioremediation – Phytoremediation – Soil fracturing – Biostimulation – Bioaugmentation –Chemical oxidation and reduction.

Total Hours:45

SUGGESTED READINGS:

1. Calvin Rose(2004). An Introduction to the Environmental Physics of Soil, Water and Water Sheds, Cambridge Karpagam academy of Higher Education Press .
2. Paul Nathanail C. and Paul Bardos R(2005). Reclamation of Contaminated Land, John Wiley & Sons Limited
3. Hari D. Sharma and Krishna R. Reddy(2004). Geo-Environmental Engineering : Site Remediation, Water Contaminant and Emerging Water Management Technologies, John Wiley & Sons Limited.
4. Marcel Vander Perk, Taylor & Francis(2013). Soil and Water Contamination from Molecular to Catchment Scale.
5. William J. Deutsch(2010). Groundwater Geochemistry : Fundamentals and Applications to Contamination, Lewis Publishers.

Web Sites:

1. www.springer.com
2. www.nptel.com
3. www.wikipedia.com
4. www.civil.ubc.ca
5. www.aboutcivil.com

Semester I

19MEWE1E03 DESIGN OF BIOLOGICAL TREATMENT SYSTEMS 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- The student acquires the knowledge on problem associated with soil contamination, safety disposal of waste and remediates the contaminated soils by different techniques to protect the environment.
- To educate the students on the principles and process designs of various treatment systemsfor water and wastewater and students should gain competency in the process employed in design of treatment systems and the components comprising such systems, leading to the selection of specific process.

Course Outcomes:

At the time of completion of this course, students well know about

1. Principles Of Aerobic And Anaerobic Treatment
2. Design Of Sewage Treatment Plant Units.
3. Aerobic And Anaerobic Treatment Of Wastewater , Sludge Treatment And Disposal
4. Construction Operations And Maintenance Aspects

UNIT I INTRODUCTION 9

Objectives of biological treatment – significance – Principles of aerobic and anaerobic treatment - kinetics of biological growth – Factors affecting growth – attached and suspended growth - Determination of Kinetic coefficients for organics removal – Biodegradability assessment –selection of process- reactors-batch-continuous type.

UNIT II AEROBIC TREATMENT OF WASTEWATER 9

Design of sewage treatment plant units –Activated Sludge process and variations, SequencingBat ch reactors, Membrane Biological Reactors-Trickling Filters-Bio Tower-RBC-Moving Bed Reactors-fluidized bed reactors, aerated lagoons, waste stabilization ponds – nutrient removal systems – natural treatment systems, constructed wet land – Disinfection – disposal options – reclamation and reuse – Flow charts, layout, PID, hydraulic profile, recent trends.

UNIT III ANAEROBIC TREATMENT OF WASTEWATER : 9

Attached and suspended growth, Design of units – UASB, up flow filters, Fluidized beds MBR, septic tank and disposal – Nutrient removal systems – Flow chart, Layout and Hydraulic profile – Recent trends**.**

UNIT IV SLUDGE TREATMENT AND DISPOSAL 9

Design of sludge management facilities, sludge thickening, sludge digestion, biogas generation, sludge dewatering (mechanical and gravity) Layout, PID, hydraulics profile – upgrading existing plants – ultimate residue disposal – recent advances.

UNIT V **9**

Construction and Operational Maintenance problems – Trouble shooting – Planning, Organizing and Controlling of plant operations – capacity building - Retrofitting Case studies – sewage treatment plants – sludge management facilities.

Total Hours:45

SUGGESTED READINGS:

1. Metcalf & Eddy, INC,(2013). Wastewater Engineering – Treatment and Reuse, Fourth Edition, Tata Mc Graw-Hill Publishing Company Limited, New Delhi.
2. Arceivala, S.J(2006). Wastewater Treatment for Pollution Control, TMH, New Delhi, Second Edition.
3. F.R. Spellman(2009). Hand Book of Water and Wastewater Treatment Plant operations, CRC Press,New York.
4. David Hendricks(2013). Fundamentals of Water Treatment Process, CRC Press, New York.

websites:

1. www.springer.com
2. www.nptel.com
3. www.wikipedia.com
4. www.civil.ubc.ca

Semester I

19MEWE1E04 CLIMATE CHANGE AND ADAPTATION 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To understand the Earth's Climate System and the concept of Global Warming, the impact of climate change on environment, adaptation and its mitigation measures.

Course Outcomes:

At the time of completion of this course, students well know about

1. To orient towards the global climate change and its impact on water resources.
2. To understand the climate change phenomenon and its related issues on water, irrigation and its social implications.

UNIT I EARTH'S CLIMATE SYSTEM 9

Introduction-Climate in the spotlight - The Earth's Climate Machine – Climate Classification - Global Wind Systems – Trade Winds and the Hadley Cell – The Westerlies - Cloud Formation and Monsoon Rains – Storms and Hurricanes - The Hydrological Cycle – Global Ocean Circulation – El Nino and its Effect - Solar Radiation –The Earth's Natural Green House Effect – Green House Gases and Global Warming – Carbon Cycle.

UNIT II OBSERVED CHANGES AND ITS CAUSES 9

Observation of Climate Change – Changes in patterns of temperature, precipitation and sea level rise – Observed effects of Climate Changes – Patterns of Large Scale Variability – 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**.**

UNIT III IMPACTS OF CLIMATE CHANGE 9

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.

UNIT IV CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES 9

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 & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

UNIT V CLEAN TECHNOLOGY AND ENERGY 9

Clean Development Mechanism –Carbon Trading- examples of future Clean Technology – Bio-diesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding.

SUGGESTED READINGS:

1. Jan C. van Dam(2003). Impacts of Climate Change and Climate Variability on Hydrological Regimes, Cambridge Karpagam academy of Higher Education Press.
2. Dash Sushil Kumar(2007). Climate Change – An Indian Perspective, Cambridge Karpagam academy of Higher Education Press India Pvt. Ltd.

Semester I

19MEWE1E05 WATER SUPPLY DISTRIBUTION AND BURIED PIPELINES 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To educate the students in detailed design concepts related to water transmission mains, water distribution system and buried pipes with emphasis on computer application

Course Outcomes:

At the time of completion of this course, students well know about

1. The students will be able to get a basic knowledge of the design of pipe networks.
2. They will be able to analyze pipe network problems using computer software like EPANET2.0

UNIT I WATER SUPPLY SYSTEMS 9

Water requirement – sources of water – water demand – reservoir storage – nodal hydraulic gradient level values - water supply consideration, Types of water supply systems- piping system- distribution network- labeling- network components – Network models – design – optimization in practice

UNIT II HYDRAULIC PRINCIPLES AND NETWORK PARAMETERS 9

Energy and hydraulic gradient lines – head loss in links – equivalent pipes – series – parallel pipes – path head loss and loop head loss – analysis of water distribution network- static node, dynamic node – network performance – flow analysis - Layout – in situ lining - pipes material – appurtenances – minimization of water losses – leak detection.

UNIT III STORM WATER DISTRIBUTION AND BURIED PIPES 9

Planning – runoff estimation – rainfall data analysis – storm water drain design Introduction to Buried pipes – external loads – gravity flow design, pressurized flow- rigid and flexible pipes – installation – trenchless technology

UNIT IV RELIABILITY ASSESSMENT AND DESIGN 9

Uncertainty and reliability – affecting events- assessment – reliability parameters- configurations. Design methodology - strengthening and expansion

UNIT V SOFTWARE APPLICATIONS 9

Use of software in water transmission, water distribution and sewer design – LOOP 4.0, SEWER, EPANET, BRANCH, SEWERCAD, WATERCAD, STROMNET

Total Hours:45

SUGGESTED READINGS:

1. Bhave P. R(2003). **Optimal design of water distribution networks,** Narosa publishing House, New Delhi.
2. Bajwa. G. S(2003). Practical handbook on Public Health Engineering, Deep publishers, Shimla.
3. CPHEEO(2016). Ministry of Urban Development, GOI, New Delhi
4. B.A. Hauser(2011). Practical hydraulics Hand Book, Lewis Publishers, New York.

web sites:

1. www.springer.com
2. www.nptel.com
3. www.wikipedia.com

Semester I

19MEWE1E06 GROUNDWATER AND DRAINAGE ENGINEERING 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- Students will be exposed to ground water, hydraulics of ground water related to drainage, drainage concepts, planning, design and management of drainage related work.
- They will learn about the latest developments in ground water applications to drainage on the basis of a clear understanding of the principles of drainage engineering.

Course Outcomes:

At the time of completion of this course, students well know about

1. This course impacts knowledge about the need for irrigation drainage system and its design.
2. In addition it enabled to manage the salinity problems and leaching process.

UNIT I BASICS OF GROUND WATER 9

Occurrence of Ground water – Utilization – Ground water component in hydrologic cycle – Geological formations – Types of aquifers and their characteristics – Ground water movement – Darcy's Law.

UNIT II GROUND WATER HYDRAULICS RELATED TO DRAINAGE 9

Steady and unsteady flow of ground water– Ground water recharge – Dupuit-Forchheimer assumptions - Subsurface flow into drains – Steady and unsteady state drainage equations – Seepage from river into aquifers – Seepage from open channels.

UNIT III DRAINAGE PRINCIPLES AND CRITERIA 9

Factors to be considered in land drainage – Combined irrigation and drainage systems - Water balance – Equations for water balance – Drainage surveys – Agricultural drainage criteria – Effect of field drainage systems on agriculture.

UNIT IV DESIGN AND MANAGEMENT OF DRAINAGE SYSTEMS 9

Drainage materials – Surface drainage systems, their components and applications in sloping areas – Subsurface drainage systems – Mole drainage - Tube well irrigation - Drainage application and design – Management and maintenance of drainage systems.

UNIT V SALINITY CONTROL 9

Salinity in relation to irrigation and drainage – Salt balance of the root zone – Leaching process – Bio drainage – Environmental aspects of drainage.

