Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

Curriculum for

M. TECH

Water Resource and Environmental Engineering

Department of Civil Engineering

VISION:

- Excellence in Civil Engineering Education

MISSION:

- Make competent Civil Engineers with high level of professional, moral and ethical values.
- Attain highest standards in theoretical as well as practical knowledge and skill set.
- Establish Centre of Excellence in major areas of Civil Engineering to respond to the current and future needs of the industry, higher studies as well as research.

BansilalRamnathAgarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

Department of Civil Engineering

Structure for Final Year M. Tech. Civil Engineering with effect from academic year 2017 – 2018

F.Y. M. Tech- Semester - I											
Sr. No	Course Code	Course	Teaching Scheme		Examination Scheme					Total	Credits
			L	P	ISE		CE	ESE	PR/OR		
					T1	T2					
1	CVPA11171	Advanced Fluid Mechanics	4	-	15	15	20	50	-	100	4
2	CVPA11172	Environmental Chemistry & Microbiology	4	-	15	15	20	50	-	100	4
3	CVPA11173	Research Methodology	4	-	15	15	20	50	-	100	4
4	CVPA11174	Elective I (Program Specific)	4	2	15	15	20	50	50	150	5
5	CVPA11175	Elective II (Department)	4	-	15	15	20	50	-	100	4
6	CVPA11176	Seminar I	-	2	-	-	-	-	50	50	1
7	CVPA11177	Lab practice I	-	6	-		-	-	50	50	3
		Total	20	10	75	75	100	250	150	650	25

Elective I- Planning and management of water resource/ Air pollution and control /Dam Engineering / Remote sensing and GIS

Elective II- Optimization Techniques / Finite Element Analysis

BOS Chairman

Dean Academics

Director

BansilalRamnathAgarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

Department of Civil Engineering

F.Y. M. Tech- Semester - II											
Sr. No	Course Code	Course	Teaching Scheme		Examination Scheme					Total	Credits
			L	P	ISE		CE	ESE	PR/OR		
					T1	T2					
1	CVPA12171	Open Channel Hydraulics	4	-	15	15	20	50	-	100	4
2	CVPA12172	Advanced Water and Waste Water Treatment	4	-	15	15	20	50	-	100	4
3	CVPA12173	Hydrology	4	-	15	15	20	50	-	100	4
4	CVPA12174	Elective III (Program Specific)	4	-	15	15	20	50	-	100	4
5	CVPA12175	Elective IV (Program Specific)	4	-	15	15	20	50	-	100	4
6	CVPA12176	Seminar II	-	2	-	-	-	-	50	50	1
7	CVPA12177	Intellectual Property Rights	1	-	25	25	-	-	-	50	1
	CVPA12178	Lab practice II	-	6	-	-	-	-	50	50	3
9	CVPA12179	AUDIT Course									
		Total	21	8	75	100	100	250	100	650	25

Elective III – Wave Mechanics/ Irrigation &Drainage Engineering / Basics of climate change studies / Design of hydraulic structures.

Elective IV- Solid and Harazadous waste Treatment / Advanced water treatment / Industrial waste water treatment/ Environmental Impact Assessment and Management

BOS Chairman

Dean Academics

Director

S.Y. M. Tech- Semester - I											
Sr. No	Course Code	Course	Teaching Scheme		Examination Scheme					Total	Credits
			L	P	ISE		CE	ESE	PR/OR		
					T1	T2					
1	CVPA21171A	Open Elective (Institute)	3	-	15	15	20	-	-	50	3
2	CVPA21171B	Foreign Language	2	-	15	15	20	-	-	50	2
3	CVPA21172	Internship/Value added course/In-house Project	-	8	-	-	100	-	100	200	8
3	CVPA21173	Project Stage I	-	12	-	-	100	-	100	200	12
		Total	5	20	30	30	240	-	200	500	25
Open Elective: Project Management/ Non Destructive Techniques and Engineering Diagnosis											

S.Y. M. Tech- Semester - II										
Sr. No	Course Code	Course	Teaching Scheme		Examination Scheme				Total	Credits
			L	P	ISE	CE	ESE	OR		
1	CVPA22171	Project Stage II	-	25	-	100	-	100	200	25
		Total	-	25	-	100	-	100	200	25

BOS Chairman Dean Academics Director

M.TECH FIRST YEAR - SEMESTER I

Advanced Fluid Mechanics

Teaching Scheme
Credits: 4
Lectures: 4Hrs/week
Laboratory Work: NA

Examination Scheme
In Sem Assessment: 50 Marks
End Sem Assessment: 50 Marks
Total Marks:100

Prerequisite: Fluid Mechanics at UG level including Kinematics, Dynamics, laminar and turbulent flow, differential and integral Calculus

Course Objectives:

1. To impart knowledge of kinematics to solve problems of fluid mechanics (other than UG level)
2. To introduce students to Navier Stokes equations and their exact solutions
3. To impart knowledge of boundary level development and determining its thickness to students
4. To introduce students to Reynolds equations of motion and their solutions
5. To introduce students to compressible flow and its applications in fluid flow mechanics

Course Outcomes:

By the end of the course,

1. Students should be able to solve problems related to motion of fluid particles using principles of Kinematics.
2. Students should be able to extend the principles of kinematics for flow patterns and different techniques.
3. Students should be able to derive equations of motion using principles of dynamics and apply Navier Stokes equations for solving laminar flow problems
4. Students should be able to extend the solution of NS equation for Boundary flow and calculate the boundary thickness using various methods.
5. Students should be able to derive Reynolds equation of motion for turbulent flow and solve them for some typical cases
6. Students should be able to derive and apply principles of compressibility for various cases.

Unit 1: Kinematics I (6 Hrs.)

Revision of concepts in basic Fluid Mechanics such as classification of flows, Equation of continuity for three dimensional flow in Cartesian co-ordinates, equation of continuity for one-dimensional flow along a streamline, types of motion, rotational and irrotational motion velocity potential, stream function and flow net

Unit 2: Kinematics II: (6 Hrs.)

Continuity Equation in polar and cylindrical coordinates, solving Laplace equation by graphical method, conformal mapping. Standard two dimensional flow pattern, source, sink, doublet and their combination

Unit 3: Laminar Flow:(6 Hrs)

Euler's equation of motion along a streamline and its integration, Bernoulli's equation. Derivation of Navier Stokes' equations, solution of NS equations for flow between parallel plates –a) both plates stationary b) one plate moving , derivation of Hagen Poiseuille's equation using NS equations

Unit 4: Boundary Layer Theory: (6 Hrs)

Development of boundary layer on a flat plate nominal, displacement, momentum, energy thicknesses, laminar, transitional and turbulent boundary layer, laminar sub layer, Local and mean drag coefficients, Karman's momentum integral equation, Karman Pohelhausen's solution, boundary layer separation

Unit 5: Turbulent Flow: (6 Hrs)

Reynolds' equation of motion, typical solution, Energy and Momentum equation, Statistical theory of turbulence, Isotropic and homogeneous turbulence, probability density function

Unit 6: Fundamentals of Compressible Flow: (6 Hrs.)

Compressible fluid flow-fundamental equation, continuity equation, energy equation, velocity of propagation, Pressure, density and temperature in terms of Mach number, Normal shock in one dimensional compressible flow and compressible flow around immersed bodies

Text books:

1. Hydraulics and Fluid Mechanics by P. N. Modi and S. N. Seth Standard book house
2. Fluid Mechanics and Hydraulic Machines – SukumarPati, Tata McGraw-Hill
3. Introduction to fluid Mehanics and fluid machines – S.K.Som, GautamBiswas , SumanChakraborty - McGraw-Hill – 2013 ed.

Reference books:

1. Fluid Mechanics by Streeter, Wylie and Bedford – Tata McGraw Hill
2. Fluid Mechanics by White – Mc-Graw Hill
3. Fluid Mechanics-Fundamentals and Applications- Cengel and Cimbala, McGraw- Hill
4. Fluid Mechanics and Machinery – C.S.P Oza, R.Berndtsson, P.N.Chandramouli- Oxford University Press

Environmental Chemistry and Microbiology

Teaching Scheme
Credits: 4
Lectures: 4Hrs/week
Laboratory Work: NA

Examination Scheme
In Sem Assessment: 50 Marks
End Sem Assessment: 50 Marks

Prerequisite: Environmental Engineering I & II at UG level

Course Objectives:

1) To impart knowledge of various aspects of chemistry in environmental engineering.
2) To develop understanding of role of micro-organisms and their activities of environmental significance.

Course Outcomes:

By the end of the course,

1) Students would understand the Environmental Chemistry and its application on Environmental Engineering
2) Students would understand the role and importance of microorganism in water and wastewater treatment.

Unit 1: General and Physical Chemistry (6 Hrs.)

Theory of valence, oxidation numbers, oxidation reduction reactions, Dissociation constant, Solubility and solubility product constant, Reversible Reaction, Law of mass action,stochimetry, Gas Laws. Colloidal chemistry, Amphoteric hydroxides, chemical equilibrium and ways of shifting it, Fundamentals of chemical kinetics.

Unit 2: Chemistry of Pollutants in Atmosphere (6 Hrs.)

Sources and Chemical composition of solid, liquid, gaseous and radioactive pollutants inatmosphere; photochemical and chemical reactions in the atmosphere; Effect of temperature, solar radiation, wind currant, and rain scrubbing on the various pollutants; chemistry of greenhouse gases and ozone layer depletion; gaseous transformations in the atmosphere and removal mechanisms; photochemical smog.

Unit 3: Process Chemistry for Water and Wastewater Treatment (6 Hrs.)

Basic Principles: Thermodynamic equilibrium; Acid Base Equilibria: Alkalinity and acidity, Buffering in water system; Solubility Equilibria; **Water stabilization:** Corrosion, Langelier saturation Index; Equilibria governing iron and manganese solubility; Oxidation Reduction Equilibria; Application of redox chemistry; **Fundamentals of process kinetics:** Reaction rates and order, Reactor design; Fundamentals of surface and colloidal chemistry; Adsorption – physical versus chemical adsorption, factors influencing adsorption, Adsorption isotherms, Design of adsorption column.

