KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)

(Established Under Section 3 of UGC Act 1956)

Coimbatore – 641 021. INDIA

FACULTY OF ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

M.E. WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PART TIME)

Curriculum Structure

(2019 BATCH ONWARDS)

PROGRAMME EDUCATIONAL COURSE OBJECTIVESSS (PEOs):

I. To prepare students to excel in research and to succeed in Water resources and Environmental engineering profession through global, rigorous post graduate education

II. To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve in Water resources and Environmental engineering problems

III. To train students with good scientific and engineering knowledge so as to comprehend, analyze, design, and create novel products and solutions for the real-life problems

IV. To inculcate students in professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to relate in Water resources and Environmental engineering issues to broader social context.

V. To provide student with an academic environment aware of excellence, leadership, written ethical codes and guidelines, and the life-long learning needed for a successful professional career

PROGRAMME OUTCOMES (POs):

On successful completion of the programme,

a. Graduates will demonstrate knowledge of mathematics, science and engineering.

b. Graduates will demonstrate an ability to design a system, component or process as per needs and specifications.

c. Graduates will demonstrate an ability to visualize and work on laboratory and multidisciplinary tasks.

d. Graduate will demonstrate skills to use modern engineering tools, software and equipment to analyze problems.

e. Graduates will demonstrate knowledge of professional and ethical responsibilities.

f. Graduate will be able to communicate effectively in both verbal and written form.

g. Graduate will develop confidence for self education and ability for life-long learning.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

h. Graduates will demonstrate an ability to identify, formulate and solve engineering problems.

i. Graduate will demonstrate an ability to design and conduct experiments, analyze and interpret data.

j. Graduate will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.

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MAPPING:

PEOs	a	b	c	d	e	f	g	h	i	j
I	√			√			√	√	√	
II		√			√				√	√
III			√		√	√		√	√	
IV	√			√			√			√
V		√	√			√			√	√

(2020 BATCH ONWARDS)

COURSE CODE	NAME OF THE COURSE	COURSE OBJECTIVES S AND OUT COMES		INSTRUCTION HOURS /WEEK			CREDITS	MAXIMUM MARKS		
		PEO's	PO's	L	T	P		CIA	ESE	TOTAL
								40	60	100
SEMESTER – I										
19PMEWE101	Surface Water Hydrology	I, II	a,b,h	3	0	0	3	40	60	100
19PMEWE102	Probability and statistical methods	I, II	a,b,c, i	3	0	0	3	40	60	100
19PMEWE1E0	1. Industrial Wastewater Pollution – Prevention and Control 2. Soil Pollution Engineering 3. Design of Biological Treatment Systems 4. Climate change and Adaptation	I, III I, III I, IV I, II, V	a,b,d, j c,d,f, i e,f,g, j a,b,g	3	0	0	3	40	60	100
19PMEWE111	Environmental Engineering lab	III	c,d,i	0	0	2	2	40	60	100
Total				**9**	**0**	**2**	**11**	**160**	**240**	**400**
SEMESTER – II										
19PMEWE201	Design of Hydraulic and Environmental Engineering Structures	I, II	a,b,i	3	0	0	3	40	60	100
19PMEWE202	Air pollution and control	I, II	a,b,c	3	0	0	3	40	60	100
19PMEWE2E0	1. Water Supply Distribution and Buried Pipelines 2. Ground Water and Drainage Engineering 3. Rural Water Supply and On-Site Sanitation 4. Remote Sensing and GIS Applications in Environmental Management 5. River Engineering	I, III I, III I, IV I, II, V III, V	a,b,d, i c,d,f, j e,f,g, i a,b,g, h a,d,f	3	0	0	3	40	60	100
19PMEWE211	Geotechnical engineering lab	III	c,d,i	0	0	2	2	40	60	100
Total				**9**	**0**	**2**	**11**	**160**	**240**	**400**
SEMESTER – III										
19PMEWE301		I, II	a,b,i	3	0	0	3	40	60	100

19PMEWE302	Research Methodology and IPR	I, II	a,b,c, h	2	0	0	2	40	60	100
19PMEWE3E0	1. Environmental Impact Assessment of Water Resources Development 2. Environmental Quality Monitoring 3. Environment, Health and Safety in Industries 4. Environmental Hydraulics	I, III I, III I, IV I, II, V	a,b,d, h,i c,d,f, i e,f,g, I,h a,b,g	3	0	0	3	40	60	100
19PMEWE311	Geographical Information system lab	III	c,d,i	0	0	2	2	40	60	100
Total				**8**	**0**	**2**	**10**	**160**	**240**	**400**
SEMESTER – IV										
19PMEWE4E0	1. Solid and Hazardous waste management 2. Groundwater Modeling and Management 3. Landfill Engineering and Remediation Technology 4. Air and Water Quality Modeling 5. Flood and Drought Management	I, III I, III I, IV I, II, V III, V	a,b,d c,d,f, i e,f,g a,b,h a,d,i	3	0	0	3	40	60	100
19PMEWE4E0	6. Rehabilitation and Modernization of Irrigation Systems 7. Watershed Conservation and Management 8. Urban Water Resources Management 9. Water Power and Dam Engineering 10. Coastal Engineering	I, III I, III I, IV I, II, V III, V	a,b,j c,d,h e,f,i a,b,i a,d,j	3	0	0	3	40	60	100
19PMEWE411	Numerical Analysis Lab	III	c,d,i	0	0	2	2	40	60	100
19PMEWE412	Mini Project	III	c,d,i	0	0	4	2	40	60	100*
Total				**6**	**0**	**6**	**10**	**160**	**240**	**400**
SEMESTER – V										
19PMEWEOE0	1. Business Analytics	I, III I, III	a,b,d c,d,,h	3	0	0	3	40	60	100