Total Hours:45

SUGGESTED READINGS:

1. Todd D.K(2011). Ground Water Hydrology, Ground Water Hydrology.
2. Ground Water Hydrology(2007). Ground Water, Wiley Eastern Ltd., New Delhi.
3. Kessler J(2003). Drainage Principles and Applications Vol. II and IV, International Institute of Land Reclamation and Improvement.

web sites:

1. www.springer.com
2. www.nptel.com
3. www.wikipedia.com
4. www.civil.ubc.ca

Semester I

19MEWE1E07 RURAL WATER SUPPLY AND ON SITE SANITATION 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To educate the students on the principles of rural water supply and sanitation and to develop understanding of factors governing the aspects in rural water supply and sanitation.

Course Outcomes:

1. The students will be able to get a basic knowledge of the design of pipe networks.
2. They will be able to analyze pipe network problems using computer software like EPANET2.0

UNIT I DEVELOPMENT OF WATER SOURCES 9

Sources of water – Surface and ground water sources – Development of deep bore wells; Estimation of yield – Alternate sources of water supply – Rain water harvesting - pumps – Types and selection of pumps for deep bore wells – Construction, operation and maintenance.

UNIT II WATER TREATMENT 9

Quality of water – Standards - conventional water treatment – Technologies for removal of spec ific contaminants; Iron, Arsenic, Fluoride, T.D.S; Disinfection – Alternate disinfection methods – solar disinfection.

UNIT III SANITATION 9

Basic requirement of sanitation; Decentralized / onsite wastewater management; small bore / settled effluent sewer system – Design and operation.

UNIT IV SEWAGE TREATMENT 9

Fundamentals of sewage treatment; Decentralized sewage treatment; Septic tank with depression pit – DEWATS, Intermittent sand filters – Anaerobic filters – Waste stabilization ponds – Design and operation.

UNIT V SEWAGE DISPOSAL AND REUSE 9

Methods of disposal, Land disposal, sewage farms – Artificial recharge of ground water; Recycle and Reuse of sewage – Grey water Harvesting – Salt water intrusion and remediation – Ground water pollution and remediation.

Total Hours:45

SUGGESTED READINGS:

1. Metcalf & Eddy(2004). Wastewater Engg. Treatment and Reuse, Tata McGraw Hill, New Delhi.
2. Govt. of India(2004). CPHEEO Manual on Water Supply and Treatment.
3. Govt. of India(2012). CPHEEO Manual on Sewerage and Sewage Treatment.
4. Todd, D.K(2006). Ground Water Hydrology,John Wiley & Sons, New York.
5. F.R. Spellman(2013). Hand Book of Water and Wastewater Treatment Plant operations, CRC Press, New York

.websites:

1. www.nptel.com
2. www.civil.ubc.ca
3. www.aboutcivil.com

Semester I

19MEWE1E08 ADVANCED GROUND WATER HYDROLOGY 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- The objective of this course is enabling the student to understand the basic empirical knowledge of the residence and movement of groundwater, as well as a number of quantitative aspects.

Course Outcomes:

1. At the end of the course, the student should be able to evaluate the aquifer parameters and groundwater resources for different hydro-geological boundary conditions.
2. Students are able to understand aquifer properties and its dynamics after the completion of the• course. It imparts exposure towards well design and practical problems of ground water aquifers.

UNIT I GENERAL 9

Historical background – Characterization of groundwater – Utilization of groundwater – Groundwater in hydrological cycle – Origin of groundwater – Aquifer – Types of aquifer – other geological formations.

UNIT II HYDRO GEOLOGICAL PARAMETERS 9

Interstices – Porosity – Specific yield – Specific retention – Specific storage and storage coefficient – Intrinsic permeability – Hydraulic conductivity – Transmissivity, safe yield – factors controlling safe yield – Darcy's Law and limitations.

UNIT III GROUND WATER HYDRAULICS 9

Ground water potentials – Classic properties of aquifer skeleton and water, basic principles – ground water flow equations – Flow nets – Dupuit-Forchheimer assumptions – Seepage from and to streams – Well hydraulics – Well losses – Image well theory – Partial penetrations of wells – Interference of wells – Collector wells and infiltration galleries.

UNIT IV PUMPING TEST ANALYSIS 9

Methods of analysis for unconfined and non-leaky and leaky confined aquifer and water table aquifer – locating hydro-geological boundaries – determination of well characteristics and specific capacity of wells – well characteristics for large diameter wells.

UNIT V DESIGN AND CONSTRUCTION 9

Well design criteria – Construction of wells – Well drilling methods – filter design – artificial and natural packing – well casting and screens – production test – maintenance of production wells.

Total Hours:45

SUGGESTED READINGS:

1. Todd. D.K(2006). Groundwater hydrology, John Wiley & Sons Inc, New York.
2. Bear.J(2012). Hydraulics of ground water, McGraw-Hill, New York.
3. Bouwer.H(2004). Groundwater hydrology, McGraw-Hill, New York.
4. Hantush.M.S(2011). Hydraulics of wells in advances in hydroscience, Academic press, New York.
5. Ragunath. H.M(2007). ground water, Wiley eastern Ltd., New Delhi.

web sites:

1. www.springer.com
2. www.nptel.com

Semester I

19MEWE1E09 RIVER ENGINEERING 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To teach the students about rivers, its classification and river hydraulics.
- River mechanics, surveys, models and river maintenance.

Course Outcomes:

At the end of this course the students

1. will understand theoretical concepts of water and sediment movements in rivers
2. to inculcate the benefits of fluvial system to the society

UNIT I RIVER FUNCTIONS 9

Primary function of a river – River uses and measures – Water and Sediment loads of river – Rivers in India, Himalaya and Peninsular.

UNIT II RIVER HYDRAULICS 9

Physical Properties and Equations – Steady flow in rivers – uniform and non uniform – Turbulence and velocity profiles – resistance co efficients – Boundary conditions and back waters – Transitions – Rating Curve – Unsteady flow in rivers : Propagative of surface waves – Characteristics, flood waves – knematic and diffusion analogy – velocity of propagation of flood waves – Flood wave –Maximum

UNIT III RIVER MECHANICS 9

River Equilibrium : Stability of Channel – regime relations – river bend equilibrium – hydraulic geometry of downstream - Bars and meandering - River dynamics – degradation and aggradation of river bed – Confluences and branches – River Data base.

UNIT IV RIVER SURVEYS AND MODEL 9

Mapping – Stage and Discharge Measurements – Sediments – Bed and suspended load – Physical hydraulic Similitude – Rigid and mobile bed – Mathematical – Finite one dimensional – multi – dimensional – Water Quality and ecological model

UNIT V RIVER MANAGEMENT 9

River training works and river regulation works – Flood plain management – waves and tides in Estuaries - Interlinking of rivers – River Stabilization

Total Hours:45

SUGGESTED READINGS:

1. Janson PL.Ph., Lvan BendegamJvanden Berg, Mdevries A. Zanen(2011). Principles of River Engineering, Pitman.
2. Pierre Y. Julien (2018). River Mechanics, Cambridge Karpagam academy of Higher Education Press.
3. K.L Rao(2011). INDIA's WATER WEALTH, Orient Longman Ltd.

web sites:

1. www.springer.com
2. www.nptel.com
3. www.wikipedia.com
4. www.civil.ubc.ca
5. www.aboutcivil.com

Semester I

19MEWE1E010 PROBABILITY AND STATISTICAL METHODS 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To understand the knowledge of the basic probability concepts.
- Be introduced to the notion of sampling distributions and have acquired knowledge of statistical techniques useful in making rational decision in management problems.
- Be exposed to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.

Course Outcomes:

1. To understand the concept of probability and random variables.
2. To apply the design of experiments in Engineering problems.
3. To test the Statistical Quality of a product.

UNIT I PROBABILITY AND DISTRIBUTION

Axioms of probability – Conditional probability – Total probability– Random variables – Binomial, Poisson and Normal distributions with Moment generating functions – Correlation – Regression.

UNIT II SAMPLING DISTRIBUTION AND ESTIMATION

Sampling distributions – Estimation of parameters – Method of Moments – Principle of Least squares – Method of Maximum Likelihood.

UNIT III TESTING OF HYPOTHESIS

Basic definitions of Statistical Hypothesis – Tests based on Normal, t, Chi-square and F distributions for mean, variance and proportion.

UNIT IV DESIGN OF EXPERIMENTS

Analysis of variance – One way and Two-way classifications – Completely randomized design – Randomized block design – Latin square design – 2 factorial design.

UNIT V STATISTICAL QUALITY CONTROL

Statistical quality control – Statistical process control – X and R or S control chart- Attribute control charts – P chart and U chart – Control chart performance.

SUGGESTED READINGS:

1. Gupta, S.C. and Kapur, V.K(2007). Fundamentals of Mathematical Statistics, Sultan Chand and Sons,New Delhi.
2. Gupta, S.C and Kapoor, V.K(2001). Fundamentals of Applied Statistics, S.Chand& Co., New Delhi.
3. Johnson, R.A. Miller and Freund's(2005). Probability and Statistics for Engineers, Prentice-Hall of India Private Ltd., New Delhi.
4. Montgomery.D.C. and Runger, G.C(2007). Applied Statistics and Probability for Engineers, Wiley Student Edition publishers, India.
5. TamasRudas(2008). Handbook of Probability, SAGE publication, India pvt.Ltd.

Semester I

19MEWE111 ENVIRONMENTAL ENGINEERING LAB 2H:2C

Instruction Hours/ Week : L:0 T:0 P:2 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- This subject includes the list of experiments to be conducted for characterisation of water and municipal sewage.

Course Outcomes:

At the end of the course, the student is expected

1. to be aware of the procedure for quantifying quality parameters for water and sewage.

Experiments

1. Hydrochemistry - Physical and chemical properties of water
2. On site estimations and laboratory analysis of water
3. Collection of water samples
4. Major ions analysis of collected water samples
5. Suspended and dissolved solids - EC and pH

Total Hours : 30

Semester I

19MEWE112 GEOTECHNICAL ENGINEERING LABORATORY 2H:2C

Instruction Hours/ Week : L:0 T:0 P:2 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To estimate index properties of soils (coarse and fine).
- To estimate consistency limit of fine grained soils.
- To estimate shear strength of soils by direct shear test, triaxial shear test, vane shear test & unconfined compressive test.
- To estimate the engineering properties of the soils by density test, CBR test permeability test and consolidation test.