Unit 4: Chemistry of Various Organic and Inorganic Compounds (6 Hrs.)

Monitoring techniques and toxic effects of organic compounds such asPhenols, Pesticides, Surfactants, Tannin, Lignin and Hydrocarbons; Environmental toxicity and analysis: Principles of toxicity and standards, Analysis of Chromium, Cobalt, Manganese, Nickel, Copper, Mercury, Arsenic and Organometallic compounds.

Unit 5: Microbiological and Bio kinetics (6 Hrs.)

Bacteria: classification and characteristics of bacteria, cell morphology, growth rate curve, culture, metabolism – basic metabolic models, microbial growth kinetics; Bio kinetic coefficients, determination of bio kinetic coefficient, application of bio kinetic constant in ASP, Trickling filter, Lagoon , Oxidation ponds, UASB, Anoxic treatment, anaerobic digester, septic tank.

Unit 6: Microorganisms in Environmental Engineering (6 Hrs.)

Microbial characteristics of water and wastewater, Microbial examination of water and wastewater, MPN, Heterotrophic Plate Count (HPC) and Membrane filtration techniques. Algae: classification, symbiosis, factors affecting algal growth, control of algae, fungi, moulds, protozoa, population dynamics, role of microbes, substrate utilization in biological waste treatment, significance of F/M ratio, acclimatization of bacteria, bioassay tests, aerobic and aerobic metabolism. Structure of prokaryotic and eukaryotic cells.

Text books:

1) Chemistry for Environmental Engineering and Science by Sawyer C.N., McCarty P.L. and Parkin G.F.- Tata McGraw Hill Publishing Company Ltd., New Delhi.
2) A Textbook of Environmental Chemistry and Pollution Control by Dara S.S.- S. Chand and Company Ltd., New Delhi.
3) Environmental Chemistry by Manhan, S.E.- Lewis Publishers

Reference books:

1) Microbiology by Pelczar M.J., Chan E.C.S., Krieg N.R. - Tata McGraw Hill Education (P) Ltd., New Delhi.
2) Environmental Microbiology by E. Gaudy and Gaudy - Tata McGraw Hill Education (P) Ltd., New Delhi.
3) Environmental Chemistry by De A.K.- New Age International (P) Ltd., New Delhi.
4) Environmental Pollution Analysis by Khopkar S.M.- New Age International (P) Ltd., New Delhi.

Research Methodology

Teaching Scheme
Credits: 4
Lectures: 4Hrs/week
Laboratory Work: NA

Examination Scheme
In Sem Assessment: 50 Marks
End Sem Assessment:50 Marks

Prerequisite: Basis statistical tools

Course Objectives: Upon completion of the course students must be able to:

1. Get introduced to the concept of research and research design
2. Formulate the problem statement and prepare research plan for the problem under investigation.
3. Apply various numerical /quantitative techniques for data analysis.
4. Communicate the research problem effectively.
5. Get introduced to applications of soft computing techniques in research

Course Outcomes:The students will be able to:

1. Define research and formulate a research problem
2. Understand applications of Soft computing in Research
3. Explain the importance of literature review, Data collection, Measuring, Sampling and Scaling techniques
4. Discuss preliminary data analysis and Advanced data analysis techniques
5. Identify and evaluate various research designs
6. Write a research proposal to a suitable funding agency

Unit 1: Introduction to Research and Research problem **(8 Hrs.)**

Meaning of research, types of research, process of research, Objectives of research, Research and Scientific Method, Sources of research problem, Criteria / Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem, defining a research problem (Real life example or case study), formulation of research hypotheses, Qualities of a good Hypothesis, Null Hypothesis & Alternative Hypothesis. Hypothesis Testing -Logic & Importance

Unit 2: Research Design **(8 Hrs.)**

Research Design- Concept and Importance in Research, Features of a good research design, different research designs in research studies, Experimental research designs (informal and formal), Replication, Randomization, Blocking.

Unit 3: Data collection, Measuring, Sampling and Scaling **(8 Hrs.)**

Classification of data, benefits and drawbacks of data, evaluation of data, qualitative methods of data collection, types of data analysis, statistics in research- measure of central tendency, measure of dispersion, measure of asymmetry, measure of relationship, Sampling, sample size, sample design-concept of probability sampling and non-probability sampling, attitude measurement and scaling, types of measurements, criteria of good measurements, classification of scales

Unit 4: Data analysis **(8 Hrs.)**

Testing of hypothesis- concepts and testing, analysis of variance techniques, introduction to non-parametric tests. Validity and reliability, Approaches to qualitative and quantitative data analysis. Correlation and regression analysis, Introduction to factor analysis, discriminant analysis, cluster analysis, multidimensional scaling, Descriptive statistics, inferential statistics, Multidimensional measurement and factor analysis.

Unit 5: Report, Research proposal and funding agencies (8 Hrs.)

Need of effective documentation, types of reports, report structure, Format of research proposal, Individual research proposal, Institutional research proposal, Funding for the proposal, Different funding agencies. Plagiarism. Research briefing, presentation styles, elements of effective presentation, writing of research paper, presenting and publishing paper, patent procedure.

Unit 6: Soft computing in Research (8 Hrs.)

Demonstration of statistical software like SPSS, GRETL, minitabetc. in research. Introduction to evolutionary algorithms- Fundamentals of Genetic algorithms, Neural Network based optimization, Optimization of fuzzy systems with applications.

Internal Assessment:

A research proposal should be made which should consist of writing a research proposal to a suitable funding agency with a suitable research problem, identification of gap in research, hypothesis, Methodology, data collection, sampling, probable method of data analysis, cost analysis and time frame (with reference to the type of project and/or requirement of funding agencies, other relevant topics can be added). The proposal should be made using Latex or MS office- with techniques and a plagrism check with free software to be done. **The Research proposal made using Latex / MS office with plagrism checked report is a compulsory assignment to be performed.**

Text books:

1. Research Methodology: Methods and Trends', by Dr. C. R. Kothari--- New Age International Publishers.
2. Research Methods in Education---Louis Cohen,Manion,Morrison---Routledge(Taylor &Francis Group) / -- Cambridge University Press India Pvt. Ltd.-ISBN-978-0-415-58336-7
3. Research Methodology: An Introduction' by Wayne Goddard and Stuart Melville
4. Research Methodology: A Step by Step Guide for Beginners', by Ranjit Kumar
5. Research in Education---John Best and James Kahn,Prentice Hall of India Pvt.Ltd.
6. Fuzzy Logic with Engg Applications, Timothy J.Ross, Wiley Publications, 2nd Ed[d]
7. Genetic Algorithms in Search, Optimization, and Machine Learning by David E. Goldberg
8. Neural Networks - A Systematic Introduction- Raul Rojas, Springer; 1 edition (July 12, 1996)
9.e-Resource---For class room ppts---www.wileyeurope.com/college/sekaran

Reference books:

1. Research Methodology**:** concepts and cases—Deepak Chawla and NeenaSondhi,Vikas Publishing House Pvt.Ltd. (ISBN 978-81-259-5205-3)
2.Research Methods for Business—Sekaran Uma and Roger Bougie—Wiley,India

Elective I : Planning And Management of Water Resources

Teaching Scheme
Credits: 5
Lectures: 4Hrs/week
Laboratory Work: 2 Hrs/week

Examination Scheme
In Sem Assessment: 50 Marks
End Sem Assessment:50 Marks
Oral Exam : 50 Marks
Total :150 Marks

Prerequisite: Hydrology and Ground water engineering, FM-I , FM-II

Course Objectives:

1. To impart the necessity and aspects of water resource planning and management.
2. To introduce students to Spatial and temporal characteristics of water resources
3. To impart the knowledge of reservoir operation and sedimentation
4. To give a knowhow of ground water resources and its management.
5. To make students aware of economics of water resources projects.
6. To expose students to the reality of practicing water resources by virtue of cost benefit analysis.

Course Outcomes:

By the end of the course,

1. Students would understand the necessity and aspects of water resource planning and management.
2. Students would be able to envisage Spatial and temporal characteristics of water resources and constraints for its development
3. Students would be able to design the reservoir operation, estimate sediment load for managing the surface water resources.
4. Students would develop an insight into managing the ground water resources by virtue of learning well hydraulics.
5. Students would be able to plan single and multipurpose projects economically.
6. Students would be able to do cost benefit analysis for any water resources projects.

Unit 1: Introduction (6 Hrs.)

Objectives: of water resource planning and management, its Necessity, Aspects of water resources planning, water resource development; needs and opportunities; social goals

Unit 2: Characteristics Of Water Resources (6 Hrs)

Spatial and temporal characteristics of water resources, constraints for its development like non-reversibility; planning region and horizons.

Unit 3: Management of Surface Water Resources: (6Hrs.)

Characteristics and functions of reservoir; reservoir sedimentation; conservation storage; conflict among uses, Reservoir operation studies - effect on river regime; long term simulation; reliability; resiliency and vulnerability assessment

Unit 4: Management of Ground-Water Resources: (6 Hrs.)

Ground water evaluation; conjunctive use of surface and ground water, Ground water and well hydraulics, interference and specific yield of wells, construction and maintenance of artificial wells

Unit 5: Economic Planning: (6 Hrs.)

studies of single and multipurpose projects– multi objective planning models, financial analysis of water resources projects, allocation of cost of multipurpose projects; repayment of cost. Demand for drinking water; irrigation, hydropower; navigational; planning for flood control.

Unit 6: Benefit Cost Analysis **(6 Hrs.)**

Discounting techniques; benefit cost parameters; estimation of benefits and costs; appraisal criteria; social benefit cost analysis. Basin planning; inter-basin transfer of water

Laboratory Work

One assignment based on each unit is mandatory.

The assignments should cover case studies/ numerical problems/ short and detail notes / analysis of single objective projects/ analysis of multi objective projects.