	2. Industrial Safety 3. Operations Research 4. Cost Management of Engineering Projects 5. Composite Materials 6. Waste to Energy 7. Advanced Ground Water Hydrology 8. Resource and Energy Recovery from Waste	I, IV I, II, V III, V II, V III, IV I, III, V	e,f,g a,b,g a,d,f a,f,i b,e,g, h,g c,e,g, i							
19PMEWE591	Project Work – Phase I	III	c,d	0	0	20	10	40	60	100*
Total				**3**	**0**	**20**	**13**	**80**	**120**	**200**
SEMESTER – VI										
19PMEWE691	Project Work – Phase II	III	c,d,i	0	0	32	16	120	180	300
Total				**0**	**0**	**32**	**16**	**120**	**180**	**300**

L-Lecture T-Tutorial P-Practical C-Credit
CIA – Continuous Internal Assessment
ESE – End semester Examination

Total credits = 71
Total Marks = 2100

*** To be evaluated internally by a committee of members**

Review 1& 2 – 60 marks
Final presentation and viva voce – 40 marks

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester I

19PMEWE101 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:

1. 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.
2. To Understand different rain gauges and Perform various kind of Rainfall Analysis
3. To estimate various losses such as evaporation, Evapotranspiration and Infiltration.
4. 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.
5. To impart the knowledge on Precipitation, Abstraction and Runoff processes of hydrologic cycle, their estimation and field measurements and Water harvesting methods.
6. To impart knowledge in soil erosion and sedimentation to estimate the life of the reservoir.

Course Outcomes:

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

1. Describe the hydrologic cycle and devices for hydro meteorological Measurements
2. Explain different rain gauges and Perform various kind of Rainfall Analysis
3. Estimate various losses such as evaporation, Evapotranspiration and Infiltration.
4. Discuss the various methods of runoff estimation and derive hydrographs
5. Demonstrate the various methods of Stream flow measurement and water harvesting Techniques.
6. 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 (2008), Hydrology, Tata McGraw Hill Co., New Delhi.

Web Sites:

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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester I

19PMEWE102 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

OBJECTIVES:

1. To provide an overview of probability and statistics and the basic concepts of two-dimensional random variables
2. Be introduced to the notion of sampling distributions which is useful in making rational decision in management problems.
3. To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
4. To introduce the basic concepts of classifications of design of experiments.
5. To gain knowledge in Quality Control.
6. To understand the concept of testing of hypothesis for small and large samples in real life.

OUTCOMES:

1. Understand the basic concepts of probability and one- and two-dimensional random variables have knowledge of standard distribution which can describe real life phenomenon.
2. The students know how to use the Sampling Theory in real life situations.
3. They can also formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data
4. Apply the concept of testing of hypothesis for small and large samples in real life problems**.**
5. To apply the basic concepts of classifications of design of experiments in the field of statistical methods.
6. Summarize the concept of testing of hypothesis for small and large samples in real life.

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.

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester I

19PMEWE1E01 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:

1. To understand the principle of various processes applicable to industrial wastewater treatment
2. To impart knowledge on the concept and application of Industrial pollution prevention, cleaner technologies, industrial wastewater treatment and residue management.
3. To identify the best applicable technologies for wastewater treatment from the perspective of yield production.
4. To audit and analyze environmental performance of industries to internal, external client, regulatory bodies and design water reuse management techniques
5. To conduct research to develop effective management systems for industrial wastewater that are technically sound, economically feasible and socially acceptable
6. To know about various pollutants which are from various processes in industries and its effects in our environment.

Course Outcomes:

1. Explain the source and types of industrial wastewater and their environmental impacts and choose the regulatory laws pertaining to environmental protection
2. Identify industrial wastewater pollution and implement pollution prevention, waste minimization in industries
3. Apply knowledge and skills to design industrial wastewater treatment schemes
4. Audit and analyze environmental performance of industries to internal, external client, regulatory bodies and design water reuse management techniques
5. Conduct research to develop effective management systems for industrial wastewater that are technically sound, economically feasible and socially acceptable
6. Know about various pollutants which are from various processes in industries and its effects in our environment.

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 – payback 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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester I

19PMEWE1E02 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:

1. To acquire the knowledge on problem associated with soil contamination
2. To know about safety disposal of waste and remediates the contaminated soils by different techniques to protect the environment.
3. To know about composition and properties of various types of soil.
4. To know about various ground improvement techniques.
5. To understand contaminant transport in soil and various remedial techniques.
6. To impart knowledge in soil pollution and its remedial measures.

Course Outcomes:

1. The student acquires the knowledge on problem associated with soil contamination
2. Know about composition and properties of various types of soil.
3. Know about safety disposal of waste and remediates the contaminated soils by different techniques to protect the environment.
4. Know about various ground improvement techniques.
5. Understand contaminant transport in soil and various remedial techniques.
6. Apply knowledge in soil pollution and its remedial measures.

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.