Course Outcomes:

1. On completion of the course, the students will be able to:
2. Classify soil by physical observation of the soils.
3. Classify soil based on estimated index and engineering characteristics of soils.
4. Carry out interpolation among the estimated soil design parameters.

LIST OF EXPERIMENTS

1. Specific gravity of soil grains(Specific gravity bottle &Pycnometer)
2. Grain size distribution - Sieve analysis
3. Relative density of sands
4. Atterberg limits test
   a) Liquid Limit
   b) Plastic Limit
   c) Shrinkage Limit
5. Determination of moisture - Density relationship using standard Proctor test.
6. Permeability determination (constant head and falling head methods)
7. Determination of shear strength parameters.
   a) Direct shear test on cohesion less soil
   b) Unconfined compression test on cohesive soil
   c) Triaxial compression test (Study Experiment)
8. One dimensional consolidation test (Determination of co-efficient of consolidation only, Study Experiment)
9. Field density test
   a) Core cutter and
   b) Sand replacement methods

SUGGESTED READINGS:

1. Head, K.H(2009). Manual of Soil Laboratory Testing (Vol-1 to 3), John Wiley & Sons, Chichester.
2. Lambe T.W(2009). Soil Testing for Engineers, John Wiley and Sons, New York.
3. Saibaba Reddy, E. and Rama Sastri, K(2002). Measurement of Engineering Properties of Soils, New Age International Publishers, New Delhi.
4. I.S.Code of Practice (2720) Relevant Parts, as amended from time to time

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (FT) 2019-20

Semester II

19MEWE201 DESIGN OF HYDRAULIC AND ENVIRONMENTAL ENGINEERING STRUCTURES 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To provide sufficient mathematical and physical background to formulate real life problems in hydraulic and environmenta engineering structures

Course Outcomes:

1. Students able to design all tipes of water tanks
2. Able to design rcc and pre stressed pipes

UNIT I DESIGN OF PIPES 9

Design of Concrete, Pre-stressed Concrete, Steel and Cast iron piping mains, sewerage tanks design - anchorage for pipes - massive outfalls - structural design and laying - hydrodynamic considerations. Advances in the manufacturing of pipes.

UNIT II ANALYSIS AND DESIGN OF WATER TANKS 9

Design of circular, rectangular, spherical and Intze type of tanks using concrete. Design of pre-stressed concrete cylindrical tanks - Economic analysis - introduction to computer aided design and packages.

UNIT III DESIGN OF SPECIAL PURPOSE STRUCTURES 9

Underground reservoirs and swimming pools, Intake towers, Structural design including foundation of water retaining structures such as settling tanks, clarifloculators, aeration tanks etc. - effect of earth pressure and uplift considerations - selection of materials of construction.

UNIT IV REPAIR AND REHABILITATION OF STRUCTURES 9

Diagnosing the cause and damage, identification of different types of structural and non-structural cracks – repair and rehabilitation methods for Masonry, Concrete and Steel Structures.

UNIT V STRUCTURES USED IN WATER AND SEWERAGE WORKS 9

Exposure on steel, lattice structures used in water and sewerage works. Design of hydraulic structures-Selection of types of dams- Development of storage dams in India-Design of hydropower installation- Intake structures- Water conductor structures- tunnels – surge tanks- Penstocks- Values – anchor blocks- type of power house- Turbines and their foundations.

Total Hours:45

SUGGESTED READINGS:

1. P.Dayaratnam.(2018). Reinforced Concrete.
2. Krishna Raju(2012). Prestressed Concrete, Tata McGraw-ill Publishing Co.
3. N.C.Sinha & S.K.Roy(2009). Reinforced Concrete, S.Chand and Co.
4. Hulse R., and Mosley, W.H(2002**).** Reinforced Concrete Design by Computer**,** Macmillan Education Ltd.
5. Ramaswamy, G.S(2002). Design and Construction of Concrete shell roofs, CBS Publishers, India.
6. Green, J.K. and Perkins, P.H(2012). Concrete liquid retaining structures, Applied Science Publishers.

web sites:

1. www.springer.com
2. www.nptel.com

Semester II

19MEWE202 ENVIRONMENTAL GEOTECHNOLOGY 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- This subject is enabling the student to develop environmentally sound solutions to geotechnical problems and to solve environmental engineering problems unique to several soil and subsurface conditions.

Course Outcomes:

At the end of course students able to know about

1. Soil water environment interaction relating to geotechnical problems.
2. Effect of pollution on soil water behaviour-Sources,production and classification of wastes.
3. Ground modification techniques and Remediation technology

UNIT I INTRODUCTION 9

Introduction to Environmental Geotechniques-Environmental cycles and their interaction-Soil water environment interaction relating to geotechnical problems-Effect of pollution on soil water behaviour-Sources,production and classification of wastes-Environmental regulations in India-Case studies of foundation failures by ground contamination.

UNIT II SITE SELECTION AND METHOD OF DISPOSALS 9

Criteria for selection of sites for waste disposal facilities-parameters controlling the selection of wastes disposal sites-current practices for waste disposal, subsurface disposal techniques-Passive contaminant systems-Leachate contamination-applications of geomembrane and other techniques in solid and liquid waste disposal-rigid or flexible membrane liners.

UNIT III HYDROLOGY OF CONTAMINANTS 9

Transport phenomena in saturated and partially saturated porous media-contaminant migration and contaminant hydrology-Hydrological design for ground water pollution control-Ground water pollution downstream for landfills Bearing capacity of compacted fills-foundation for waste fill ground-pollution of aquifers by mining and liquid wastes-protection of aquifiers

UNIT IV HAZARDOUS WASTE DISPOSAL 9

Hazardous waste control and storage system-Stabilisation/Solidification of wastes-Processes and Functions- Monitoring and performance of contaminant facilities-Environmentally safe disposal of solid and liquid waste

UNIT V REMEDIAL MEASURES: Ground modification techniques in waste fill, Remedial measures for contaminated grounds-Remediation technology-Bio-remediation 9

Total Hours:45

SUGGESTED READINGS:

1. Wentz, C.A(2006). Hazardous Waste management, McGraw Hill, Singapore.
2. Daniel, B.E(2012). Geotechnical practice for waste disposal, Chapman and Hall, London.
3. Ott, W.R, Ann. Arbor(2003). Proceedings of the international symposium of Environmental Geotechnology, Environmental publishing company.
4. Fried, J.J(2010). Groundwater pollution, Elsevier.
5. Westlake, K(2003). landfill waste pollution and control, Albion publishing Ltd.
6. Lagrega, Md., Buckingham, P.L., and Evans, J.C(2010). Hazardous waste management, McGraw Hill, Singapore.

Semester II

19MEWE2E01 ENVIRONMENTAL IMPACT ASSESSMENT OF WATER RESOURCES DEVELOPMENT 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- This subject is enabling the student to develop environmentally sound solutions to environmental problems and to solve environmental engineering problems.

Course Outcomes:

1. At the end of this course the students will understand the need, methodology, documentation and usefulness of environmental impact assessment in water resources development.

UNIT I ENVIRONMENTAL ISSUES 9

Water resources development and environmental issues – Environment in water resources project planning – Environmental regulations and requirements – The EIA (Environmental Impact Assessment) notification

UNIT II EIA FUNDAMENTALS 9

Environmental Impact Assessment (EIA) – Environmental Impact Statement – EIA in Project Cycle – Legal and Regulatory aspects in India according to Ministry of Environment and Forests – Types and limitations of EIA – Cross sectoral issues and terms of reference in EIA –Participation of Public and Non-Governmental Organizations in environmental decision making

UNIT III ENVIRONMENTAL IMPACTS 9

Hydrological and water quality impacts – Ecological and biological impacts – Social and cultural impacts – Soil and landscape changes – Agro economic issues – Human health impacts – Ecosystem changes.

UNIT IV METHODS OF EIA 9

EIA team formation – Development of scope, mandate and study design – Base line survey – Check lists – Ad hoc procedures – Network and matrix methods – Semi-quantitative methods – ICID checklist – Economic approaches – Environmental Impact Statement (EIS) preparation.

UNIT V ENVIRONMENTAL MANAGEMENT 9

In-stream ecological water requirements - Public participation in environmental decision making – Sustainable water resources development – Ecorestoration – Hydrology and global climate change – Human ecology – Ecosystem services – Environmental monitoring programs.

Total Hours:45

SUGGESTED READINGS:

1. Canter, L.W(2013). Environmental Impact Assessment**,** McGraw Hill International Edition, New York.
2. Barathwal, R.R(2002). Environmental Impact Assessment, New Age International Publishers, New Delhi.
3. Petts, J(2013). Handbook of Environmental Impact Assessment, Blackwell Science London.
4. Lawrence, D.P(2003). Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Inter Science, New Jersey.
5. Arnel, N(2014). Hydrology and global environmental change, Prentice Hall, Harlow.

web sites:

1. www.springer.com
2. www.nptel.com

Semester II

19MEWE2E02 ENVIRONMENTAL QUALITY MONITORING 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- This subject is enabling the student to educate the various instrumental methods of monitoring the quality of air, water, soil and its parameters.

Course Outcomes:

At the end of this course the students will understand

1. How to use Spectroscopic Method, Chromatrographic Method, Electro And Radio Analytical Methods in environmental quality monitoring.

UNIT I INTRODUCTION 9

Wet Chemistry methods and their limitations-Instrumental Methods, Selection of method- Precision and Accuracy, Error in measuring signals- Quality control & assurance- Sample preservation, Sample preparation and analyte isolation.