Text books

1. Bhave P.R., "Water Resources Systems", Narosa Publications, New Delhi. .
2. Water Resources System Planning – by M.C.Chaturvedi.
3. Water Management System Application-A.K.Biswas

Elective I: Dam Engineering

Teaching Scheme
Credits: 5
Lectures: 4Hrs/week
Laboratory Work: 2 Hrs/week

Examination Scheme
In Sem Assessment: 50 Marks
End Sem Assessment:50 Marks
Total Marks:100

Prerequisite: Fluid Mechanics at UG level including Kinematics, Dynamics, laminar and turbulent flow, differential and integral Calculus

Course Objectives:

1. To introduce students to various aspects of dam engineering like classification of dams, social issues, Displacement and rehabilitation etc.
2. To impart the knowledge aboutassessment of hydropower potential of a dam project and different instruments for safety purposes.
3. To equip the students to design the gravity dam
4. To equip the students to design the earthen dam
5. To equip the students to design spillway.
6. To impart the knowledge of general aspects of rock dam fill dam and arch dam

Course Outcomes:

By the end of the course, students would be able to

1. Understand the various aspects of dam engineering like classification of dams, social issues, Displacement and rehabilitation etc.
2. Asses the hydropower potential of a dam project and apply different instruments for safety purposes.
3. Design of gravity dam
4. Design of earthen dam
5. Design of spillway.
6. Understand the general aspects of rock dam fill dam and arch dam

Unit 1: Introduction (6 Hrs.)

Introduction, Historical development of dams, Different terms related to dams, Selection of site for dam, Factors governing selection of type of dam, Classification of dams based on purpose, materials, size of project, hydraulic action, structural action, Dams and earthquakes, Dams and social issues, Large dams verses small dams, Displacement and rehabilitation, Dams and climate change.

Unit 2: Dam Safety and Instrumentation and Hydropower (6 Hrs)

Introduction, Objectives of dam safety and instrumentation, Selection of Equipments , general working principles of instruments, Introduction to hydropower, Advantages and limitations of hydropower, Assessment of hydropower potential, Definition and different terms related to hydropower ,Features of layout of hydropower plant, Classification of hydropower plants based on storage ,functions, head, plant capacity, location, nature of project

Unit 3: Gravity Dams (6 Hrs.)

Forces acting on the gravity dams earthquake force-pseudo static and dynamic response approach, load classifications, stability analysis, distribution of shear and normal stresses, principle stresses, Stress concentration around openings, foundation treatments, Design of concrete dam. Reservoir operation

Unit 4: Spillways (6Hrs.)

Spillway-types, components, design principles, Design of different spillways such as Ogee, side

channel, siphon. Energy dissipation devices and their design

Unit 5: Earthen Dams **(6 Hrs.)**

Seepage through dam and its foundations, stability analysis for sudden drawdown condition, steady seepage condition, end of constructions, seismic effects, pore pressures, protection of upstream and downstream slopes.

Units 6:Rock fill Dams and Arch Dams **(6 Hrs.)**

Rock fill Dams: Relevant rocks fill characteristics, general design, principal, method of construction and compaction. **Arch Dams:** General concepts of trail load theory, elastic shell methods, thick cylinder theory.

Laboratory Work

One assignment based on each unit is mandatory.

The assignments should cover case studies/ numerical problems/ short and detail notes / analysis of single objective projects/ analysis of multi objective projects.

Text books

1. Irrigation, Water Resources and Water Power Engineering- Modi, P.N. - Standard Book House, New Delhi, 2nd ed, 1990.
2. Irrigation Engineering and Hydraulic Structures- Garg S.K- Khanna Publishers N.D. 13th ed, 1998.
3. Design Textbook in Civil Engineering: Volume Six: Dams- Leliavsky, Serge – Oxford and IBH Publishing Co. Pvt. Ltd., 1981.

Reference books

1. Concrete Dams – R.S. Varshney
2. Earth Dams – J.L. Sherard
3. Water resources Engineering Principles and Practice- S. Murty Challa- New Age International

I.S. Codes

I.S. 8605 – 1977 (Reaffirmed 1998), I.S. 6512-1984 (Reaffirmed 1998), I.S. 457 – 1957 (Reaffirmed, 2005), I.S. 10135 – 1985, I.S. 14591 – 1999, I.S. 11223 – 1985 (Reaffirmed 2004), I.S. 6934 – 1998 (Reaffirmed 2003), I.S. 11155- 1994, I.S. 5186 – 1994, I.S. 10137- 1982 (Reaffirmed 2004), I.S. 4997 – 1968 (Reaffirmed 1995) given by B.I.S. New Delhi.

Elective I :Air Pollution and Control

Teaching Scheme
Credits: 5
Lectures: 4Hrs/week
Laboratory Work: 2 Hrs/week

Examination Scheme
In Sem Assessment: 50 Marks
End Sem Assessment:50 Marks
Oral Exam : 50 Marks
Total :150 Marks

Prerequisite: Environmental Engineering-I, FM-I , FM-II

Course Objectives:

1. To introduce the student to the air pollution, quality and standards.
2. To give a knowhow of meteorological parameters and their effects.
3. To make the student aware of the indoor air pollution, sources, causes and effects.
4. To impart the knowledge of technology of air pollution control.
5. To impart the knowledge of air pollution modeling.
6. To impart the knowledge of air quality modeling.

Course Outcomes:

By the end of the course,

1. Student would understand the various pollutant and air quality standards.
2. Students would understand meteorological parameters and their effects.
3. Students would understand indoor air pollution and its effect.
4. Students would be able to design the air pollution control technology.
5. Students would understand air pollution modeling for controlling air pollution.
6. Students would be able to do air quality modeling.

Unit 1: Air Quality and Standards (6 Hrs.)

Air Pollution: Definition of Air Pollution - Sources & Classification of Air Pollutants - Effects of air pollution - Global effects - Air Quality and Emission standards - Sampling of Pollutants in ambient air - Stack sampling. Reactions of pollutants and their effects – Smoke–smog and ozone layer disturbance – Ambient air and stack sampling – pollutant measurement methods– Principles and instruments –Ambient air quality standards,Emission standards, emission inventory, and Acts.

Unit 2: Meteorology (6 Hrs.)

Meteorological parameters and their effects on urban air pollution, Wind rose, Atmospheric motion, Lapse rates, Atmospheric stability, Inversions and its effects on pollutants, Atmospheric diffusion of pollutants, Transport, Transformation and deposition of air contaminants; Global air pollution: Acid rain, Ozone layer depletion, Global warming, Greenhouse effect and Trans-boundary pollution, Kyoto protocol, Carbon credit and carbon trading.

Unit 3: Indoor Air Pollution (6 Hrs.)

Indoor air pollution sources, indoor pollutant levels, monitoring instruments; indoor pollution control strategies: source control, control equipment and ventilation; energy conservation and indoor air pollution; effects of indoor air population; risk analysis; models for predicting source emission rates and their impact on indoor air environments.

Unit 4: Air Pollution Control (6 Hrs.)

Control of Particulate Pollutants: Properties of particulate pollution - Particle size distribution - Control mechanism - Dust removal equipment - Design and operation of settling chambers, cyclones, wet dust scrubbers, fabric filters & ESP. **Control of Gaseous Pollutants:** Process and equipment for the removal by chemical methods - Design and operation of absorption and adsorption equipment - Combustion and condensation equipment.

Unit 5: Air Pollution Modeling

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, atmosphere, transport and diffusion of stack emission –atmospheric characteristics significant to transport and diffusion of stack emission – stack plume characteristics, Maximum Mixing Depths – Plume rise – Types of dispersion models

Unit 6 : Air Quality Models

Kinetics of air pollutants: Atmospheric advection-diffusion of pollutants; Fick's law of diffusion; No-flow boundary effect; Models for no-flow boundary conditions; Reynolds theory of turbulence; Atmospheric boundary layer; Modeling: Classification of air quality models, Gaussian plume model for a point source, Plume rise, Brigg's and Holand's equations for estimating plume rise; Dispersion coefficients; Buoyancy and flux parameters for plume rise; Gaussian approach to special cases of point, area and line sources of pollution.

Laboratory Work

One assignment based on each unit is mandatory.

The assignments should cover case studies/ numerical problems/ short and detail notes / analysis of single objective projects/ analysis of multi objective projects.

Text books:

1. Rao, M. N. and Rao, H. V. N., Air pollution, Tata McGraw-Hill Publishing Co; Ltd, New Delhi, 1993.
2. Nevers, N. D., Air Pollution Control Engineering, McGraw-Hill International Ed., 1993.
3. Pandey V., Noise Pollution, Meerut Publishers, 1995.

Reference books:

1. Wark, K. and Warner, C.F., Air Pollution, Its Origin and Control, Harper and Row, New York,1981.
2. Wayne T. D., Air Pollution Engineering Manual, John Wiley & Sons, 2000.
3. Rao, C. S., Environmental Pollution Control Engineering, New Age Int. Pubs, 1991, Reprint, 2005.
4. Barratt, R., Atmospheric Dispersion Modeling, Earthscan Publication Ltd, 2003.
5. Rau J. G. and Wooten D. C., Environmental Impact Analysis: Handbook, McGraw Hill Publications, 1985.
6. Khare, M. and Sharma P., Modeling the Vehicular Exhausts Emission, WIT press, UK, 2002.

Elective I: Remote sensing and GIS

Teaching Scheme
Credits: 5
Lectures: 4Hrs/week
Laboratory Work: 2 Hrs/week

Examination Scheme
In Sem Assessment: 50 Marks End Sem Assessment:50 Marks
Total Marks:100

Unit 1: Introduction to Remote Sensing and EMR (8Hrs.)

Introduction of Remote Sensing – Energy sources and Radiation principles, Energy equation, EMR and Spectrum, EMR interaction with Atmosphere scattering, Absorption, EMR interaction with earth surface features reflection, absorption, emission and transmission, Spectral response pattern , vegetation, soil, water bodies- Spectral reflectance. Aerial photography and photogrammetry, height determination contouring - photographic interpretations - stereoscopy – parallax bar- Flight Planning- Photo Interpretation.

Unit 2: Data Acquisition and Satellites. (6 Hrs.)

Data acquisition –Procedure, Reflectance and Digital numbers- Intensity- Reference data , Ground truth, Analog to digital conversion, Detector mechanism- Spectro- radiometer-Ideal remote sensing system – Characters of real and successful remote sensing system- Platforms and sensors- orbits types – Resolution. Remote sensing satellites: Land observation satellites, characters and applications, IRS series, LANDSAT series and INSAT series.