UNIT III CONTAMINATION AND TRANSPORT IN SOIL 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 vapor extraction - Soil washing – Solidification and Stabilization – Electro-kinetic remediation – Thermal desorption – Vitrification – In-situ and Ex-situ Bioremediation – Phytoremediation – Soil fracturing – Bio stimulation – 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

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

Course Objectives:

1. To understand the microbial process and its kinetics
2. To design and size the different components of conventional aerobic treatment systems.
3. To design and size the different components of advanced aerobic treatment systems.
4. To understand in detail about the anaerobic treatment of wastewater which includes the design of attached and suspended growth processes.
5. To design the different elements of sludge treatment systems and understand the importance O&M issues pertaining to biological treatment systems
6. To understand Principles of Aerobic and Anaerobic Treatment

Course Outcomes:

1. Understand the microbial process and its kinetics
2. Design and size the different components of conventional aerobic treatment systems.
3. Design and size the different components of advanced aerobic treatment systems.
4. Understand in detail about the anaerobic treatment of wastewater which includes the design of attached and suspended growth processes.
5. Design the different elements of sludge treatment systems and understand the importance O&M issues pertaining to biological treatment systems
6. Principles of Aerobic and Anaerobic Treatment

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, Sequencing Bat 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

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

Course Objectives:

1. To understand the Earth's Climate System
2. To know the concept of Global Warming, the impact of climate change on environment, adaptation and its mitigation measures.
3. To orient towards the global climate change and its impact on water resources.
4. To understand the climate change phenomenon
5. To analyze related issues on water, irrigation and its social implications.
6. To implement clean technology and energy

Course Outcomes:

1. Understand the Earth's Climate System
2. Know the concept of Global Warming, the impact of climate change on environment, adaptation and its mitigation measures.
3. Orient towards the global climate change and its impact on water resources.
4. Understand the climate change phenomenon
5. Analyze related issues on water, irrigation and its social implications.
6. Develop clean technology and energy

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.

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester I

19PMEWE111 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

1. Understand the impact of humans on environment and environment on humans
2. Be able to identify and value the effect of the pollutants on the environment: atmosphere, water and soil.
3. To select the most appropriate technique for the treatment of water, wastewater solid waste and contaminated air.
4. To plan strategies to control, reduce and monitor pollution.
5. To analyze the impact of humans on environment and environment on humans
6. To know the different designing elements in sewer systems.

Course Outcomes

1. Analyze the impact of humans on environment and environment on humans
2. Be able to examine the effect of the pollutants on the environment: atmosphere, water and soil.
3. Be able to plan strategies to control, reduce and monitor pollution.
4. Be able to select the most appropriate technique for the treatment of water, wastewater solid waste and contaminated air.
5. Be conversant with basic environmental legislation.
6. Able now the different designing elements in sewer systems.

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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester II

19PMEWE201 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:

1. To provide sufficient mathematical and physical background to formulate real life problems in hydraulic and environmental engineering structures
2. To design RCC and pre stressed pipes
3. To design all types of water tanks
4. To design spécial propose structures
5. To repair and rehabilitate hydraulic structures using various repair methods
6. To design structures used in water and sewerage works

Course Outcomes:

1. Understand sufficient mathematical and physical background to formulate real life problems in hydraulic and environmental engineering structures
2. Design RCC and pre stressed pipes
3. Design all types of water tanks
4. Design spécial propose structures
5. Repair and rehabilitate hydraulic structures using various repair methods
6. Design structures used in water and sewerage works

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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester II

19PMEWE202 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:

1. To study various types and sources of air pollution and its effects
2. To understand methods of source and ambient monitoring and dispersion of pollutants and their modeling
3. To understand the principles and design of control of particulate pollutants
4. To understand the principles and design of control of gaseous pollutant
5. To analyze the sources, effects and control of vehicular, indoor air and noise pollution
6. To impart knowledge on types and sources of air pollution, its effects and design of control methods

Course outcomes:

1. Understand various types and sources of air pollution and its effects
2. Know source and ambient monitoring and dispersion of pollutants and their modeling
3. Determine the principles and design of control of particulate pollutants
4. Determine the principles and design of control of gaseous pollutant
5. Analyze the sources, effects and control of vehicular, indoor air and noise pollution
6. Understand the types and sources of air pollution, its effects and design of control methods

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 – Radioactive 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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester II

19PMEWE2E01 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:

1. To educate the students in detailed design concepts related to water transmission mains, water distribution system and buried pipes with emphasis on computer application
2. To analyze the design of water distribution system and various nodes.
3. To Perform the network design of the pipes & flow analysis.
4. To assess the reliability and uncertainty of the design.
5. To study the pipe distribution software's and sewer design.
6. To get knowledge about the importance of storm water distribution.

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
3. The student can able to perform the network design of the pipes & flow analysis.
4. Educate the students in detailed design concepts related to water transmission mains, water distribution system and buried pipes with emphasis on computer application.
5. The student can assess the reliability and uncertainty of the design.
6. They can able to know the importance of storm water distribution.

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 drains 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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester II

19PMEWE2E02 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:

1. Students will be exposed to ground water, hydraulics of ground water related to drainage, drainage concepts, planning, design and management of drainage related work.

2. 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.
3. To Understand the interaction among various processes in the Combined irrigation and drainage systems.
4. To Apply the application of drainage system and its design.
5. To study the design procedures for drainage system and its management.
6. To get knowledge about the salt balance of the root zone.