UNIT II SPECTROSCOPIC METHODS 9

Principles, techniques and applications of spectrophotometry, fluorimetry, nephelometry and turbidimetry, Atomic Absorption Spectrometry (Flame, graphite furnace and hydride generation), Atomic Emission Spectrometry (AES) , flame and Inducted Coupled Plasma (ICP) – TOC Analyzer

UNIT III CHROMATROGRAPHIC METHODS 9

Column, Paper and thin layer chromatography (TLC)- Principles, techniques and applications of GC, GC-MS, High performance liquid chromatography (HPLC) and Ion chromatograph (IC)- Hyphenated techniques for Environmental contaminant(trace organics) analysis.

UNIT IV ELECTRO AND RADIO ANALYTICAL METHODS 9

Principles, techniques and applications of Conductometry, potentiometry, coulometry, AOX analyzer Amperometry, polarography, New Activation Analysis (NAA), X-ray Fluorescence (XRF) and X-ray Diffraction (XRD) methods.

UNIT V CONTINUOUS MONITORING INSTRUMENTS 9

Principles, techniques and applications of NDIR analyzer for CO, chemiluminescent analyzer for NOx Fluorescent analyzer for SO2- Particulates analysis- Auto analyzer for water quality using flow injection analysis. **Total Hours:45**

SUGGESTED READING:

1. Barceló, D(2008). Environmental analysis. Techniques, Applications and Quality Assurance, Elsevier, The Netherlands.
2. Marcel Dekker, Paul R. Loconto(MAY2005). Trace Environmental Quantitative Analysis: Principles, Techniques, and Applications**.**
3. 3.(2000). Ewing Instrumental Methods of Chemical Analysis, McGraw Hill, New York.
4. Reeve, R.N(2002). Introduction to Environmental Analysis, John Wiley & Sons.

web sites:

1. www.springer.com
2. www.nptel.com
3. www.wikipedia.com
4. www.civil.ubc.ca

Semester II

19MEWE2E03 ENVIRONMENT, HEALTH AND SAFETY IN INDUSTRIES 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- This subject is enabling the student to educate the various environmental health hazards and safety methods in industries.

Course Outcomes:

At the end of this course

1. The student acquires the knowledge about the health hazards and the safety measures to be followed in the industrial environment.
2. Also the different techniques and training followed in the industrial environment

UNIT I INTRODUCTION 9

Need for developing Environment, Health and Safety systems in work places. Status and relationship of Acts, Regulations and Codes of Practice. Role of trade union safety representatives. International initiatives. Ergonomics and work place.

UNIT II OCCUPATIONAL HEALTH AND HYGIENE 9

Definition of the term occupational health and hygiene. Categories of health hazards. Exposure pathways and human responses to hazardous and toxic substances. Advantages and limitations of environmental monitoring and occupational exposure limits. Hierarchy of control measures for occupational health risks. Role of personal protective equipment and the selection criteria. Effects on humans, control methods and reduction strategies for noise, radiation and excessive stress.

UNIT III WORKPLACE SAFETY AND SAFETY SYSTEMS 9

Features of the satisfactory design of work premises HVAC, ventilation. Safe installation and use of electrical supplies. Fire safety and first aid provision. Significance of human factors in the establishment and effectiveness of safe systems. Safe systems of work for manual handling operations. Control methods to eliminate or reduce the risks arising from the use of work equipment. Requirements for the safe use of display screen equipment. Procedures and precautionary measures necessary when handling hazardous substances. Contingency arrangements for events of serious and imminent danger.

UNIT IV TECHNIQUES OF ENVIRONMENTAL SAFETY 9

Elements of a health and safety policy and methods of its effective implementation and review. Functions and techniques of risk assessment, inspections and audits. Investigation of accidents- Principles of quality management systems in health and safety management. Relationship between quality manuals, safety policies and written risk assessments. Records and other documentation required by an organisation for health and safety. Industry specific EHS issues.

UNIT V EDUCATION AND TRAINING 9

Requirements for and benefits of the provision of information, instruction, training and supervision. Factors to be considered in the development of effective training programmes. Principles and methods of effective training. Feedback and evaluation mechanism.

Total Hours:45

SUGGESTED READINGS:

1. Nicholas P. Cheremisinoff and Madelyn L. Graffia(2007). Environmental and Health and Safety Management, William Andrew Inc. NY.
2. Brian Gallant(2007). The Facility Manager's Guide to Environmental Health and Safety, Government Inst Publ.
3. Bill Taylor(2005). Effective Environmental, Health, and Safety Management Using the Team Approach, Culinary and Hospitality Industry Publications Services.

web sites:

1. www.springer.com
2. www.nptel.com
3. www.wikipedia.com
4. www.civil.ubc.ca
5. www.aboutcivil.com

Semester II

19MEWE2E04 ENVIRONMENTAL HYDRAULICS 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To apply the knowledge of fluid mechanics to analyze and predict mixing in natural bodies of water.
- To study the hydrodynamic aspects of water quality management in natural bodies of water.

Course Outcomes:

1. The students will be able to gain a basic knowledge advection-dispersion processes in the environment.
2. They will gain the skills to take up research activities solving environmental problems involving fluid motions.

UNIT I FUNDAMENTAL RELATIONSHIPS FOR FLOW AND TRANSPORT 9

Concentration and units of measure – Conservation laws – Systems and Control Volume approach – Differential element approach – Sources, Sinks and box-models – Mixing.

UNIT II DIFFUSION AND DISPERSION 9

Derivation of diffusion equation – Solution of diffusion equation – Advective diffusion – Turbulent diffusion – Shear flow diffusion.

UNIT III TRANSPORT PROCESSES IN RIVERS 9

Mixing in Rivers – Continuous point discharges – Two rivers mixing – Dispersion in rivers.

UNIT IV TRANSPORT PROCESSES IN LAKES AND RESERVOIRS 9

Reservoir classification – External energy sources – Surface layer – mixing in the hypolimnion – inflows and outflows.

UNIT V TRANSPORT PROCESSES IN THE ESTUARIES 9

Classification – Forces – wind, tides, rivers – Trapping and pumping – Estuarine Circulation.

Total Hours:45

SUGGESTED READINGS:

1. Fischer, H.B., List, E.G., Koh, R.C.Y., Imberger(2010). Mixing in Inland and Coastal Waters, Academic Press, New York.
2. Clark, M.M(2009). Transport Modeling for Environmental Engineers and Scientists, Wiley and Sons, New York.
3. 3 Chapra, S.C(2008). Surface Water Quality Modeling, McGraw Hill Book Co. Singapore.
4. M.Thomann, R.V. and Mueller, J.A(2003). Principles of Surface Water Quality Modeling and Control . Harper and Row, New York.
5. Csanady, G.T., D.Reidel(2002). Turbulent Diffusion in the Environment, Publishing Co. Holland.

web sites:

1. www.springer.com
2. www.nptel.com
3. www.wikipedia.com

Semester II

19MEWE2E05 SOLID AND HAZARDOUS WASTE MANAGEMENT 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- This subject is designed to provide students with the necessary background and knowledge about the various sources and
- the management of solid wastes and the on-site/off-site processing of the same and the disposal methods.

Course Outcomes:

1. At the end of the course student know about the various effects and disposal options for solid waste.

UNIT I INTRODUCTION 9

Types and Sources of solid and hazardous wastes - Need for solid and hazardous waste management – Elements of integrated waste management and roles of stakeholders - Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, lead acid batteries, plastics and fly ash.

UNIT II WASTE CHARACTERISATION AND SOURCE REDUCTION 9

Waste generation rates and variation - Composition, physical, chemical and biological properties of solid wastes – Hazardous Characteristics – TCLP tests – waste sampling and characterization plan - Source reduction of wastes – Recycling and reuse – Waste exchange.

UNIT III STORAGE, COLLECTION AND TRANSPORT OF WASTES 9

Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations Optimizing waste allocation– compatibility, storage, labeling and handling of hazardous wastes – hazardous waste manifests and transport.

UNIT IV WASTE PROCESSING TECHNOLOGIES 9

Objectives of waste processing – material separation and processing technologies – biological and chemical conversion technologies – methods and controls of Composting - thermal conversion technologies and energy recovery – incineration – solidification and stabilization of hazardous wastes - treatment of biomedical wastes.

UNIT V WASTE DISPOSAL 9

Waste disposal options – Disposal in landfills - Landfill Classification, types and methods – site selection - design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – closure of landfills – landfill remediation.

SUGGESTED READINGS:

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil(2007). Integrated Solid Waste Management, McGraw-Hill International edition, New York.

2. CPHEEO(2018). Manual on Municipal Solid waste management, Government of India, New Delhi.
3. Micheael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans(2010). Environmental Resources Management, Hazardous waste Management, McGraw-Hill International edition, New York.
4. Vesilind P.A., Worrell W and Reinhart(2011). Solid waste Engineering, Thomson Learning Inc., Singapore.

web sites:

1. www.springer.com
2. www.nptel.com

Semester II

19MEWE2E06 GROUNDWATER MODELING AND MANAGEMENT 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To introduce the students to the application of management models to estimate the groundwater quantity and qualities. After the completion of the course, the student should able to understand the inputs, system parameters, policy, variables and outputs of a groundwater management models.

Course Outcomes:

1. Students are able to develop and apply numerical model for various application along with better understanding aquifer characteristics

UNIT I GROUNDWATER PROSPECTING 9

Investigation and evaluation – Geophysical methods- Electrical Resistivity methods – Interpretation of data – Seismic method – Subsurface investigation – Test drilling – Resistivity logging – Application of remote sensing techniques.

UNIT II GROUNDWATER FLOW MODEL 9

Physical models – Analog models – Mathematical modeling – Unsaturated flow models Numerical modeling of groundwater flow – Finite Differential equations - Finite difference solution – Successive over Relaxation, Alternating direction implicit procedure – Crank Nicolson equation – Iterative methods -Direct methods - Inverse problem – Finite element method

UNIT III CONTAMINANT TRANSPORT MODEL 9

Contaminant transport theory – Advection, dispersion equation – Longitudinal and transverse dispersivity – Hydrodynamic dispersion – Analytical models – Numerical simulation of solute transport – Solution methods - Sorption model – Subsurface mass transport through the vadose zone - Density driven flow - Heat transport.