Unit 3:Types of remote sensing and image interpretation (8Hrs.)

Introduction- Active, Passive, Optical Remote sensing, sensors and characters. SLAR, SAR Scattrometers,- Altimeter, Characteristics , Image interpretation characters. Introduction to:Image Acquisition And Format, Image Distortion And Rectification, Image Enhancement, Image Classification Image Analysis.

Unit 4: Introduction to GIS (8Hrs.)

Definitions, Components of GIS, Representation of Geographic features in Vector and Raster Data models, Concept of arc, node, vertices and topology – maps and spatial information, Hardware &Software requirements for GIS.

Unit 5: Data& Processing(8Hrs.)

Types of geographic data, levels of measurements. Concepts of space and time, Spatial data models, encoding methods of data input – Keyboard, Manual Digitizing and Automatic Digitizing methods, Linking of Spatial and Attribute data to maps, Metadata Spatial data input: Digitization, error identification. Errors: Types, sources, correction. Editing and topology building.

Unit 6: Applications of RS GIS in water resources engineering (8Hrs.)

Simple-complex query with two or more tables using SQL. Queries using Union, Intersection, Join etc operations. Types of Models, Conceptual Models of WREE, GIS analysis and Interpretation, Over view of Open sources softwares such as ARC – GIS, Q – GIS.

Laboratory Work

One assignment based on each unit is mandatory.

The assignments should cover case studies/ numerical problems/ short and detail notes / analysis of single objective projects/ analysis of multi objective projects.

Text books:

1. Remote sensing methods & applications – R. Michael Hord, Wily Interscience Publication.
2. Chang, K. T. (2008): Introduction to Geographic Information Systems, Avenue of the Americas, McGraw-Hill, New York

3. Kresse, W. and Danko, D. (2002): Springer Handbook of Geographic Information,
4. Springer Drecht, London
5. Bao, J., Tsui, Y. (2005): Fundamentals of Global Positioning System Receivers, John Wiley Sons, Inc., Hoboken .

Reference books:

1. Remote sensing & image interpretation – Lilleson J.T.M. &Krefer R.W. Wiely, New York.
2. Photogrammetry by – Sheford
3. Environmental Systems Research Institute, Inc. (1998): Understanding GIS: The ARC/INFO Method, ESRI Press, Redland
4. Ahmed, E. L., Rabbany (2002): Introduction to Global Positioning System, Artech
5. House, Boston

Elective II : Optimization Techniques

Teaching Scheme
Credits: 4
Lectures: 4Hrs/week
Laboratory Work: NA

Examination Scheme
In Sem Assessment: 50 Marks End Sem Assessment:50 Marks
Total marks : 100

Prerequisite: M-I , M-II, M-III

Course Objectives:

1. To introduce students to optimization techniques and basic concepts of Linear programming
2. To equip the students to advanced Linear Programming techniques.
3. To impart the knowledge of Non Linear Programming through unconstrained optimization techniques.
4. To make students aware of dynamic programming.
5. To impart the knowledge of different Stochastic Methods of optimization
6. To expose students to benefits of game theory and to furnish them to solve the water resources Problems.

Course Outcomes:

By the end of the course, students would be able to

1. Well conversant with optimization techniques and its components
2. implement LPP with all its variants
3. Use of NLP like constrained and unconstrained optimization
4. use of Dynamic Programming for problems related to project investment
5. Implement sequencing, queuing theory and simulation to stochastic problems
6. Use the fundamental of game theory to optimize the practical problem

Unit 1: Linear Programming I: **(6 Hrs.)**

Introduction to Optimization techniques, Linear programming basic concepts, graphical method, Simplex method, Big M Method, Two phase method, Duality, sensitivity analysis.

Unit 2: Linear Programming II: **(6 Hrs.)**

Application of Linear Programming in civil engineering, Transportation Model and its variants, Assignment Model, and its variants

Unit 3: Non Linear Programming: **(6 Hrs.)**

Unconstrained one Dimensional search methods: Dichotomous search method, Fibonacci, Golden section, Multivariable unconstrained techniques: Steepest ascent and Descent methods, Newton's methods, Constrained technique: Lagrangian Multiplier.

Unit 4: Dynamic Programming: **(6Hrs.)**

Multi stage decision processes, Principle of optimality, recursive equation, Applications of D.P.

Unit 5: Stochastic Methods: **(6 Hrs.)**

Sequencing– n jobs through 2, 3 and M machines
Queuing Theory : elements of Queuing system and it's operating characteristics, waiting time and ideal time costs, Kendall's notation, classification of Queuing models, single chanel Queuing theory : Model I (Single channel Poisson Arrival with exponential services times, Infinite population (M/M/1) : (FCFS/ ∞ / ∞)
Simulation : Monte Carlo Simulation

Unit 6 -Games Theory: **(6 Hrs.)**

Theory of games, 2 person zero sum game with and without saddle point, mixed strategies (2 x n games or m x 2 games), 2 x 3 game with no dominance, graphical method

Text books

1. Operations Research – Premkumar Gupta &D.S.Hira ., S.Chand
2. Problems in Opeartions Research - Premkumar Gupta &D.S.Hira ., S.Chand

Reference books

1. Engineering Optimazation Theory & Practice – S.S. Rao.,Wiely.
2. Operation Research – TahaHamdeyA.
3. Principles of Operation Research – Wagner, PrenticeHall.

Elective II : Finite Element Analysis

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week
Laboratory Work: NA

Examination Scheme
In Sem Assessment: 50 Marks
End Sem Assessment:50 Marks
Total Marks:100

Prerequisite:

Course Objectives:

1. Be able to analyze some real problem and to formulate the conditions of FEA application
2. Be able to execute a reasonable choice of parameters and variables of the FEA model (geometry, material properties, boundary conditions)
3. Be able to analyze the result FEA model solution by standard computational programs

Course Outcomes:

By the end of the course,

4. To be able to execute the analysis concepts using Computational methods
5. To be able to use formulation techniques
6. To be able to use theory for finite element analysis Final examination

Unit 1: (Introduction) (6 Hrs.)

Module 1:

a. **Introduction to Finite Element Analysis:** Background of Finite Element Analysis, Numerical Methods, Concepts of Elements and Nodes, Degrees of Freedom, Steps in Finite Element Analysis
b. **Basic Concepts of Finite Element Analysis:** Discretization of Technique Basic, Concepts of Finite Element Analysis, Advantages of FEA, Disadvantages of FEA, Limitations of the FEM, Errors and Accuracy in FEA
c. **Introduction to Elasticity**, Strain-Displacement Relations, Linear Constitutive Relations,

Unit 2: (Finite Element Formulation Techniques) (6 Hrs)

Module 2:

a. Virtual Work and Variational Principle: Introduction, Principle of Virtual Work, Variational Principle, Weighted Residual Method.
b. Galerkin Method: Introduction, Galerkin Method for 2D Elasticity Problem, Galerkin Method for 2D Fluid Flow Problem

Unit 3: (Finite Element Method: Displacement Approach) (6 Hrs)

Module 3:

Choice of Displacement Function: Convergence criteria, Compatibility, Geometric invariance, Shape Function, Degree of Continuity, Isoparametric Elements, Various Elements

Unit 4: (Stiffness Matrix and Boundary Conditions) (6 Hrs)

Module 4:

a. Element Stiffness Matrix, Global Stiffness Matrix, Boundary Conditions, Stiffness of Truss Members: Introduction, Element Stiffness of a Truss Member, Member Stiffness with Varying Cross Section,
b. Generalized Stiffness Matrix of a Plane Truss Member: Analysis of Truss, Element Stiffness of a 3 Node Truss Member

c. Stiffness of Beam Members: Introduction, Derivation of Shape Function, Derivation of Element Stiffness Matrix, Generalized Stiffness Matrix of a Beam Member

Unit 5: (FEM for Two and Three Dimensional Solids) (6 Hrs.)

Module 5 :

a. Constant Strain Triangle: Element Stiffness Matrix for CST, Nodal Load Vector for CST
b. Linear Strain Triangle: Element Stiffness Matrix for LST, Nodal Load Vector for LST, Numerical Example using CST
c. Shape functions in cartesian & natural coordinate systems

Unit 6: (FEM for Two and Three Dimensional Solids) (6 Hrs.)

Module 6 :

a. Rectangular Elements: Computation of Element Stiffness, Computation of Nodal Loads,
b. Numerical Evaluation of Element Stiffness (Numerical Examples): Evaluation of Stiffness using One Point Gauss Quadrature, Evaluation of Stiffness using Two Point Gauss Quadrature
c. Computation of Stresses, Geometric Nonlinearity and Static Condensation: Computation of Stresses, Geometric Nonlinearity, Steps to include effect of geometrical nonlinearity, Static Condensation

Lab Practice assignment for the term work:

1.Any three assignments based on FEM by using coding tools such as EXCEL, MATLAB etc. for
a) Formulation of stiffness matrix for any 1-D element
b) Formulation of stiffness matrix for any 2-D element
c) Formulation of stiffness matrix for any 3-D element
d) Assembly procedure using Jacobian matrix
2. Finite Element Method – Software applications using either SATDD-Pro / Anysis / Etabs / SAP.

Text books:

1. S.S. Bhavikatti - Finite Element Analysis – New Age International Publishers, Delhi
2. Thompson---Introduction to the Finite Element, Method: Theory, Programming and Applications, Wiley, India
3. S.S. Rao - The Finite Element Method in Engineering 4th Edition – Elsevier Publication
4. G.R. Buchanan – Finite Element Analysis Schaum's outlines - Tata McGraw Hill Publishing Co. Ltd
5. Energy & Finite Element Methods in Structural Mechanics by Iriving Shames & Clive Dym, New Age International Publishers, Delhi
6. NPTEL Notes

Reference books:

1. Zienkiewicz & Taylor - The Finite Element Method 4th Edition – Vol – I & II – McGraw Hill International Edition
2. Robert D. Cook, D.S. Malkus, M.E. Plesha – Concepts & Applications of Finite Element Analysis – Wiley ,India.
3. J.N. Reddy – An Introduction to the finite element method – Tata McGraw Hill Publishing Co. Ltd
4. Segerlind L.J. – Applied Finite Element Analysis - John Wiley & Sons.
5. C.S. Krishnamoorthy – Finite Element Analysis – Theory & Programming – Tata McGraw Hill Publishing Co. Ltd

Seminar I

Teaching Scheme
Credits:1
Lectures:NA
Laboratory Work: 2Hrs/week

Examination Scheme
In Sem Assessment: NA
End Sem Assessment: NA
Oral Marks : 25 Marks
Total marks :25

Prerequisite:

Course Objectives:

To train the students to study a advanced topic relevant to their curriculum and make a report both in writing as well as in the form of presentation showing its highlights.