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.
3. The students can able to apply the usage of drainage system and its design.
4. They can have more knowledge about the irrigation practice.
5. They can design the drainage system without others help.
6. They can get information about the irrigation and drainage system.

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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester II

19PMEWE2E03 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:

1. 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.
2. To Understand the impact of humans on environment and environment on humans.

3. To be able to identify and value the effect of the sanitation on the environment.
4. To select the most appropriate technique for the treatment of water, wastewater solid waste and contaminated air.
5. To plan strategies to control, reduce the effect and monitor ponds.
6. To know the different designing elements in sewer systems

Course Outcomes:

1. Analyze the impact of humans on environment and treating by disinfection method.
2. Be able to plan strategies to control, reduce and monitor filters.
3. Be able to select the most appropriate technique for the treatment of water, wastewater solid waste and contaminated air.
4. Be conversant with basic environmental legislation.
5. Able now the different designing elements in sewer systems.
6. Have knowledge about the pollution and its control.

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 specific 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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester II

19PMEWE2E04 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:

1. 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.
2. The student acquires the knowledge about the principles, its Data Processing and applications of remote sensing and GIS in environmental management.
3. To identify and define the main morphological and geological characteristics as shown on maps and data structures.
4. Analyze geological parameters important in geotechnical studies by using remote sensing
5. To establish and describe topographical and geological sections by GIS Concepts.
6. To collect, analyze, and report geologic data using standards in engineering practice

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 Decision making
4. Potential of remote sensing and GIS is solving problems in water resources through case studies.
5. To get knowledge about the principles, its Data Processing and applications of remote sensing and GIS in environmental management.
6. To identify and define the main morphological and geological characteristics as shown on maps and data structures.

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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester II

19PMEWE2E05 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:

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

3. To design about the river hydraulics, Boundary conditions and back waters.
4. To do mapping and measurement of discharge surveys and models.
5. To manage the river training and regulation works.
6. To study the Rivers of India, Himalaya and Peninsular regions.

Course Outcomes:

At the end of this course the students

1. The student will understand theoretical concepts of water and sediment movements in rivers
2. They will inculcate the benefits of fluvial system to the society.
3. Design about the river hydraulics, Boundary conditions and back waters.
4. They can able to do mapping and measurement of discharge surveys and models.
5. Manage the river training and regulation works, Flood plain management.
6. Analyses the River mechanics, surveys, models and river maintenance.

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 efficient – Boundary conditions and back waters – Transitions – Rating Curve – Unsteady flow in rivers: Propagative of surface waves – Characteristics, flood waves – kinematic 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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester II

19PMEWE211 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:

1. To estimate index properties of soils (coarse and fine).
2. To estimate shear strength of soils by direct shear test, triaxial shear test, vane shear test & unconfined compressive test.
3. To estimate the engineering properties of the soils by density test, CBR test permeability test

and consolidation test.

4. To Perform laboratory experiments to estimate various Atterberg limits and evaluate index properties of soils
5. To determine the permeability of soils through various laboratory and field tests;
6. To perform laboratory test to determine the maximum dry density and optimum moisture content of the soil

Course Outcomes:

On completion of the course, the students will be able to:

1. Classify soil by physical observation of the soils.
2. Classify soil based on estimated index and engineering characteristics of soils.
3. Carry out interpolation among the estimated soil design parameters.
4. Prepare a soil investigation report based on borehole log data and various in-situ tests like SPT, CPT, etc.
5. Estimate various Atterberg limits and evaluate index properties of soils
6. Get familiar with the various test available for determining the permeability of soil.

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 (PT) 2019-2020

Semester III

19PMEWE301 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:

1. This subject is enabling the student to develop environmentally sound solutions to geotechnical problems
2. To solve environmental engineering problems unique to several soil and subsurface conditions.
3. To understand soil water environment interaction relating to geotechnical problems.

4. To study the effect of pollution on soil water behavior- Sources, production and classification of wastes.
5. To implement Ground modification techniques and remediation technology
6. To give solution for environmental related problems

Course Outcomes:

At the end of course students able to know about

1. Environmentally sound solutions to geotechnical problems
2. Environmental engineering problems unique to several soil and subsurface conditions.
3. Soil water environment interaction relating to geotechnical problems.
4. Effect of pollution on soil water behavior- Sources, production and classification of wastes.
5. Ground modification techniques and Remediation technology
6. Solution for environmental related problems

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 behavior-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.

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester III

19PMEWE302 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:

1. To formulate research problem
2. To carry out research analysis
3. To follow research ethics
4. To understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
5. To understand about IPR and filing patents in R & D.