UNIT IV MODEL DEVELOPMENT 9

Data requirements – Conceptual model design : Conceptualization of aquifer system – Parameters, Input-output stresses, Initial and Boundary conditions - Model design and execution : Grid design, Setting boundaries, Time discretization and Transient simulation – Model calibration : steady state and unsteady state – sensitivity analysis – Model validation and prediction – Uncertainty in the model prediction

UNIT V GROUNDWATER MANAGEMENT MODEL 9

Optimal groundwater development – Indian GEC norms – Conjunctive use models Modeling multilayer groundwater flow system -Modeling contaminant migration – Modeling fracture flow system – Artificial recharge feasibility through modeling – Simulation of movements of solutes in unsaturated zone – Stochastic modeling of groundwater flow - Groundwater contamination, restoration and management

Total Hours:45

SUGGESTED READINGS:

1. Anderson M.P., and Woessner W.W(2015). Applied Groundwater Modelling : Simulation of flow and advective transport, Academic Press, Inc.
2. Fetter C.W(2017). Contaminant Hydrogeology, Prentice Hall.
3. Rushton K.R(2004). Groundwater Hydrology : Conceptual and Computational Models, Wiley.
4. Elango L. and Jayakumar, R.(2011). Modelling in Hydrology, Allied Publishers Ltd.
5. Remson I., Hornberger G.M. and Moltz F.J(2002). Numerical Methods in Subsurface Hydrology,Wiley, New York.
6. Robert Willis and William W.G.Yenth(2011). Groundwater System Planning and Management, Prentice Hall, Englewood Cliffs.
7. Randall J.Charbenea2006). Groundwater Hydraulics and Pollutant Transport, Printice Hall.

web sites:

1. www.springer.com
2. www.nptel.com
3. www.wikipedia.com
4. www.civil.ubc.ca
5. www.aboutcivil.com

Semester II

19MEWE2E07 LANDFILL ENGINEERING AND REMEDIATION TECHNOLOGY 3 H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- This course enables the students to know about landfill and remediation technologies in detail

Course Outcomes:

1. To understand the important characteristics and design principles of the waste containment and remediation industry as well as know the relevant regulations and engineering design requirements of landfills and contaminated site remediation

UNIT I LANDFILL BASICS 9

Waste management Hierarchy- Need for landfills –Environmental Protection by Landfills- Landfill Classification – Sanitary and Secure Landfills - Components and Configuaration – Legal framework for landfilling – Landfill Site investigation- Regional Landfills- Environmental control using site design –- Landfill Design Tasks

UNIT II LANDFILL LINERS AND COVER SYSTEMS 9

Landfill barrier system components – Design of Compacted clay liners: Factors affecting hydraulic conductivity , Water content-density criteria, Thickness, Desiccation - Geosynthetic Clay Liners and Geomembranes; types, manufacturing, handling, seaming and testing - Asphalt Barriers and Capillary barrier - Composite Liner system design- liner construction and quality control- Leakage through Liners- vapor transmission and chemical compatibility - Installation of Geomembranes - Liner Leakage Mechanism – Diffusion - Controls on advection through liners - Single phase flowadvection-diffusion- Landfill cover systems- Design of Cover Systems – Daily Cover – Intermediate Cover – Final Cover - Flow through Landfill Covers- Design and Analysis of Slope Stability- Anchor Trenches- Access ramps - Erosion control

UNIT III LEACHATE AND LANDFILL GAS MANAGEMENT 9

Waste decomposition in landfills - Factors affecting leachate and landfill gas generation – Factors affecting Leachate Quantity in active and post closure conditions- Hydrologic Evaluation of Landfill Performance (HELP) model – Leachate Drainage Layer – Geotextile and Geonet design – Leachate Collection and Removal systems-Temporal trends in leachate composition – Design of Landfill gas collection and removal systems- Gas condensate issues & knockouts – Leachate treatment methods (biological and physico-chemical)- Leachate re-circulation & bioreactor landfills- monitoring and control of leachate and Landfill gas- Landfill Settlement

UNIT IV LANDFILL OPERATION AND CLOSURE 9

Landfill Construction and Opeartional Controls – Fill Sequencing Plans – Cell Construction- Dozer and Compactor operations-Selection of Landfill Equipment- Landfill Administration-Record Keeping -Topographic mapping-Environmental Controls – Odour, Vector and Litter Control – Landfill Safety -Fire Control – Ground and Surface water Monitoring – Methane Gas monitoring - Audits of landfill environmental performance and management – Post Closure care and use of

landfills – Landfill Economics- landfill construction and operational cost estimation – establishing tipping fees

UNIT V CONTAMINATED SITE REMEDIATION 9

Contaminaed sites - Fate and behaviour of toxics and persistent substances in the environment – Engineering Issues in Site Remediation - Site Characterization - Framework for risk assessment at landfill sites - Remediation Principles: Source Control and Management of Migration Covers, Cutoff Walls, Solidification / Stabilization - Pump-and-Treat Systems - Solvent Vapor Extraction, Air Sparging, Soil Flushing – Bioremediation - Natural Attenuation - Remedy Selection and Risk Assessment – Geotechnical Aspects of In Situ Remediation Technology - Specific case studies in contaminated site remediation – Rehabilitation of Open dumps- Landfill Mining

Total Hours:45

SUGGESTED READINGS:

1. Robert M. Koerner and Donald H Gray(2002). Geotechnical aspects of Landfill Design and Construction, Prentice Hall, New Jersy.
2. Neal Bolton P.E(1995). The Handbook of Landfill Operations, Blue Ridge Services Inc., Atascadro.
3. David E Daniel and Robert M. Koerner(2007). Waste Containment Facilities –Guidance for construction Quality Assurance and Construction Quality Control of Liner and Cover Systems, American Socirty of Civil Engineers, ASCE Press.
4. Donald L Wise and Debra J Trantolo(2010). Remediation of Hazardous Waste Contaminated Soils, Marcel Dekker Inc., New York.
5. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil,(2001). Integrated Solid Waste Management, Mc-Graw Hill International edition, New York.
6. Hari D Sharma and Krishna R. Reddy(2004). Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Techonolgies, John Wiely, New Jersy.
7. Oweis, I.S. and Khera, R.P(2008). Geotechnology of Waste Management, 2nd Edition, PWS Publishing Co., Boston, MA.

web sites:

1. www.springer.com
2. www.nptel.com
3. www.wikipedia.com
4. www.civil.ubc.ca
5. www.aboutcivil.com

Semester II

19MEWE2E08 AIR AND WATER QUALITY MODELING 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- These courses are introduced to the students to understand the basic concept of mathematical modelling and process simulation techniques of environmental disturbances with reference to air, water and groundwater domains.

Course Outcomes:

At the end of this course students

1. able to know about modeling concept and transport phenomena.
2. able to understand water quality and air pollution modeling.

UNIT I MODELING CONCEPTS 9

Casual and statistical models-Characteristics- Steps in model development - Importance of model building.- conservation of mass and mass balance –calibration and verification of models; Transport phenomena – Advection, diffusion, dispersion, simple transport models; chemical reaction kinetics – Law of mass action, Rate constants, reaction order, types of reactions, equilibrium principles.

UNIT II WATER QUALITY MODELING 9

Water quality models – Historical development – Mass balance equation – Streeter - Phelps Equation – Modification to Streeter – Phelps Equation – Waste load allocations – Dissolved oxygen in Rivers and estuaries; Lake Water Quality Models; Models for Nitrogen, Bacteria, Phosphate and toxicants - Ground Water Quality Modeling - Contaminant solute transport equation, Numerical methods.

UNIT III AIR POLLUTION MODELING 9

Chemistry of air Pollutants - Atmospheric reactions, sinks for air pollution –Transport of air Pollutants - Meteorological settling for dispersal of air pollutants – Vertical structure of temperature and stability, atmospheric motions, Wind and shear, self cleaning of atmosphere; transport and diffusion of stack emissions – atmospheric characteristics significant to transport and diffusion of stack emission – stack plume characteristics.

UNIT IV AIR QUALITY MODELS 9

Types modeling technique, modeling for nonreactive pollutants, single source, short term impact, multiple sources and area sources, Fixed box models- diffusion models – Gaussian plume derivation-modifications of Gaussian plume equation- long term average-multiple cell model- receptor oriented and source oriented air pollution models- model performance, accuracy and utilization.

UNIT V APPLICATIONS 9

Software package applications: Air quality modeling and water quality modeling.

Total Hours: 45

SUGGESTED READINGS:

1. Steven C.Chapra(2008). Surface Water Quality Modeling ,The McGraw-Hill Companies, Inc., New Delhi.
2. J.L.Schnoor(2002). Environmental Modeling Fate and Transport of Pollutants in Water, Air and Soil, John Wiley & Sons Inc., New York.
3. Arthur C.Stern(2006). Air Pollutants, their transformation and Transport, Academic Press.
4. Deaton and Wine Brake(2012). Dynamic Modeling of Environmental Systems, Wiley & Sons.

Semester II

19MEWE2E09 FLOOD AND DROUGHT MANAGEMENT 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- This subject aims at making the students to understand the hydrologic extremes of floods and droughts, estimation of severity and extent of damages and the mitigation measures to combat them.

Course Outcomes

1. Students know the different methods of design flood estimation and perform channel reservoir routing. They carryout flood inundation modeling and suggest suitable flood control measures.
2. Student acquires the knowledge about different types of drought and their impacts. They asses the severity, duration and frequency of drought using drought using drought indices.
3. Students exposed to various approaches, measures and case studies of drought indices.

UNIT I FLOOD ESTIMATION AND ROUTING 9

Estimation of design flood – SPF/MPF empirical methods – Statistical methods – Frequency analysis – Unit hydrograph method – Flood estimation in small watersheds and mountainous region – Estimation by lumped, distributed model – Routing – Lumped – Distributed – Hydraulic and hydrological routing.

UNIT II FLOOD CONTROL AND MANAGEMENT 9

Flood control methods – Structural and non structural measures - Flood plain Zoning – Flood disaster monitoring and mitigation procedure – Methods of forecasting – Data analysis and warning – Flood fighting -Remote Sensing for flood management.