Course Outcomes:

By the end of the course,
Students would be able to write a report about the topic chosen by them in the prescribed format and give oral presentation of the same.

Seminar I

Seminar I: Shall be on state of the art topic of student's own choice approved by an authority. The student shall submit the duly certified seminar report in standard format, for satisfactory completion of the work by the concerned Guide and head of the department/institute.

Lab Practice I

Teaching Scheme
Credits: 3
Lectures: NA
Laboratory Work: 6Hrs/week

Examination Scheme
In Sem Assessment: NA
End Sem Assessment: NA
Oral Exam : 50Marks
Total Marks: 50

Prerequisite:

Lab Practice I :

The lab. practice-I will be based on completion of assignments / practicals / reports of site visits, confined to the course in that semester.

The term work will consist of --

i) **Visit reports** of minimum two site visits, exploring the field aspects for various subjects

ii) **Report on** minimum 2 software applications on any subject of the semester.

iii) **Report of laboratory work consisting of following....**

1. Solution of Laplace equation by graphical / relaxation method.
2. Flow past a cylinder using wind tunnel
3. Flow past aerofoil using wind tunnel.
4. Growth of a boundary layer along a flat plate using wind tunnel/air flowbench
5. Determination of friction factor using experimental observations, Darcy-Weishbach equation and Moody's diagram for different pipes(materials)
6. Assignment based on cost benefit studies of single and multipurpose projects– multi objective planning models, financial analysis of water resourcesprojects.
7. Assignment on basin planning for watermanagement
8. Ambient air quality analysis for RSPM, PM 10, and analysis of automobile exhaust for CO, leadanalysis.
9. Physico-Chemical analysis of water Turbidity, Solids: Dissolved, Suspended, pH, Electrical Conductivity, Alkalinity and acidity, Hardness, Sulphate, Iron and Manganes, Optimum dose of alum, MPNNumber.
10. Determination of cations, anions and any one heavy metal fromwater.
11. Sample collection methods and standardization ofchemicals.

M TECH FIRST YEAR - SEMESTER II

Open Channel Hydraulics

Teaching Scheme
Credits: 4
Lectures: 4Hrs/week
Laboratory Work: NA

Examination Scheme
In Sem Assessment: 50 Marks
End Sem Assessment:50 Marks
Total Marks: 100

Prerequisite: Fluid Mechanics at UG level including Kinematics, Dynamics, laminar and turbulent flow, differential and integral Calculus

Course Objectives:

1. To introduce students to design the rigid boundary channels using the concepts of Depth Energy relationship and Uniform flow.
2. To impart the knowledge of hydraulic jump in horizontal and slopping channels along with its controlling measures.
3. To make students aware of different flow profiles
4. To introduce students to spatially varied flow and its occurrences.
5. To impart the knowledge of gradually and rapidly varied unsteady flow.
6. To equip the students for Routing the flow at a c/s using various techniques.

Course Outcomes:

By the end of course , students would be able to

1. Understand the concept of Depth Energy relationship and Uniform flow to design the rigid boundary channels.
2. Understand the hydraulic jump in horizontal and slopping channels along with its controlling measures.
3. Classify the flow profile and calculate the length between the two c/s
4. Derive the equations for spatially varied flow and apply them for different cases.
5. Derive and solve equations gradually and rapidly varied unsteady flow.
6. Route the flow at a c/s using various techniques.

Unit 1: Uniform Flow **(6 Hrs.)**

Specific Energy, Specific Force, Critical depth, and its computations, critical flow, critical velocity .section factor , First Hydraulic exponent, Depth Energy relationship, Uniform flow, Flow through prismatic channels

Unit 2: Hydraulic Jump **(6 Hrs)**

Introduction to Jump, Momentum equation of jump, classification of jump, Characteristics of jump in a rectangular channel, Formations of jump in expanding channel, jump at an abrupt drop and rise, control of jump by baffle blocks , jump in sloping rectangular channels

Unit 3: Gradually Varied Steady Flow **(6 Hrs.)**

Gradually varied steady flow and rapidly varied steady flow in open channels, surface profiles in GVF-analysis, different method of computations, Chow's methods, standard step method, finite difference method.

Unit 4: Spatially Varied Flow **(6Hrs.)**

Differential Equation of spatially varied flow with increasing and decreasing discharge , side weir , bottom rack.

Unit 5: Unsteady Flow **(6 Hrs.)**

Gradually varied unsteady flow: Continuity equation, dynamic equation, Monoclinal rising waves, dynamic equation for uniformly progressive flow, wave profile of uniformly progressive flow, wave propagation,

Rapidly varied unsteady flow: Uniformly progressive flow, positive surge, negative surge

Unit 6: Flood Routing **(6 Hrs.)**

Hydraulic and Hydrologic flood routing, Reservoir and channel routing, Differential form of Momentum Equation, Muskinghum method, Finite difference scheme, Method of characteristics.

Text books

1. Flow in Open Channel – K. Subramanya, Tata Mc-Graw Hill.
2. Hydraulics and Fluid Mechanics by P. N. Modi and S. N. Seth Standard book house
3 Open Channel Flow: K. G. RangaRaju - Tata McGraw Hill.

Reference books

3. Open Channel Hydraulics – VenTe Chow, Mc-Graw Hill.
4. Flow through Open Channel-K.G.RangaRaju, Tata Mc-Graw Hill.
5. Open Channel Hydraulics-French, Mc-Graw Hill.

Advance water and waste water treatment

Teaching Scheme
Credits: 4
Lectures: 4Hrs/week
Laboratory Work: NA

Examination Scheme
In Sem Assessment: 50 Marks
End Sem Assessment:50 Marks

COURSE OBJECTIVES-

1. To introduce students to design water & waste water treatment units.
2. To impart the knowledge of low cost treatment & ecofriendly unit.
3. To make students aware of different standards for the disposal of water and its various consequences.
4. To impart the knowledge of advance treatment units.

COURSE OUTCOME

By the end of course , students would be able to

1. Understand the basic concept and criteria for design of treatment units.
2. Understand the need of low cost treatment design.
3. Understand the various standards for effluent disposal and their consequences.
4. Understand the need of advance treatment unit and their advantages.

Prerequisite-Env. Engg.-I,II for U.G. level

Unit 1: ADVANCE WATER TREATMENT INTRODUCTION 6Hrs

Objectives of advance water treatment, water characteristic such as physical, chemical and biological, Physical and chemical interactions due to various forces, suspensions and dispersions. Surface and colloidal chemistry, use of peak factor, flowcharts, function and basic principles involved in different units of water treatment.

Unit 2: SEDIMENTATION TANK & COAGULATION 6Hrs

Objectives of sedimentation tank. Settling velocity of various particles. Efficiency of an ideal settling basin. Size weight composition and removal. Reduction in settling efficiency by currents. Short circuiting and basin stability. Elements of tank design with basic criteria. Design of tube settler. Inlet and outlet hydraulics. Common tank loadings. Theory of common coagulant. Coagulation mechanisms mixing and stirring devices(Gravitational and mechanical), design of flash mixer.

Unit 3: FLOCULATION TANK& FILTRATION 6Hrs

Objectives. Flocculator loading and performance design of flocculator with gear box,Calculation of velocity, gear reduction ratio, power consumption, and number of teeth on gear and spur gear, different type of gear use and their application.Theory of filtration, mechanism of filtration,Filter media single, dual head loss calculation in filtration by using Rose Equation (Problem on Rose Equation). Preparation of filter sand hydraulics of filtration. Hydraulics of stratified. unstratified and fluidized beds. , Chemical oxidation/reduction processes.Disinfection using chlorine, UV, Hexagonal water, Ionizer Ozonation.

Unit 4: ADVANCE WASTE WATER TREATMENT INTRODUCTION 6Hrs

Objectives of advance waste water treatment. Physical, Chemical and Biological Characteristics of sewage.Classification and application of wastewater treatment methods Elements of plant analysis.Modelling of suspended growth systems, techniques for evaluation of kinetic and stoichiometric parameters. Optimal selection of waste water treatment chain, engineered systems, concepts and principles of carbon oxidation, nitrification, denitrification, methanogenasis.

Unit 5:WASTE WATER TREATMENT UNIT DESIGN 6Hrs

Anaerobic treatment (process options, components of anaerobic reactions that influence process design); Attached growth reactors (process description, design and applications). De-centralised wastewater treatment systems high rate two stage T.F.; Low cost options and design of units, constructed wetlands. Reliability and cost effectiveness of wastewater systems. Introduction and theory of Phytoremediation technology for wastewater treatment, Introduction and theory of root zone cleaning system. (Including numerical)

Unit 6: DISPOSAL OF SEWAGE **6Hrs**

(A) Land treatment systems - Fundamental consideration. Irrigation systems - Design objectives. site Selection. Pre-application treatment. loading rates. land requirements. Crop-selection. distributionsystems. Rapid - infiltration systems. over land flow systems. land application of sludge.
(B) Effluent disposal and Reuse: Receiving water standards. Effluent standards. Disposal bv dilution. Disposal into lakes. Disposal into rivers. Re-oxygenation in rivers. De-oxygenation in rivers. Oxygen sag mode. Disposal into estuaries. Disposal into ocean. Direct and indirect reuse of wastewater

Text book-

1. Water supply engineering by- S.K.Garg
2. Waste water Engineering by- B..Punmia

References

1. Physiochemical Processes for treatment of Water By - W.J. Weber

2. Environmental Engineering By - H.S. Peary. DR. Rowe & G. Tehobanoglous

3. Manual on water Supply & Treatment CPHEEO. Min of Urban Development. New Delhi.

4. Water Supply & Sewerage By - Ernest W. Steel (Mc-Graw Hill Book Co.)

5. Waste Water Engineering Treatment & Reuse bv - Metcalf & Eddy (Tata Mc-Graw Hill) "

6. Water & Wastewater Technology bv - Mark J.Hammer (Prentice - Hall of India) .."

7. Manual on Sewerage & Sewage Treatment CPHEEO. Min of Urban Dev. New Delhi

Hydrology

Teaching Scheme
Credits: 4
Lectures: 4Hrs/week
Laboratory Work: NA

Examination Scheme
In Sem Assessment: 50 Marks
End Sem Assessment:50 Marks
Total Marks:100

Prerequisite: Hydrology at UG level and basic statistics.