6. To analyze research related information

Course Outcomes:

1. Ability to formulate research problem
2. Ability to carry out research analysis
3. Ability to follow research ethics
4. Ability to understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
5. Ability to understand about IPR and filing patents in R & D.
6. Analyze research related information

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 approach, 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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester III

19PMEWE3E01 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:

1. To understand need for environmental clearance, its legal procedure, need of EIA, its types, stakeholders and their roles
2. To understand various impact identification methodologies, prediction techniques and model of impacts on various environments
3. To understand relationship between social impacts and change in community due to development activities and rehabilitation methods

4. To document the EIA findings and prepare environmental management and monitoring plan
5. To identify, predict and assess impacts of similar projects based on case studies
6. To understand the need and methodology adopted for environmental impact assessment

Course Outcomes:

1. Understand need for environmental clearance, its legal procedure, need of EIA, its types, stakeholders and their roles
2. Understand various impact identification methodologies, prediction techniques and model of impacts on various environments
3. Understand relationship between social impacts and change in community due to development activities and rehabilitation methods
4. Document the EIA findings and prepare environmental management and monitoring plan
5. Identify, predict and assess impacts of similar projects based on case studies
6. Understand the need and methodology adopted for environmental impact assessment

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 – Eco restoration – 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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester III

19PMEWE3E02 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:

1. This subject is enabling the student to educate the various instrumental methods of monitoring the quality of air, water, soil and its parameters.
2. To analyze the quality and control and its assurance.
3. To study about the various spectroscopic methods such as fluorimetry, nephelometry and turbidimetry.
4. To get knowledge about the electro and radio analytical methods.
5. To assess the Principles, techniques and applications of NDIR analyzer for Continuous monitoring systems.

6. To study about the various Chromatographic methods such as Column, Paper and thin layer chromatography

Course Outcomes:

At the end of this course the students will understand

1. Use Spectroscopic Method, Chromatographic Method, Electro and Radio Analytical Methods in environmental quality monitoring.
2. Analyze the quality and control and its assurance.
3. The students can able to study about the various spectroscopic methods such as fluorimetry, nephelometry and turbidimetry.
4. They can assess the Principles, techniques and applications of NDIR analyzer for Continuous monitoring systems.
5. Study about the various Chromatographic methods such as Column, Paper and thin layer chromatography
6. They can get knowledge about the electro and radio analytical methods.

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.
7. Marcel Dekker, Paul R. Loconto(MAY2005). Trace Environmental Quantitative Analysis: Principles, Techniques, and Applications**.**
8. 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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester III

19PMEWE3E03 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:

1. This subject is enabling the student to educate the various environmental health hazards and safety methods in industries.
2. This subject serves as a synopsis of the three majors environmental, health, and safety (EHS) disciplines.
3. They can able to fit and work together within the organizational structure of a facility.
4. Provide a safe place of employment. provide a safe working environment.
5. Provide a written safety policy/risk assessment. look after the health and safety of others.

6. Will assist you in identifying safety and occupational health issues, and any environmental aspects.

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.
3. Providing a safe place of employment and safe working environment.
4. Assist students in identifying safety and occupational health issues, and any environmental aspects.
5. Able to know the procedures and precautionary measures necessary when handling hazardous substances.
6. To know about the factors to be considered in the development of effective training programmes.

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 organization 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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester III

19PMEWE3E04 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:

1. To apply the knowledge of fluid mechanics to analyze and predict mixing in natural bodies of water.
2. To study the hydrodynamic aspects of water quality management in natural bodies of water.
3. Apply the application of fluid mechanics and use of computers in solving a host of problems in environment hydraulic engineering.
4. Study types and classes of hydraulic simulation models and design procedures for safe and effective passage of flood flows for design of hydraulic structures
5. To cover the fundamental relationship for flow and transport.
6. To study about the reservoir classification and external energy sources.

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.
3. Solve the Derivation of different types of diffusion equations.
4. Study the transport processes in lakes and reservoirs.
5. To get more knowledge about the transport processes in the estuaries.
6. Calculate the Systems and Control Volume approach

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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester III

19PMEWE311 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:

1. 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.
2. To know the importance of remote sensing and GIS in solving the spatial problems in water resources.
3. To expertise in digital image processing
4. To gain good exposure to the Global positioning system in real time data processing
5. To know the potential of Geographical Information System
6. To use Data integration between Satellite data, GPS and GIS in Decision Making

Course Outcomes

1. The principles and applications of remote sensing, GPS and GIS in the context of water resources.
2. The importance of remote sensing and GIS in solving the spatial problems in water resources.
3. Expertise in digital image processing
4. Good exposure to the Global positioning system in real time data processing
5. Potential of Geographical Information System
6. 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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester IV

19PMEWE4E01 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:

1. To gain a brief knowledge on different hazardous waste and its disposal methods.
2. To provide students with the necessary background and knowledge about the various sources.
3. To know the on-site/off-site processing of the Solid waste management and the disposal methods.
4. To characterize the waste and its sources with various test available for checking the quality.
5. To know the different methods available for storage and collection of municipal solid wastes.
6. To gain the knowledge of processing and conversion technologies.

Course Outcomes:

1. Brief knowledge on different hazardous waste and its disposal methods.
2. The necessary background and knowledge about the various sources.

3. The on-site/off-site processing of the Solid waste management and the disposal methods.
4. Characterize the waste and its sources with various test available for checking the quality.
5. Different methods available for storage and collection of municipal solid wastes.
6. Processing and conversion technologies used in solid and hazardous waste technologies.

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.

Total Hours:45

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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester IV

19PMEWE4E02 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:

1. To gain the knowledge of management models to estimate the groundwater quantity and qualities.
2. To understand the inputs, system parameters, policy, variables and outputs of a groundwater management models.
3. To know the different methods available for investigation of groundwater.
4. To gain the knowledge of groundwater flow model.
5. To gain the conceptual model design.
6. To analyses the Groundwater contamination, restoration and management methods.