UNIT III DROUGHTS 9

Definitions based on rainfall, stream flow, vegetation and comprehensive aspects - Characterization of Drought/water shortage/aridity/desertification - NCA classification – Direct and indirect losses.

UNIT IV DROUGHT ASSESSMENT 9

Drought indices - Drought severity assessment – meteorological, hydrological and agricultural aspects - IMD, Palmer, Herbst, Aridity Indices and Ramaprasad methods.

UNIT V DROUGHT MONITORING AND MANAGEMENT 9

Drought monitoring - Supply and demand oriented measures – Traditional water conservation - Drought Prone Areas Programme (DPAP) – Integrated drought management – Remote Sensing Applications for drought mitigation - NDVI concepts.

Total Hours:45

SUGGESTED READINGS:

1. Chow V.T., Maidment D.R., Mays L.W(2010). **Applied Hydrology,** McGraw Hill Publications, New York.
2. Chow V.T., Maidment D.R., Mays L.W(2010). **Applied Hydrology,** McGraw Hill Publications, New York.
3. Vijay P.Singh(2006). Elementary Hydrology, Prentice Hall of India, New Delhi.
4. Yevjevich V (2013). Drought Research Needs, Water Resources Publications, Colorado State.
5. Rangapathy V., Karmegam M., and Sakthivadivel R(1988). Monograph in Flood Routing Methods as Applied to Indian Rivers, Anna Karpagam academy of Higher Education Publications.

Semester II

19MEWE211 GEOGRAPHICAL INFORMATION SYSTEM LAB 2H:2C

Instruction Hours/ Week : L:0 T:0 P:2 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- This subject includes the list of experiments to be conducted to teach the principles and applications of remote sensing, GPS and GIS in the context of water resources. At the end of the course, the student will appreciate the importance of remote sensing and GIS in solving the spatial problems in water resources.

Course Outcomes

1. Expertise in digital image processing
2. Good exposure to the Global positioning system in real time data processing
3. Potential of Geographical Information System
4. Data integration between Satellite data, GPS and GIS in Decision Making

List of Experiment

1. Registration of spatial data
2. GPS- Mapping-Transformation
3. Different data format
4. Creating spatial data- Attribute entry- spatial analysis
5. Reclassification
6. Over lay analysis
7. Interpolation
8. Digital Elevation Model.

Total Hours : 30

Semester II

19MEWE212 NUMERICAL ANALYSIS LAB 2H:2C

Instruction Hours/ Week : L:0 T:0 P:2 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To introduce the scientific computing, covering some important aspects of solving algebraic equations, IVP, BVP.
- To implement the methods using the spread sheet in Excel

Course Outcomes

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

1. Find Roots of non-linear equations by Bisection method and Newton's method.
2. Do curve fitting by least square approximations
3. Solve the system of Linear Equations using Gauss - Elimination/ Gauss - Seidal Iteration/ Gauss - Jorden Method.
4. To Integrate Numerically Using Trapezoidal and Simpson's Rules.
5. To Find Numerical Solution of Ordinary Differential Equations by Euler's Method, Runge-KuttaMethod..

SYLLABUS CONTENTS:

1. Find the Roots of Non-Linear Equation Using Bisection Method.
2. Find the Roots of Non-Linear Equation Using Newton's Method.
3. Curve Fitting by Least Square Approximations.
4. Solve the System of Linear Equations Using Gauss - Elimination Method.
5. Solve the System of Linear Equations Using Gauss - Seidal Iteration Method.
6. Solve the System of Linear Equations Using Gauss - Jorden Method.
7. Integrate numerically using Trapezoidal Rule.
8. Integrate numerically using Simpson's Rules.
9. Numerical Solution of Ordinary Differential Equations By Euler's Method.
10. Numerical Solution of Ordinary Differential Equations ByRunge- Kutta Method.

SUGGESTED READINGS:

1. Steven C. Chapra, Raymond P. Canale(2014). Numerical Methods for Engineers, McGraw - Hill Pub. Co. Ltd.
2. Curtis F. Gerald and Patrick O. Wheatley(2009). Applied Numerical Analysis, Pearson Education, South Asia.

Semester II

19MEWE213 MINI PROJECT 4H:2C

Instruction Hours/ Week : L:0 T:0 P:4 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To take up any research and challenging practical problem for finding better solutions.
- To provide a clear idea of his/her area of work and they are in a position to carry out the project phase I and phase II work in a systematic way.

Course Outcomes

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

1. Identify structural engineering problems reviewing available literature.
2. Study different techniques used to analyze complex structural systems.
3. work on the solutions given and present solution by using his/her technique applying engineering principles.

SYLLABUS CONTENTS:

Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution.

Continuous assessment ofMini Project at Mid Sem and End Sem will be monitored by the departmental committee.

Semester III

19MEWE3E01 REHABILITATION AND MODERNISATION OF IRRIGATION SYSTEMS 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To expose the students to the need and importance of the rehabilitation and modernization of irrigation systems and to train them in the related concepts and methods.

Course Outcomes

1. The students will be familiar in understanding the different types of maintenance problems with respect to technical and social aspects, its occurrence and to overcome these problems by rehabilitation and modernization methods.
2. The students will get an overall exposure to different types of irrigation system maintenance issues and to solve them for improving their performance based on service oriented approach.

UNIT I Irrigation Systems 9

Historical evolution of irrigation systems in India; its importance to agricultural production. Irrigation system classification – Nature of system modernization and rehabilitation. Distinction between rehabilitation and modernization; Rehabilitation and modernization objectives – Theory and Practice.

UNIT II System Maintenance 9

Maintenance: essential, catch up, preventive and normal – Diagnostic analysis of flow, seepage and other parameters through Participatory Rural Appraisal, Rapid Rural Appraisal and Walk-through Survey – Development and maintenance programme – Kudimaramath – Turnover – WUA.

UNIT III Problem Identification 9

System performance: history of inflow, cropping pattern, system alterations, distribution performance – Operational constraints – Management constraints – Resources constraints

UNIT IV Rehabilitation 9

Baseline survey – Deferred maintenance – Causes – Criteria used for taking rehabilitation programmes – Software and hardware improvements – Prioritization – Role of water users' association – Monitoring and evaluation.

UNIT V Implementation 9

Rehabilitation and modernization programmes – Periyar Vaigai Project – Walawe Project – Tank Modernization Project – Water Resources Consolidation Project. IAM WARM Project.

Total Hours:45

SUGGESTED READINGS:

1. CWR(2000). Baseline Survey of Irrigation Commands, Anna Karpagam academy of Higher Education, Chennai.
2. IIMI and WALMI(2000). Diagnostic Analysis of Irrigation Systems Volume 2: Evaluation Techniques, Gujarat, India, CSU.
3. Water Management Synthesis Project(1984). Colorado State Karpagam academy of Higher Education, USA.

web sites:

1. www.springer.com
2. www.nptel.com
3. www.wikipedia.com

Semester III

19MEWE3E02 WATERSHED CONSERVATION AND MANAGEMENT 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To provide the technical, economical and sociological understanding of a watershed.
- To provide a comprehensive discourse on the engineering practices of watershed management for realizing the higher benefits of watershed management.

Course Outcomes

1. The students will be able to apply the knowledge of overall concepts of watershed which would help to comprehend and analyze for better management.

UNIT I WATERSHED CONCEPTS 9

Watershed - Need for an Integrated Approach - Influencing Factors: Geology – Soil – Morphological Characteristics - Toposheet - Delineation – Codification – Prioritization of Watershed – Indian Scenario

UNIT II SOIL CONSERVATION MEASURES 9

Types of Erosion – Water and Wind Erosion: Causes, Factors, Effects and Control – Soil Conservation Measures: Agronomical and Mechanical - Estimation of Soil Loss – Sedimentation

UNIT III WATER HARVESTING AND CONSERVATION 9

Water Harvesting Techniques – Micro-Catchments - Design of Small Water Harvesting Structures – Farm Ponds – Percolation Tanks – Yield from a Catchment

UNIT IV WATERSHED MANAGEMENT 9

Project Proposal Formulation - Watershed Development Plan – Entry Point Activities – Estimation – Watershed Economics - Agroforestry – Grassland Management – Wasteland Management – Watershed Approach in Government Programmes –Developing Collaborative know how – People's Participation – Evaluation of Watershed Management

UNIT V GIS FOR WATERSHED MANAGEMENT 9

Applications of Remote Sensing and Geographical Information System - Role of Decision Support System – Conceptual Models and Case Studies

Total Hours:45

SUGGESTED READINGS:

1. Ghanashyam Das(2008). Hydrology and Soil Conservation engineering, Prentice Hall of India Private Limited, New Delhi.
2. Vir Singh, Raj , (2000). Watershed Planning and Management, , Yash Publishing House, Bikaner.
3. pp. Heathcote, I. W. (2006). Integrated Watershed Management: Principles and Practice. , John Wiley and Sons, Inc., New York.
4. Lal, Ruttan. (2000). Integrated Watershed Management in the Global Ecosystem. , CRC Press, New York..
5. Heathcote, I. W. (2009). Integrated Watershed Management: Principles and Practice. , John Wiley and Sons, Inc., New York..

web sites:

1. www.springer.com
2. www.nptel.com
3. www.wikipedia.com

Semester III

19MEWE3E03 URBAN WATER RESOURCES MANAGEMENT 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- Students will be introduced to the role of disciplines of ecology and socio-economics play in management of urban water resources management.
- They will be exposed to global food security and public-private participation issues and legal and regulatory settings, in the context of UWRM

Course Outcomes

1. They will gain a broad understanding of the complexities of dealing with water resources problems.
2. At the end of this course the students are introduced with the concepts of urbanization and its impact on the natural water cycle and the student is exposed to use the urban storm water models for better storm water management.
3. And also different types of operation and maintenance.

UNIT I URBAN HYDROLOGIC CYCLE 9

Water in the urban eco-system – Urban Water Resources – Major problems – Urban hydrological cycle – Storm water management objectives and limitations – Storm water policies – Feasibility consideration.