Course Objectives:

1. To introduce students to rainfall runoff processes and their modeling techniques.
2. To impart the knowledge of various stochastic processes to analyze and forecast hydrologic variables
3. To equip the students to estimate and forecast the flood by various methods
4. To introduce students to concept of Ground Water and well hydraulics.
5. To impart the knowledge of various attributes of ground water like exploration, well construction & design, pumping equipment, quality and pollution of ground water.
6. To expose the students to various ways of ground water conservation

Course Outcomes:

By the end of the course, students would be able to

1. Understand the rainfall runoff processes and their modeling techniques.
2. Apply various Stochastic processes to analyze and forecast hydrologic variables
3. Estimate and forecast the flood by various methods
4. Understand the concept of Ground Water and well hydraulics
5. Deal with various attributes of ground water like exploration, well construction & design, pumping equipment, quality and pollution of ground water.
6. Know various ways of ground water conservation

Unit 1: Introduction (6 Hrs.)

Hydrologic Cycle, Precipitation, Evaporation, Infiltration, Interception and Depression, Depth area duration analysis, Unit hydrograph theory, IUH, Rainfall runoff models-SWM, Tanks, CLS models

Unit 2: Stochastic processes (6 Hrs)

Stochastic processes-classification, time series & it's components, various statistical distributions like binomial, normal, log-normal, Poisson, Beta B, gamma, Pearson type I, II and III & their uses in hydrology, Chi square test, plotting, position, frequency factors, extreme value theory, synthetic generation of yearly and monthly flows in hydrology.

Unit 3: Flood Analysis (6 Hrs.)

Flood estimation by various methods, forecasting of floods, flood frequency analysis, Gumbel's, Pearson type I, II, and III distribution, Log-normal method, design flood for various hydraulic structures

Unit 4: Ground Water Hydraulics (6Hrs.)

Definition of Ground Water, aquifers, vertical distribution of subsurface water, Darcy's Law-it's range of validity, DupuitForchheimer assumption, application of Darcy's law to simple flow systems governing differential equation for confined and unconfined aquifers, fully & partially penetrating wells, interference of wells, pumping test with steady & unsteady flow, method of image.

Unit 5: Ground Water Development (6 Hrs.)

Ground water Exploration, well types, well construction & design, screens, perforations & gravel packs, pumping equipment, quality of ground water, pollution of groundwater

Unit 6: Ground Water Conservation (6 Hrs.)

Ground water budget, seepage from surface water artificial recharge, Porous media models, Analog models, Electric analog models, Digital computer models.

Text books

1. Engineering Hydrology-K. Subramanya, Tata Mc-Graw Hill.
2. Hydrology- H.M. Raghunath, Wily Eastern, New Delhi.
3. A text book of Hydrology- Jaya Rami Reddy, University Science Press

Reference books

1. Applied Hydrology-LinsleyKolhar&Paulhas (Mc-Graw Hill)
2. Water Resource & Hydrology-S.K. Garg.
3. Stochastic Hydrology-Jaya Rami Reddy, Laxmi Pub., New Delhi.
4. Applied Hydrology-V.T. Chow, McGraw-Hill Book Company.

Elective III: Wave Mechanics

Teaching Scheme
Credits: 4
Lectures: 4 Hrs/week

Examination Scheme
In Sem Assessment: 50 Marks
End Sem Assessment: 50 Marks
Total Marks: 100

Unit 1: Introduction to Wave Mechanics **(6 Hrs.)**

Introduction, Generation, Decay, Classification, Measurement, Basic hydrodynamic equations, Wave Forecasting: The Significant Wave, Simplified versus Elaborate Technique, Numerical Wave Modelling (introduction only, no mathematical treatment): Phase resolving models, Phase averaging models, Introduction to Wave watch III, SWAN, MIKE

Unit 2: Wave Theories **(6 Hrs.)**

wave theories - Linear wave theory , Bottom boundary condition, Kinematic free surface boundary conditions, Dynamic free surface boundary conditions, Solution to linear water wave problem, wave length, wave celerity, classification of waves , wave particle velocities, water particle acceleration, water particle displacement, Wave energy: potential and kinetic energy.

Unit 3: Wave Propagation **(6 Hrs.)**

Wave shoaling, wave refraction, wave diffraction, wave reflection, combined effects using numerical solutions, wave breaking, wave set up and set down, wave runup, radiation stresses.

Unit 4: Wave Statistics **(6 Hrs.)**

Wave statistics: Short term wave statistics, Tucker method, Long term wave statistics- Gumbel distribution, Weibull Distribution, Log Normal Distribution, Wave spectrum analysis, wave spectra and statistics, Theoretical spectra: Pierson-Muskowitz Spectrum, Bretschneider Spectrum, JONSWAP Spectrum, Scott Spectrum, Scott-Wiegel Spectrum

Unit 5: Coastal Area and Processes **(6 Hrs.)**

Overview of Coastal Engineering, The Coastal Area, The Beach and Nearshore System, Dynamic Beach Response to the Sea, page, Causes of Shoreline Erosion, Coastal Protection Methods and Navigation Works

Unit 6: Littoral Processes **(6 Hrs.)**

Introduction of Littoral process, Littoral Materials, Littoral Wave Conditions, Nearshore Currents, Littoral Transport, Role of Foredunes in Shore Processes, Sediment Budget, Engineering Study of Littoral Processes

Text books:

Dean, R. G., Darlymple R. A. (1991). "Water Wave mechanics for Engineers and Scientists", World Scientific
Sorensen, R. M. (1997). "Basic Coastal Engineering", Springer
Mani, J.S., (2012), "Coastal Hydrodynamics", PHI Learning Pvt. Ltd, New Delhi

Reference books:

Sarpkaya, T., Issacson, M. (1981). "Mechanics of Wave Induced Forces on Offshore Structures", Van Nostrand Reinhold.
Army Corps of Engineers. (2002). "Coastal Engineering Manual", U.S. Army Corps of Engineers, Washington,D.C
WMO. (1988), "Guide to Wave Analysis and Forecasting", Pub. NO. 702, World Meteorological Organization, Secretariat of WMO, Geneva

Elective III: Irrigation and Drainage Engineering

Teaching Scheme
Credits: 4
Lectures: 4Hrs/week
Laboratory Work: NA

Examination Scheme
In Sem Assessment: 50 Marks
End Sem Assessment:50 Marks
Total Marks:100

Prerequisite: Fluid Mechanics at UG level including Kinematics, Dynamics, laminar and turbulent flow, differential and integral Calculus

Course Objectives:

1. To introduce students to various aspects of Irrigation and methods.
2. To impart the knowledge of Soil Water and Crop Relationship
3. To equip the students to design the lift and drip irrigation schemes.
4. To expose the students to design the Sprinkler irrigation scheme
5. To impart the knowledge of effects of water logging, salinity and its remedial measures.
6. To equip the students to design the drainage system the irrigated land

Course Outcomes:

By the end of the course, students would be able to

1. Understand the various aspects of Irrigation and methods. .
2. Understand Soil Water and Crop Relationship
3. Design the lift and drip irrigation schemes.
4. Design the Sprinkler irrigation scheme.
5. Understand effects of water logging, salinity and its remedial measures.
6. To design the drainage system the irrigated land

Unit I: Introduction (6 Hrs.)

Definition, Necessity of irrigation, Benefits of Irrigation, ill effects of irrigation. Types of irrigation systems. Classification of Irrigation methods, Factors affecting the choice of irrigation methods, quality of irrigation water. Surface and Subsurface irrigation methods, sprinkler irrigation, Micro irrigation (theory only)

Unit –II: Soil Water-Crop Relationship (6 Hrs.)

Soil classification, soil moisture and crop water Relationship, Determination of soil moisture, factors governing consumptive use of water, estimation of consumptive use and frequency of irrigation, irrigation efficiencies for economical use of water, assessmentwatercharges,conjunctiveuseofsurfaceandgroundwater,multi-cropirrigation scheduling

Unit -III: Lift Irrigation andDrip Irrigation (6 Hrs)

Lift Irrigation: General concepts, advantages, disadvantages, elements of lift Irrigation schemes, design considerations involved in intake well, jackwell, rising main, distribution systems, concept of cost economics.

Drip Irrigation:

Definition and functions,types of drip Irrigation systems, components of Drip Irrigation systems. Design and installation of drip Irrigation systems,advantages and disadvantagesof Drip Irrigation systems, operations and maintenance of Drip assembly.

Unit -IV: Sprinkler Irrigation (6 Hrs)

Sprinkler Irrigation:

Definition and introduction of Sprinkler Irrigation,, advantages and disadvantages of Sprinkler Irrigation, components of sprinkler Irrigation systems (Pumping set, desilting basin and debris screen , main and lateral pipe lines , sprinkler heads, perforated pipes, take off volves and flow control valves, fertilizer applicators), types of sprinklers, design of considerations sprinkler Irrigation systems(preparation of inventory of basic data, criteria for system layout, selection of sprinkler and its spacing, discharge capacity of the pump hydraulic design of sprinkler head, main and lateral pipe sizes)

Unit V: Salt affected land and their reclamation: (6 Hrs)

Salt accumulation in soil water, classification of salts affecting the soils and their characteristics, reclamation of saline and alkaline soils, leaching and salinity control. Water and wind erosion, design of various types of soil conservation measures.

Unit VI -Drainage of irrigated land (6 Hrs.)