Course Outcomes:

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

2. The knowledge of management models to estimate the groundwater quantity and qualities.
3. Understand the inputs, system parameters, policy, variables and outputs of a groundwater management models.
4. The different methods available for investigation of groundwater.
5. The knowledge of groundwater flow model.
6. Analyses the Groundwater contamination, restoration and management methods.

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 dispersity – 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.Charbenea (2006). 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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester IV

19PMEWE4E03 LANDFILL ENGINEERING AND REMEDIATION TECHNOLOGY

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:

1. This course enables the students to know about landfill and remediation technologies in detail.
2. To know the different Waste management Hierarchy.
3. To study about the different landfill liners and cover systems.
4. To know in detail about the hydrologic Evaluation of Landfill Performance (HELP) model.
5. To understand about the landfill management.
6. To know the relevant regulations and engineering design requirements of landfills and contaminated site remediation

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
2. Enables the students to know about landfill and remediation technologies in detail.
3. Know The different Waste management Hierarchy.
4. Study about the different landfill liners and cover systems.
5. The knowledge of hydrologic Evaluation of Landfill Performance (HELP) model.
6. Understand about the landfill management.

UNIT I LANDFILL BASICS 9

Waste management Hierarchy- Need for landfills –Environmental Protection by Landfills- Landfill Classification – Sanitary and Secure Landfills - Components and Configuration – 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 flow advection-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 Operational 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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester IV

19PMEWE4E04 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:

1. These courses are introduced to the students to understand the basic concept of mathematical modelling
2. To know about the process simulation techniques of environmental disturbances with reference to air, water and groundwater domains.
3. To know about modeling concept and transport phenomena.
4. To understand water quality and air pollution modeling
5. To understand the transport of air Pollutants in environment.
6. To gain the knowledge of software in air quality measurement.

Course Outcomes:

At the end of this course students

1. Understand the basic concept of mathematical modelling
2. Know about the process simulation techniques of environmental disturbances with reference to air, water and groundwater domains.
3. Concept of modeling concept and transport phenomena.
4. Understand water quality and air pollution modeling
5. Understand the transport of air Pollutants in environment.
6. Knowledge of software in air quality measurement.

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.

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester IV

19PMEWE4E05 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:

1. 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.
2. To know the different methods of design flood estimation and perform channel reservoir routing.
3. To carryout flood inundation modeling and suggest suitable flood control measures.
4. To acquire the knowledge about different types of drought and their impacts.
5. To assess the severity, duration and frequency of drought using drought using drought indices.
6. To exposed to various approaches, measures and case studies of drought indices.

Course Outcomes

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

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 Ram prasad 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.

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester IV

19PMEWE4E06 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:

1. To expose the students to the need and importance of the rehabilitation
2. To learn modernization of irrigation systems
3. To train them in the related concepts and methods.
4. To Diagnostic analysis of flow, seepage and other parameters
5. To study about various projects and implementation
6. To analyze Distinction between rehabilitation and modernization

Course Outcomes

1. The students will be familiar in understanding the different types of maintenance problems with respect to technical and social aspects,
2. Students can overcome these problems by rehabilitation and modernization methods.
3. The students will get an overall exposure to different types of irrigation system

4. Know the maintenance issues
5. Solve issues for improving their performance based on service-oriented approach.
6. Plan Distinction between rehabilitation and modernization

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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester IV

19PMEWE4E07 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:

1. To provide the technical, economical and sociological understanding of a watershed.
2. To provide a comprehensive discourse on the engineering practices of watershed management for realizing the higher benefits of watershed management.
3. To solve erosion, water and wind erosion problems
4. To examine Soil Conservation Measures: Agronomical and Mechanical
5. To Design of Small Water Harvesting Structures
6. To Evaluate of Watershed Management

Course Outcomes

1. The students will be able to apply the knowledge of overall concepts of watershed
2. Students can analyze for better management.
3. Deduct comprehensive discourse on the engineering practices
4. Assess watershed management for realizing the higher benefits of watershed management.
5. Evaluate the Design of Small Water Harvesting Structures.

6. Importance of Soil Conservation Measures: Agronomical and Mechanical

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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester IV

19PMEWE4E08 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
- To study socio-economics play in management of urban water resources management.
- They will be exposed to global food security and public-private participation issues
- To impact Legal and regulatory settings, in the context of UWRM
- To compare Management models for flow rate and volume control rate
- To take part in approaches to operations and maintenance

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
3. The student is exposed to use the urban storm water models for better storm water management.
4. Judge different types of operation and maintenance.

5. Discover global food security and public-private participation issues.
6. Construct in approaches to operations 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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester IV

19PMEWE4E09 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:

1. The student is exposed to the design aspects of hydro-power plants,
2. To inference various components of hydropower plants and their layout.
3. To develop Different types of dam design taking into account the suitability of the site
4. To recall different type loads that are likely to be encountered.
5. To study Dam safety and instrumentation.
6. To discuss Settlement and deformation

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,
3. Take part in Different types of dam design and the different type loads that are likely to be encountered
4. They can predict different type loads that are likely to be encountered.