UNIT II URBAN WATER RESOURCES MANAGEMENT MODELS 9

Types of models – Physically based – conceptual or unit hydrograph based – Urban surface runoff models – Management models for flow rate and volume control rate – Quality models.

UNIT III URBAN STORM WATER MANAGEMENT 9

Storm water management practices (Structural and Non-structural Management measures) – Detention and retention concepts – Modelling concept – Types of storage – Magnitude of storage – Hydraulic analysis and design guidelines – Flow and storage capacity of urban components – Temple tanks.

UNIT IV MASTER PLANS 9

Planning and organizational aspects – Inter dependency of planning and implementation of goals and measures – Socio – economics financial aspects – Potential costs and benefit measures – Measures of urban drainage and flood control benefits – Effective urban water user organizations.

UNIT V OPERATION AND MAINTENANCE 9

General approaches to operations and maintenance – Complexity of operations and need for diagnostic analysis – Operation and maintenance in urban water system – Maintenance Management System – Inventories and conditions assessment – Social awareness and involvement.

Total Hours:45

SUGGESTED READINGS:

1. Neil S. Grigg(2012). Urban Water Infrastructure Planning, Management and Operations, John Wiley and Sons.

2. Geiger, W.F., Marsalek, F., and Zuidena, F.C(2002). Manual on drainage in urbanized areas – Vol.1 and Vol.II, UNESCO.
3. Hengeveld, H. and C. De Voch.t(2011). Role of Water in Urban Ecology.
4. Martin, P. Wanelista and Yousef, A. Yousef(2013). Storm Water Management, John Wiley and sons.
5. Overtens D.E. and Meadows M.E(2014). Storm Water Modelling, Academic Press, New York.

web sites:

1. www.springer.com
2. www.nptel.com
3. www.wikipedia.com

Semester III

19MEWE3E04 WATER-POWER AND DAM ENGINEERING 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- The student is exposed to the design aspects of hydro-power plants, various components of hydropower plants and their layout.
- Different types of dams design taking into account the suitability of the site and the different type loads that are likely to be encountered.

Course Outcomes

1. The students will be able to get a basic knowledge of planning and designing hydropower plants.
2. The student is exposed to the design aspects of hydro-power plants, various components of hydropower plants and their layout, Different types of dams design and the different type loads that are likely to be encountered

UNIT I HYDROELECTRIC POWER DEVELOPMENT 9

Introduction – Types of power development – Classification. Planning – Environmental Considerations - Data requirement for assessment of hydropower. Components of hydropower.

UNIT II DESIGN OF HYDROPOWER INSTALLATION 9

Components – Intake structure – water conductor systems – tunnels – surge tanks – penstocks – valves – anchor blocks.

UNIT III TYPES OF POWER HOUSE 9

Underground – emi-underground. Turbines and their foundations – structural and geotechnical aspects of power-house design.

UNIT IV EMBANKMENT DAM ENGINEERING 9

Introduction. Nature and classification of engineering soils. Principles of design. Materials and construction. Internal seepage. Stability and stress. Settlement and deformation. Rockfill and rockfill embankments.

UNIT V CONCRETE DAM ENGINEERING 9

Loading: Concepts and criteria. Gravity dam analysis. Buttress dam analysis. Arch dam analysis. Design features and construction. Concrete for dams. Dam safety and instrumentation. Foundation measurements. Analysis of strain data.

Total Hours:45

SUGGESTED READINGS:

1. Novak, P., Moffat, A.I.B., Nalluri, C. and Narayanan, R(2017). Hydraulic Structures, Unwin Hyman Ltd., London.
2. Dandekar, M.M. and Sharma, K.N(2014). Water Power Engineering, Vikas Publishing House, New Delhi.
3. USBR.(2012). Design of Small Dams, Oxford and IBH Publishing Co. Pvt. Ltd.
4. Sharma, H.D(2009). Concrete Dams, Metropolitan New Delhi.
5. Varshney, R.S.(2014). Concrete Dams, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Varshney, R.S(2009). Hydro Power Structures, Nem Chand Bros. Roorkee.
7. Guthrie, Brown J.(2014) Hydro Electric Engineering Practice, Blackie and Son, Glasgow.

web sites:

1. www.springer.com

Semester III

19MEWE3E05 COASTAL ENGINEERING 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- The main purpose of coastal engineering is to protect harbors and improve navigation. The students to the diverse topics as wave mechanics, wave climate, shoreline protection methods and laboratory investigations using model studies.

Course Outcomes

1. Students will understand coastal engineering aspects of harbors methods to improve navigation, shoreline protection and other laboratory investigations using model studies and to use the skills and techniques in ICM.
2. enable students to understand the fundamental ocean wave theories and to protect harbours and improve navigation with the techniques required to analysis the wave and laboratory investigations of coastal modelling using model studies

UNIT I INTRODUCTION TO COASTAL ENGINEERING 9

Introduction - wind and waves – Sea and Swell - Introduction to small amplitude wave theory – use of wave tables- Mechanics of water waves – Linear (Airy) wave theory.

UNIT II WAVE PROPERTIES AND ANALYSIS 9

Introduction to non-linear waves and their properties – Waves in shallow waters – Wave Refraction, Diffraction and Shoaling –Hind seast wave generation models, wave shoaling; wave refraction; wave breaking; wave diffraction random and 3D waves- Short term wave analysis – wave spectra and its utilities - Long term wave analysis- Statistics analysis of grouped wave data.

UNIT III COASTAL SEDIMENT TRANSPORT 9

Dynamic beach profile; cross-shore transport; along shore transport (Littoral transport), sediment movement

UNIT IV COASTAL DEFENSE 9

Field measurement; models, groins, sea walls, offshore breakwaters, artificial nourishment - planning of coast protection works - Design of shore defense structures –Case studies.

UNIT V MODELINGINCOASTAL ENGINEERING 9

Physical modeling in Coastal Engineering – Limitations and advantages – Role of physical modeling in coastal engineering – Numerical modeling – Modeling aspects – limitations – Case studies using public domain models.

Total Hours:45

SUGGESTED READINGS:

1. Dean, R.G. and Dalrymple, R.A(2013). Water wave mechanics for Engineers and Scientists, Prentice-Hall, Inc.
2. Ippen, A.T(2009). Estuary and Coastline Hydrodynamics, McGraw-Hill Book Company, Inc.
3. Sorenson, R.M(2013). Basic Coastal Engineering, A Wiley-Interscience Publication.
4. Coastal Engineering Research Center(2010). Coastal Engineering Manual, Vol. I-VI, US Army Corps of Engineers.
5. Kamphuis, J.W, Introduction to coastal engineering and management.

web sites:

1. www.springer.com
2. www.nptel.com

Open Electives **Semester III**

19MEWEOE01 BUSINESS ANALYTICS 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- Understand the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data.
- Use decision-making tools/Operations research techniques.
- Mange business process using analytical and management tools.
- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Course Outcomes

1. Students will demonstrate knowledge of data analytics.
2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
4. Students will demonstrate the ability to translate data into clear, actionable insights

UNIT I: BUSINESS ANALYTICS: 9

Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics.Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of [9] probability distribution and data modelling, sampling and estimation methods overview.

UNIT II: TRENDINESS AND REGRESSION ANALYSIS: 9

Modelling Relationships and Trends in Data, simple Linear Regression.Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics [8] Technology.

UNIT III: ORGANIZATION STRUCTURES OF BUSINESS ANALYTICS: 9

Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics [9] analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT-IV: FORECASTING TECHNIQUES: 9

Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate

Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT V: DECISION ANALYSIS: 9

Formulating Decision Problems, Decision Strategies with the without 8 Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Recent Trends in : Embedded and collaborative business intelligence, Visual data 4 recovery, Data Storytelling and Data journalism.

Total Hours:45

SUGGESTED READINGS:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (FT) 2019-20

Open Electives **Semester III**

19MEWEOE02 INDUSTRIAL SAFETY 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To provide knowledge on design features for a process industry and safety in the operation of various equipment in industry.
- To understand the various hazards and prevention in commissioning stage of industry.
- To recognise and identify the safe operation of equipment in process industry.
- To plan and trained for emergency planning in a process industry.
- To get fundamental knowledge on safe storage of chemicals.

Course Outcomes

1. This course would make familiar of safe design of equipment which are the essential to chemical industry and leads to design of entire process industries.
2. Course would be helpful to understand the design of pressure systems.
3. Students would understand the problems and find innovative solutions while industries facing Problems in commissioning and maintenance stages.
4. Students can prepare the emergency planning for chemical industry problems
5. Students would be able to create safe storage systems.

UNIT-I: INDUSTRIAL SAFETY:

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT-II:FUNDAMENTALS OF MAINTENANCE ENGINEERING:

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT-III:WEAR AND CORROSION AND THEIR PREVENTION:

Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT-IV FAULT TRACING:

Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT-V PERIODIC AND PREVENTIVE MAINTENANCE:

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric

motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

SUGGESTED READINGS:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

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Open Electives **Semester III**

19MEWEOE03 OPERATIONS RESEARCH 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- This course aims to introduce students to use quantitive methods and techniques for effective decisions–making;
- model formulation and applications that are used in solving business decision problems.

Course Outcomes

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

1. Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
2. Students should able to apply the concept of non-linear programming
3. Students should able to carry out sensitivity analysis
4. Student should able to model the real world problem and simulate it.

UNIT I OPTIMIZATION TECHNIQUES 9

Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT II FORMULATION OF A LPP 9

Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

UNIT III NONLINEAR PROGRAMMING PROBLEM 9

Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

UNIT IV SCHEDULING AND SEQUENCING 9

single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT V COMPETITIVE MODELS 9

Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Total Hours:45

SUGGESTED READINGS:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

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Open Electives **Semester III**

19MEWEOE04 COST MANAGEMENT OF ENGINEERING PROJECTS 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- The course focuses on the early project phases, including examples from technical projects within various sectors and industries (amongst others, but not limited to, infrastructure projects and construction projects).