Need and purpose of drainage,waterlogging of agricultural land sand itsreclamation, steady state and transientdesignsofsurface and sub-surfacedrainage systems, drainage by wells.
Soil Erosion and Conservation.

Text books:

1. Irrigation Engineering and hydraulic structures – S.R.Sahasrabudhe- Catson books, Delhi, 2014-3ed.
2. Irrigation Engineering - S. K. Garg.
3. Irrigation, Water Resources and water power engineering- Dr. P. N. ModiPubl Standard book house.

Reference books:

1. Irrigation, Michael, B.A.M., Vikas Publishing House Pvt. Ltd. New Delhi, 1990
2. Theory & design of irrigation structures Vol.I, II, III Varshney Gupta and Gupta Nemchand and brothers publication
3. Water Management – Jasapal Singh, M.S.Achrya, Arun Sharma – Himanshu Publication Press

Design of Hydraulic structures (501085 A)

Teaching Scheme
Credits: 4
Lectures: 4 Hrs/week
Laboratory Work: NA

Examination Scheme
In Sem Assessment: 50 Marks
End Sem Assessment: 50 Marks
Total Marks:100

Unit 1: Diversion Head works **(6 Hrs.)**

Weir and Barrage, Gravity and non- gravity weirs, layout of a diversion head works and its components, The diversion weirs and its types, afflux and pond level, the under sluices or scouring sluices, the divide wall, fish ladder, head sluices, silt control devices.

Unit 2: Theories of seepage and design of weirs and Barrages **(6 Hrs.)**

Failure of hydraulic structures founded on pervious foundations. Bligh's Creep theory for seepage flow, Lane's weighted Creep theory, Khosla's theory and concept of flow nets, Design of vertical drop weir on Bligh's theory, Design of modern weirs and barrages founded on permeable foundations on the basis of Khosla's theory.

Unit 3: Canal Falls **(6 Hrs.)**

Definition and location of canal falls, Types of falls, Design of a trapezoidal notch fall, Design of syphon well drop, design of simple vertical drop fall, design of Sarda type fall, design of a straight glacis fall, design of a baffle fall or Inglis fall.

Unit 4: Regulators Modules And Miscellaneous Canal Structures **(6 Hrs.)**

Canal Regulation- Canal regulation works, canal regulators, alignment of the off taking channels, Distributary head regulator and cross regulator, design of cross regulator and head regulator, Canal escapes - types of canal escapes, Metering Flumes – Types of Metering Flumes, Canal Outlets or Modules – Requirements of good Module, types of Modules, Criteria for judging the performance of modules, certain other important definitions connected with modules, types of non-modular outlets, types of semi modules or Flexible outlets, types of rigid modules, Miscellaneous Canal Structures – Cattle crossings, bed bars.

Unit 5: Cross Drainage Works **(6 Hrs.)**

Introduction, types of Cross Drainage Works, selection of suitable type of cross drainage work, various types of aqueducts and siphon aqueducts, design consideration for Cross Drainage Works, determination of maximum flood discharge, Fixing waterway requirements for aqueducts and siphon aqueducts. provision of joints and water bars in R.C.C ducts of aqueducts and super passages

Unit 6: Rivers, Their Behavior, control and training **(6 Hrs.)**

Importance of rivers and necessity of controlling them, types of rivers and their characteristics, classification of the rivers on the basis of the topography of the river basin, Indian rivers and their classifications, Behavior of rivers, straight reaches, bends, meanders, Control and training of rivers, objective of river training, classification of river training, methods of river training, problems related to the river training.

Text books:

Irrigation Engineering and hydraulic structures: S.R.Sahasrabudhe- Catson books, Delhi, 3 ed.
Irrigation Engineering and Hydraulic Structures- Garg S.K- Khanna Publishers N.D. 13th ed, 1998.
Irrigation, Water Resources and water power engineering- Dr. P. N. Modi Publ Standard book house.

Reference books:

Theory & design of irrigation structures Vol.I, II, III Varshney- Gupta and Gupta Nemchand and br others publication

Hydraulic Structures, Vol. 1. & Vol. 2- Grishin M.M- Mir Publishers, Moscow, 1982.
Water Management – Jasapal Singh, M.S.Achrya, Arun Sharma – Himanshu Publication Press
Irrigation and Water Resources Engineering- Asawa G.L- New Age International (P) Ltd. Publishers, first ed, 2005

Elective III: Basics of Climate Change Studies

Teaching Scheme
Credits: 4
Lectures: 4Hrs/week
Laboratory Work: NA

Examination Scheme
In Sem Assessment: 50 Marks
End Sem Assessment:50 Marks
Total Marks:100

Prerequisite: Fluid Mechanics at UG level including Kinematics, Dynamics, laminar and turbulent flow, differential and integral Calculus

Course Objectives:

1. To introduce students to various impacts of Climate change .
2. To impart the knowledge of basic climate change study
3. To equip the students to analyze the effect of climate variability
4. To expose the students to design different climate change models
5. To impart the knowledge of different Statistical Methods in Hydro-climatology
6. To introduce the students to ecological climatology

Course Outcomes:

By the end of the course, students would be able to

1. Understand the various impacts of Climate change .
2. Understand basics of climate change study
3. Analyze the effect of climate variability
4. Design different climate change models
5. Understand different Statistical Methods in Hydro-climatology
6. Understand the ecological climatology

Unit I: Introduction (6 Hrs.)

Introduction to hydrological cycle, green house effect, impacts of climate change.

Unit –II: Basics of Climate change study (6 Hrs.)

Basics of Climate change study: Climate, weather and Climate Change; Overview of Earth's Atmosphere; Layers of Atmosphere; Temperature, Radiation and Variation; Heat- Balance of Earth Atmosphere System; Temporal Variation of Air temperature; Temperature Change in Soil; Thermal Time and Temperature Extremes, Hydrologic cycle.

Unit -III: Climate Variability (6 Hrs)

Climate Variability: Floods, Droughts, Drought Indicators, Heat waves, Climate Extremes.

Unit -IV: Climate Change (6 Hrs)

Climate Change: Introduction; Causes of Climate Change; Modeling of Climate Change, Global Climate Models, General Circulation Models, Downscaling; IPCC Scenarios, difference between climate change and climate variability.

Unit V: Statistical Methods in Hydro-climatology (6 Hrs)

Statistical Methods in Hydro-climatology: Trend Analysis; Empirical Orthogonal Functions, Principal Component Analysis; Canonical Correlation; Statistical Downscaling with Regression

Unit VI : Ecological Climatology (6 Hrs.)

Ecological Climatology: Leaf energy fluxes and leaf photosynthesis; Plant canopies, ecosystem and vegetation dynamics; Coupled climate vegetation dynamics, Carbon cycle, Introduction to Precipitation Recycling.

Text books:

1. Bonan G. B. ,Ecological Climatology, Cambridge University Press, 2002
2. Burde, G. I., A. Zangvil, 2001: The Estimation of Regional Precipitation Recycling. Part

I: Review of Recycling Models. *J. Climate*, **14**, 2497–2508.
3. Campbell, G. G. and Norman J. M., An Introduction to Environmental, Springer, 1998

Reference books:

1. Analysis of Climate Variability -H.von storch, A.Navarra, , 2nd Edition Springer-Verlag Berlin Heidelberg New York 1999
2. Statistical Analysis in Climatic Research -Von Storch and Zwiers F W, , Cambridge, 1999
3. A Climate Modeling Primer - McGuffie, K. and Henderson-Sellers, , Wily, 2005

IPCC Assessment Report

Elective IV- INDUSTRIAL WASTEWATER TREATMENT

Teaching Scheme
Credits: 4
Lectures: 4Hrs/week
Laboratory Work: NA

Examination Scheme
In Sem Assessment: 50 Marks
End Sem Assessment:50 Marks
Total Marks:100

Prerequisite: Hydrology at UG level and basic statistics.

Course Objectives:

1. To introduce students to sources, composition, and properties of industrial wastes
2. To impart the knowledge of industrial Wastewater Treatment
3. To make students aware of Advanced Industrial Wastewater Treatment Methods
4. To introduce students to Common Effluent Treatment Plants and able to design the same
5. To make students aware of Manufacturing process and sources of effluent from the process of different industries.
6. To impart the knowledge of different methods of treatment & disposal of effluent for the different industries and its design.

Course Outcomes:

By the end of course , students would be able to

1. Identify key sources, typical quantities generated, composition, and properties of industrial wastes
2. Understand the working of industrial Wastewater Treatment
3. Understand the concept of Advanced Industrial Wastewater Treatment Methods
4. Students are able to understand the working principal of CETP and able to design the same.
5. Students should understand the Manufacturing process and sources of effluent from the process of different industries.
6. Students are able to understand the Characteristic, composition, methods of treatment & disposal of effluent and its design

Unit I - Sources of Pollution(6 Hrs.)

Physical, Chemical, Organic and Biological properties of Industrial Wastes – Differences between industrial and municipal waste waters –Effects of industrial effluents on sewers and treatment plants. Water pollution control act, organizational set up of central and state boards for water pollution control, socio-economic aspects of water pollution control.

Unit II -Wastewater Treatment(6 Hrs)

Waste minimization - Equalization - Neutralization – Oil separation – Flotation –Precipitation – Heavy metal Removal – adsorption – Aerobic and Anaerobic biological Treatment – Sequencing batch reactors – High Rate reactors.

Unit III -Advanced Treatment Methods: (6 Hrs.)

Nitrification and De-nitrification – Phosphorous removal – Heavy metal removal – Membrane Separation Process – Air Stripping and Absorption Processes

Unit IV – Common Effluent Treatment Plants (CETPs) (6Hrs.)

Common Effluent Treatment Plants (CETPs): Location, Need, Design, Operation & Maintenance Problems and Economical aspects.

Unit V -Manufacturing process (6 Hrs.)

Manufacturing process and sources of effluent from the process of industries like chemical, fertilizer, petroleum, petro -chemical, paper, sugar, distillery, textile, tannery food processing, dairy and steel manufacturing.

Unit VI -Characteristics and composition of effluent(6 Hrs.)