5. Rule on Dam safety and instrumentation.
6. Modify different Settlement and deformation

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
2. www.civil.ubc.ca

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester IV

19PMEWE4E010 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
- To study laboratory investigations using model studies.
- To relate Statistics analysis of grouped wave data
- To show Field measurement; models, groins, sea walls, offshore breakwaters, artificial nourishment
- To prove Physical modeling in Coastal Engineering

Course Outcomes

1. Students will understand coastal engineering aspects of harbors methods
2. Analyze navigation, shoreline protection
3. Students can adapt laboratory investigations using model studies and to use the skills and techniques in ICM.
4. Decide students to understand the fundamental ocean wave theories

5. The students can formulate protect harbors and improve navigation with the techniques required to analysis the wave
6. To test 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
3. www.wikipedia.com

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester IV

19PMEWE411 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:

1. To implement the methods using the spread sheet in Excel
2. To find Roots of non-linear equations by Bisection method and Newton's method.
3. To do curve fitting by least square approximations
4. To Solve the system of Linear Equations using Gauss - Elimination/ Gauss - Seidal Iteration/ Gauss - Jorden Method.
5. To integrate Numerically Using Trapezoidal and Simpson's Rules.
6. To find Numerical Solution of Ordinary Differential Equations by Euler's Method, Runge-Kutta Method.

Course Outcomes

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

1. Implement the methods using the spread sheet in Excel
2. Find Roots of non-linear equations by Bisection method and Newton's method.
7. Do curve fitting by least square approximations

8. Solve the system of Linear Equations using Gauss - Elimination/ Gauss - Seidal Iteration/ Gauss - Jorden Method.
9. To Integrate Numerically Using Trapezoidal and Simpson's Rules.
10. To Find Numerical Solution of Ordinary Differential Equations by Euler's Method, Runge-Kutta Method.

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 by Runge- 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.

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

Semester IV

19PMEWE412 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:

1. To Identify structural engineering problems reviewing available literature.
2. To study different techniques used to analyze complex structural systems.
3. To work on the solutions given and present solution by using his/her technique applying engineering principles.
4. To work individually on a project involving theoretical and experimental studies related to Civil Engineering.
5. To produce a comprehensive report covering background information, literature Survey, problem statement, Project work details and conclusions.
6. To utilize the creative ability and inference capability.

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.
4. Work individually on a project involving theoretical and experimental studies related to Civil Engineering.
5. Produce a comprehensive report covering background information, literature Survey, problem statement, Project work details and conclusions.
6. Utilize the creative ability and inference capability.

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 of Mini Project at Mid Sem and End Sem will be monitored by the departmental committee.

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

OPEN ELECTIVES **Semester V**

19PMEWEOE01 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:

1. To understand the basics of business analytics and its life cycle.
2. To gain knowledge about fundamental business analytics.
3. To learn modeling for uncertainty and statistical inference.
4. To understand analytics using Hadoop and Map Reduce frameworks.
5. To acquire insight on other analytical frameworks.
6. To Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Course Outcomes

On completion of the course, the student will be able to

1. Identify the real-world business problems and model with analytical solutions.
2. Solve analytical problem with relevant mathematics background knowledge.
3. Convert any real-world decision-making problem to hypothesis and apply suitable statistical testing.

4. Write and Demonstrate simple applications involving analytics using Hadoop and MapReduce
5. Use open-source frameworks for modeling and storing data.
6. Apply suitable visualization technique using R for visualizing voluminous data.

UNIT I BUSINESS ANALYTICS 9

Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, 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 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.

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OPEN ELECTIVES **Semester V**

19PMEWEOE02 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:

1. Summarize basics of industrial safety
2. Describe fundamentals of maintenance engineering
3. Explain wear and corrosion
4. Illustrate fault tracing
5. Identify preventive and periodic maintenance
6. To get fundamental knowledge on safe storage of chemicals.

Course Outcomes

1. Ability to summarize basics of industrial safety
2. Ability to describe fundamentals of maintenance engineering
3. Ability to explain wear and corrosion
4. Ability to illustrate fault tracing
5. Ability to identify preventive and periodic maintenance

6. Students would be able to create safe storage systems

UNIT I: INDUSTRIAL SAFETY: 9

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: 9

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: 9

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: 9

Fault tracing-concept and importance, decision tree concept, 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: 9

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

Total Hours:45

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 V**

19PMEWEOE03 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:

1. Solve linear programming problem and solve using graphical method.
2. Solve LPP using simplex method
3. Solve transportation, assignment problems
4. Solve project management problems
5. Solve scheduling problems
6. Model formulation and applications that are used in solving business decision problems.

Course Outcomes

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

1. Formulate linear programming problem and solve using graphical method.
2. Solve LPP using simplex method
3. Formulate and solve transportation, assignment problems
4. Solve project management problems
5. Solve scheduling problems

6. 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:

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

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

OPEN ELECTIVES Semester V

19PMEWEOE04 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:

1. Summarize the costing concepts and their role in decision making
2. Infer the project management concepts and their various aspects in selection
3. Interpret costing concepts with project execution
4. Develop knowledge of costing techniques in service sector and various budgetary control techniques
5. Illustrate with quantitative techniques in cost management
6. The course focuses on the early project phases, including examples from technical projects

Course Outcomes

1. Understand the costing concepts and their role in decision making
2. Understand the project management concepts and their various aspects in selection 57
3. Interpret costing concepts with project execution
4. Gain knowledge of costing techniques in service sector and various budgetary control techniques

5. Become familiar with quantitative techniques in cost management
6. Create project execution plan, either in a team effort or on individual basis.

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 centers, 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.