Course Outcomes

At the end of this course,

1. Students will have created their own project execution plan, either in a team effort or on individual basis.
2. Of course the team effort allows for a special learning experience and we appraise active team participation

UNIT-I INTRODUCTION 9

Overview of the Strategic Cost Management Process, Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT-II PROJECT 9

meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non-technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

UNIT-III COST BEHAVIOR AND PROFIT PLANNING MARGINAL COSTING 9

Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis.

UNIT-IV PRICING STRATEGIES 9

Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT-V QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT 9

Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Total Hours:45

SUGGESTED READINGS:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

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Open Electives **Semester III**

19MEWEOE05 COMPOSITE MATERIALS 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- This course is designed as an introduction for the student to the basic theory and applications of modern composite materials.

Course Outcomes

1. The student has an understanding of all the basic engineering knowledge up until this point. Without going far into detail,
2. the student is best suited for this course by having the following prerequisites

UNIT–I: INTRODUCTION: Definition – Classification and characteristics of Composite materials Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II: REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III: Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV: Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V: Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

SUGGESTED READINGS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.
3. Hand Book of Composite Materials-ed-Lubin.
4. Composite Materials – K.K.Chawla.
5. Composite Materials Science and Applications – Deborah D.L. Chung.
6. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.
7.

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (FT) 2019-20

Open Electives **Semester III**

19MEWEOE06 WASTE TO ENERGY 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To provide information on various methods of waste management.
- To familiarize students with recent energy generation techniques.
- To detail on the recent technologies of waste disposal
- To make student realize on the importance of healthy environment

Course Outcomes

1. Waste characterization ,Segregation, Disposal etc will be made known
2. Technologies that are available for effective waste disposal along with pros / cons will become clearer to students
3. First hand information on present day waste related problems (Hazardous Waste, Pharma Waste, Biomedical Waste etc) that will be taught in this programme will make them understand the problem in a much sensible & realistic manner.

UNIT-I: INTRODUCTION to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT-II: BIOMASS PYROLYSIS: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III: BIOMASS GASIFICATION: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-IV: BIOMASS COMBUSTION: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V: BIOGAS: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

SUGGESTED READINGS:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (FT) 2019-20

Open Electives **Semester III**

19MEWEOE07 REMOTE SENSING AND GIS APPLICATIONS IN ENVIRONMENTAL MANAGEMENT 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To teach the principles and applications of remote sensing, GPS and GIS in the context of water resources. At the end of the course, the student will appreciate the importance of remote sensing and GIS in solving the spatial problems in water resources.
- The student acquires the knowledge about the principles, its Data Processing and applications of remote sensing and GIS in environmental management.

Course Outcomes

1. Introduce the technology and principles of Satellite Imaging
2. Theoretical explanations on Image processing and information extraction from Satellite Data Products
3. Functional elucidation of GIS integrating Satellite Data Products into the GIS platform for Decisionmaking
4. Potential of remote sensing and GIS is solving problems in water resources through case studies.

UNIT I OVERVIEW OF REMOTE SENSING 9

Historical Perspective, Principles of remote sensing, components of Remote Sensing, Energy source and electromagnetic radiation, Energy interaction, Spectral response pattern of earth surface features

UNIT II REMOTE SENSING TECHNOLOGY 9

Classification of Remote Sensing Systems, Energy recording technology, Aerial photographs, Photographic systems – Across track and along track scanning, Multispectral remote sensing, Thermal remote sensing, Microwave remote sensing – Active and passive sensors, RADAR, LIDAR, Satellites and their sensors, Indian space programme - Research and development

UNIT III DATA PROCESSING 9

Characteristics of Remote Sensing data, Photo grammetry – Satellite data analysis – Visual image interpretation, Digital image processing – Image rectification, enhancement, transformation, Classification, Data merging, RS – GIS Integration, Image processing software.

UNIT IV GEOGRAPHICAL INFORMATION SYSTEM 9

GIS Concepts – Spatial and non - spatial data, Vector and raster data structures, Data analysis, Database management – GIS software

UNIT V REMOTE SENSING AND GIS APPLICATIONS 9

Monitoring and management of environment, Conservation of resources, Sustainable land use, Coastal zone management – Limitations

Total Hours:45

SUGGESTED READINGS:

1. Willard H. Merritt, L. Dean, D.A. and Settle, F.A(2004). **Instrumental methods of analysis Edn,** Words Worth, New York.
2. Lillesand, T.M. and Kiefer, R.W(2015). **Remote sensing and image interpretation,** John Wiley and sons, New York.
3. Golfried Konechy(2014). Geoinformation: Remote sensing, Photogrammetry and Geographical Information Systems, CRC press.
4. Burrough, P.A. and McDonnell, R.A(2015). Principles of Geographic Information systems , Oxford Karpagam academy of Higher Education Press, New York.
5. Lintz, J. and Simonet(2012). Remote sensing of Environment, Addison Wesley Publishing Company, New Jersey.
6. Manual of Remote Sensing(2001). Pmapler and Applications of Imaging RADAR, Vol.2, ASPR.

Web Sites:

1. www.springer.com
2. www.nptel.com
3. www.wikipedia.com
4. www.civil.ubc.ca

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Open Electives **Semester III**

19MEWEOE08 RESOURCE AND ENERGY RECOVERY FROM WASTE 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To understand the principles and design of recovering materials and energy from wastesthrough mechanical, biological and thermal methods and manage the undesirable by-products

Course Outcomes

1. Waste characterization ,Segregation, Disposal etc will be made known
2. Technologies that are available for effective waste disposal along with pros / cons will become clearer to students
3. First hand information on present day waste related problems (Hazardous Waste, Pharma Waste, Biomedical Waste etc) that will be taught in this programme will make them understand the problem in a much sensible & realistic manner.

UNIT I MECHANICAL PROCESSING FOR MATERIAL RECYCLING 9

Resource recovery for a sustainable development- Material and energy flow management and analysis - Systems and processes for reduction, reuse and recycling -Objectives of Waste Processing-Source Segregation and Hand Sorting-Waste Storage and Conveyance – Shredding – Pulping - Size Separation by Screens- Density Separation by Air Classification –magnetic and electromechanical separation processes- Design Criteria and Equipment selection

UNIT II BIOLOGICAL PROCESSING FOR RESOURCE RECOVERY 9

Mechanisms of Biological Processing – Aerobic Processing of Organic fraction - Composting methods and processes- factors affecting- Design of Windrow Composting Systems- In Vessel Composting- Compost Quality Control- Vermiculture: definition, scope and importance – common species for culture - Environmental requirements - culture methods- Applications of vermiculturePotentials and constraints for composting in India-Largescale and decentralized plants.

UNIT III BIO-CHEMICAL CONVERSION OF WASTE TO ENERGY 9

Principles and Design of Anaerobic Digesters – Process characterization and control- The biochemistry and microbiology of anaerobic treatment - Toxic substances in anaerobic treatment - Methane generation by Anaerobic Digestion- Anaerobic reactor technologies – Commercial anaerobic Technologies- Single stage and multistage digesters- Digester design and performance Gas collection systems-Methane Generation and Recovery in Landfills – Biofuels from Biomass

UNIT IV THERMO-CHEMICAL CONVERSION OF WASTE TO ENERGY 9

Principles and Design of Energy Recovery Facilities -Types and principles of energy conversion processes - Incinerator design - Mass Burn and RDF Systems- Composition and calorific value of fuels and waste, Determination of the stoichiometric air consumption, Calculation of the flue gas composition - grate firing designs, boiler design, removal of bottom ash, heat recovery- Emission Controls – flue gas cleaning, de-dusting, flue gas scrubbers, DeNOx processes, dioxins and furans - Alternative thermal processes: co-incineration, pyrolysis, gasification, plasma arc – Process characterization and control- waste heat recovery- Bottom ash: Quantity, quality, treatment,

utilization, disposal- Facility design- decentralized mobile plants- Planning and construction of incineration plants

UNIT V CASE STUDIES ON WASTE RECYCLING 9

Recycling technologies for paper, glass, metal, plastic – Used Lead Acid Battery Recycling –End of Life Vehicle Recycling – Electronic Waste Recycling – Waste Oil Recycling – Solvent Recovery- Drivers and barriers for material recycling: social, legal and economic factors - Environmentalimpacts of waste recycling - Design for the environment: the life cycle approach

Total Hours:45

SUGGESTED READINGS:

1. Gary C. Young(2010). Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and Renewable Comparisons, John Wiley & Sons.
2. menti, Chiumenti, Diaz, Savage, Eggerth, and Goldstein ,(2011). Modern Composting Technologies, JG Press.
3. Aarne Veslind and Alan E Rimer(2012) .Unit operations in Resource Recovery Engineering,. Prentice Hall Inc., London.
4. Manser A G R, Keeling A A(2013). Practical handbook of processing and recycling on municipal waste, Pub CRC Lewis London, ISBN 1-56670-164.
5. Charles R Rhyner(2017). Waste Management and Resource Recovery, Lewis Publishers.

Web Sites:

1. www.springer.com
2. www.nptel.com
3. www.wikipedia.com
4. www.civil.ubc.ca

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Open Electives **Semester III**

19MEWE391 PROJECT WORK – PHASE –I 20H:10C

Instruction Hours/ Week : L:0 T:0 P:20 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To take up any research and challenging practical problem for finding better solutions.
- To provide a clear idea of his/her area of work and they are in a position to carry out the remaining phase II work in a systematic way.

Course Outcomes

At the end of the course, students will demonstrate the ability to

1. Identify a topic for study and carry out literature survey
2. Write a technical report related to selected topic
3. Present outcome of the study with the help of ppt.

SYLLABUS:

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (FT) 2019-20

Open Electives **Semester IV**

19MEWE491 PROJECT WORK – PHASE –II 32H:16C

Instruction Hours/ Week : L:0 T:0 P:32 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs

Course Objectives:

- To take up any research and challenging practical problem for finding better solutions.

Course Outcomes:

At the end of the course, students will demonstrate the ability to

1. Identify a topic for study and carry out literature survey
2. Write a technical report related to selected topic
3. Present outcome of the study with the help of ppt.
4. Manage any type of design and construction projects.

SYLLABUS:

The student should continue the phase I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.