ME – WATER RESOURCES AND ENVIRONMENTAL ENGINEERING (PT) 2019-2020

OPEN ELECTIVES **Semester V**

19PMEWEOE05 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:

1. Summarize the characteristics of composite materials and effect of reinforcement in composite materials.
2. Identify the various reinforcements used in composite materials.
3. Compare the manufacturing process of metal matrix composites.
4. Understand the manufacturing processes of polymer matrix composites.
5. Analyze the strength of composite materials.
6. To understand the basic theory and applications of modern composite materials.

Course Outcomes

1. Know the characteristics of composite materials and effect of reinforcement in composite materials.
2. Know the various reinforcements used in composite materials.
3. Understand the manufacturing processes of metal matrix composites.

4. Understand the manufacturing processes of polymer matrix composites.
5. Analyze the strength of composite materials.
6. Understand the basic theory and applications of modern composite materials.

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.

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OPEN ELECTIVES **Semester V**

19PMEWEOE06 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:

1. Interpret the various types of wastes from which energy can be generated
2. Develop knowledge on biomass pyrolysis process and its applications
3. Develop knowledge on various types of biomass gasifiers and their operations
4. Invent knowledge on biomass combustors and its applications on generating energy
5. Summarize the principles of bio-energy systems and their features
6. Provide information on various methods of waste management.

Course Outcomes

1. Understand the various types of wastes from which energy can be generated
2. Gain knowledge on biomass pyrolysis process and its applications
3. Develop knowledge on various types of biomass gasifiers and their operations
4. Gain knowledge on biomass combustors and its applications on generating energy
5. Understand the principles of bio-energy systems and their features
6. Understand waste characterization, Segregation, Disposal etc will be made known

UNIT I INTRODUCTION OF 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.

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OPEN ELECTIVE

19PMEWEOE07 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:

1. To define the groundwater system, types of aquifers and aquifer parameters
2. To apply the knowledge of groundwater basics to study the groundwater movement and its potential for confined and unconfined aquifers.
3. To explain the details of steady and unsteady flow characteristics in well hydraulics
4. To adopt design concept for various wells in different hydrogeological formations and to construct the wells for different purposes
5. To apply the creative and advance techniques in groundwater model development for management of groundwater resources.
6. To evaluate the aquifer parameters and groundwater resources for different hydro-geological boundary conditions.

Course Outcomes:

1. Define the groundwater system, types of aquifers and aquifer parameters

2. Apply the knowledge of groundwater basics to study the groundwater movement and its potential for confined and unconfined aquifers.
3. Explain the details of steady and unsteady flow characteristics in well hydraulics
4. Adopt design concept for various wells in different hydrogeological formations and to construct the wells for different purposes
5. Apply the creative and advance techniques in groundwater model development for management of groundwater resources.
6. Evaluate the aquifer parameters and groundwater resources for different hydro-geological boundary conditions.

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 hydro science, 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

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OPEN ELECTIVES **Semester V**

19PMEWEOE08 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

1. To gain the knowledge about environmental aspects of energy utilization.
2. To understand the basic principles of wind energy conversion, solar cells, photovoltaic conversion.
3. To study about solar energy collectors and its storages
4. To study about the inter connected system in wind power
5. To understand the basic principles fuel cell, Geo thermal power plants.
6. To gain the knowledge about hydro energy.

Course Outcomes

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

1. Analyze the Energy Scenario in India
2. Understand the concept of Solar Energy
3. Understand the concept of Wind Energy
4. Understand the concept of Hydro Energy

5. Analyze the different energy sources
6. Students gathered the real time inter connected system modelling in wind power

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 vermiculture Potentials 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 – Environmental impacts 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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Semester V

19PMEWE591 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 OBJECTIVESS:

To impart knowledge on

1. Developing analytical skills of the students to address any specific structural related problems.
2. Select suitable experimental method to solve the structural engineering problems.
3. Execution of the project using suitable techniques
4. On completion of the project work students will be in a position to take up any research and challenging practical problem for finding better solutions.
5. To take up any research and challenging practical problem for finding better solutions.
6. To provide a clear idea of his/her area of work and they are in a position to carry out the work in a systematic way.

COURSE OUTCOMES:

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

1. Identify the problem by analyzing the gap through literature survey
2. Conduct the experimental work to solve structural engineering problems
3. Validate the experimental results using simulation models
4. Write a technical report related to selected topic
5. Present outcome of the study with the help of ppt.
6. Manage any type of design and construction projects.

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.

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Semester VI

19PMEWE691 PROJECT WORK – PHASE –II 32H:16C

Instruction Hours/ Week: L:0 T:0 P:32 Marks: Internal–120, External–180; Total-300

End Sem. Exam–3 Hrs

COURSE OBJECTIVESS:

To impart knowledge on

1. Developing analytical skills of the students to address any specific structural related problems.
2. Select suitable experimental method to solve the structural engineering problems.
3. Execution of the project using suitable techniques
4. On completion of the project work students will be in a position to take up any research and challenging practical problem for finding better solutions.
5. To take up any research and challenging practical problem for finding better solutions.
6. To provide a clear idea of his/her area of work and they are in a position to carry out the work in a systematic way.

COURSE OUTCOMES:

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

1. Identify the problem by analyzing the gap through literature survey
2. Conduct the experimental work to solve structural engineering problems
3. Validate the experimental results using simulation models
4. Write a technical report related to selected topic
5. Present outcome of the study with the help of ppt.
6. 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.