Characteristics and composition of effluent and different methods of treatment & disposal of effluent for

the following industries: Steel, Petroleum Refineries, Tanneries, Atomic Energy Plants and other Mineral Processing IndustriesComplete design of wastewater treatment plant of any industry listed above with all components,detai.ls, drawings and cost estimation.

Reference books

1 Waste Water Engineering Metcalf Eddy McGraw Hill Publications.
2 N.L. Nemerow, Liquid waste of Industry, Addison Wesely. 1996
3 Industrial Waste Treatment Rao&Datta
1. W. Wesley Eckenfelder Jr., Industrial Waste Water Pollution Control.
2. Arceivala, S. J., Wastewater Treatment for Pollution Control, McGraw-Hill, 1998. 21
3. Frank Woodard, Industrial waste treatment Handbook, Butterworth Heinemann, New Delhi, 2001.
4. M. N. Rao&Datta, Waste water treatment.
6. Callegly, Forster and Stafferd, Treatment of Industrial Effluent, Hodder and Stonghton. 1988
7. Hardam S. Azad, (ED), Industrial Wastewater Management Hand Book 1988.
8. Indian standards: IS: 2490 (1963), IS: 3306 (1065)

Elective IV: Solid And Hazardous Waste Management

Teaching Scheme
Credits: 4
Lectures: 4Hrs/week
Laboratory Work: NA

Examination Scheme
In Sem Assessment: 50 Marks
End Sem Assessment:50 Marks
Total Marks:100

COURSE OBJECTIVES-

Course Objectives:

1. To impart the knowledge regarding solid waste management.
2. To impart the knowledge regarding reduction of solid waste.
3. To make students aware of 3R- reduce, reuse & recycle.
4. To introduce students to various methods of solid waste disposal.
5. To impart the knowledge of waste to energy conversion.

Course Outcomes:

By the end of course , students would be able to

1. Understand the full hierarchy of solid waste management
2. Understand the importance and need of solid waste reduction.
3. Understand the importance of 3R-reduce reuse and recycle.
4. Understand the various methods and flow chart for various disposal systems.
5. Understand the knowledge of waste to energy conversion method

UNIT-I INTRODUCTION & BASIC DATA 6Hrs

Concept and dimension of third pollution survey and discussion of Generation and Characterization of solid waste (Physical, Biological and Chemical); Integrated Solid waste Management; Waste Reduction at the source, community collection methods, Critical appraisal, Rate Variation, Management options for Solid Waste.Typical values for Indian cities, Factors affecting-Storage and collection: General considerations for waste storage at source, Types of collection systems

UNIT-II COLLECTION AND CONVEYANCE SYSTEM 6Hrs

Volume reduction during and prior collection Transformations and disposal Techniques, Size reduction and classification collection management systems routing and Scheduling, Special collection problems or reuse and recycling for waste alleviation, problems of sorting and separation, types of collection system according to locality and population**.**

UNIT-IIIDISPOSAL METHODS 6Hrs

Unit operations in composting practices, Vermin-Composting, Health problems and bio-degradation, soil microbes and their influence in waste disposal, public relation and marketing problems, unit operation of sanitary land fill site selection and land use planning, design of landfills Movement and control of landfill leachate & gases. Technical and economic aspects and incinerator operations, components and unit operation for waste incinerator operation problems, high temperature

UNIT-IVSOLID WASTE SYSTEM 6Hrs

solid waste management collection and conveyance system drying and incineration systems, dewatering and conditioning systems, refuse derived fuels, land filling, Discussion of solid waste acts, resources and recovery act of other countries rate of solid waste in total environment protection necessity of public education and persuasion managed solutions to collection and disposal problems, Elements of financial management plan for solid waste system. (Including numerical)

UNIT-V WASTE TO ENERGY OPTION & LEGAL FOUNDATIONS 6Hrs

Waste to energy options: combustion (unprocessed and processed fuel),gasification, anaerobic digestion, pyrolysis.
Legal Foundation-major legislation, monitoring responsibilities, sources and types of solid waste - sampling and characterization
Definition and identification of hazardous wastes - sources and characteristics - hazardous wastes in Municipal Waste - Hazardous waste regulations -minimization of Hazardous Waste-compatibility, handling and storage of hazardous waste - collection and transport.

UNIT-VIHAZARDOUS WASTE TREATMENT TECHNOLOGIES 6Hrs

Design and operation of facilities for physical, chemical and thermal treatment of hazardous waste - Solidification, chemical fixation and encapsulation, incineration, Hazardous waste landfills: Site selection, design and operation- remediation of hazardous waste disposal sites. Sampling and characterization of Solid Wastes; TCLP tests and leachate studies

Reference books-

1) Solid Waste Management Collection :A.D. Bhide and B.B. Sudershan
2) Solid Waste Engineering Principles, Tecobanoglous G.
3) Handbook of Solid Management, Frank Kreith, McgrawHill,Inc USA
4) Solid waste Management- A practical approach by ManojDatta
5) Energy form solid waste by Jackson
6) Refuse recycling and recovery by John R. Holmes
7) Handbook of Solid Waste Management Frank Kreith, Mcgraw Hill, Inc USA
8) Hand Book Environmental Engineering Vo12, Lawrence K.Wang and Worman C. Pereira, The Human Press Clifton, New Jersey (1980)
9) Hand Book Environmental Engineering Vo1, I Liptak
10) Environmental Engineering by Peavy, Rowe Tchobanogolous
11) Manual on Solid Waste Management CPHEEO,GOI
12) Waste Management and Resource Recovery by Rhyner, Schwartz &Kohrell
13) RamachandraT.V , 2006. Management of Municipal Solid Waste , Commonwealth of Learning, Canada and Indian Institute of Science, Bangalore.
14) Gorge Techobanoglous et al "Integrated solid Waste Management" McGraw Hill Publication 1993.
5. Charles A Wentz
15) " Hazardous Waste Management "McGraw-Hill Publication 1995.

Elective IV- Environmental Impact Assessment and Management

Teaching Scheme
Credits: 4
Lectures: 4Hrs/week
Laboratory Work: NA

Examination Scheme
In Sem Assessment: 50 Marks
End Sem Assessment:50 Marks
Total Marks:100

Prerequisite:
Course Objectives:
Course Outcomes:
By the end of course , students would be able to

Unit I -Introduction (6 Hrs.)

Introduction: The Need for EIA, Indian Policies Requiring EIA , The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental clearance, Application form, Composition of Expert Committee, Ecological sensitive places, International agreements.

Unit II-Identifying Key Issues(6 Hrs)

Key Elements of an Initial Project Description and Scoping, Project Location(s), Land Use Impacts, consideration of Alternatives, Process selection: Construction Phase, Input Requirements, Wastes and Emissions, Air Emissions, Liquid Effluents, Solid Wastes, Risks to Environment and Human, Health, Socio-Economic impacts, Ecological Impacts, Global Environmental Issues.

Unit III – EIA Methodologies (6 Hrs.)

Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation & Evaluation, impact communication, Methods-Adhoc methods, Checklists methods, Matrices methods, networks methods, Overlays methods, Environmental index using factor analysis, Cost/benefit analysis, Predictive or Simulation methods. Rapid assessment of Pollution sources method, predictive models for impact assessment, Applications for RS and GIS.

Unit IV –Revewing of EIA Report (6Hrs.)

Scope, Baseline Conditions, Site and Process alternatives, Public hearing. Construction Stage Impacts, Project Resource Requirements and Related Impacts, Prediction of Environmental Media Quality, Socio-economic Impacts, Ecological Impacts, Occupational Health Impact, Major Hazard/ Risk Assessment, Impact on Transport
System,Integrated Impact Assessment.

Unit V -Review of EMP and Monitoring(6 Hrs.)

Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, Stipulating the Conditions, What should be monitored? Monitoring Methods, Who should monitor? Pre-Appraisal and Appraisal.

Unit VI - Case studies (6 Hrs.)

Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, Nuclear fuel complex, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Tannery industry

Books

1 Canter, L.W., Environmental Impact Assessment, McGraw Hill Pub. Co., 1997.
2. David P. Lawrence, Environmental Impact Assessment: Practical Solutions to Recurrent Problems, John Wiley & Sons, 2003.
3. Hosetti, B. B., Kumar Eds, A., Environmental Impact Assessment & Management, Daya Publishing House, 1998.
4. UNESCO, Methodological Guidelines for the Integrated Environmental Evaluation of Water Resources Development, UNESCO/UNEP, Paris, 1987.
5. Anjaneyulu.Y., and Manickam. V., Environmental Imapact Assessment Methodologies, B.S. Publications, Hyderabad, 2007.
6. Wathern.P., Environmental Impact Assessment- Theory and Practice, Routledge Publishers, London, 2004.

Elective IV: Advanced Water Treatment

Teaching Scheme
Credits: 4
Lectures: 4 Hrs/week

Examination Scheme
In Sem Assessment: 50 Marks End Sem Assessment:50 Marks
Total Marks:100

Unit 1: Introduction to unit operations and processes (6 Hrs.)

Physical and chemical quality of surface and sub-surface waters. Components of water supply systems; Water use and demand estimation; Design period, population data and flow rates for water supply systems; Factors affecting water consumption and variation in demand Theory and design of physicochemical unit operations: screening, sedimentation, Floatation, Coagulation, Flocculation, Filtration, Disinfection.

Unit 2: Filtration (6 Hrs.)

Filtration: General Features of Rapid Sand and Pressure Filters, Filter Media, Different Operating Parameters Affecting the Filtration Performance, Hydraulics of Filtration and Backwashing Cycles, Removal Mechanisms of Filtration, Design of Rapid Sand and Pressure Filters.

Unit 3: Adsorption and Sofeting(6 Hrs.)

Adsorption: Different Types of Adsorption, factors influencing adsorption, Adsorption Isotherms(including Numerical), Adsorption Kinetics in Batch Reactors, Breakthrough Curve and Design of adsorption column. Chemical Precipitation, Hardness Removal- Lime Soda, ion exchange, zeolite process.(Including numerical).

Unit 4: Distribution system and Network Analysis (6 Hrs.)

Planning of Water System –Selection of pipe materials, Design of rising main, water hammer analysis,Water distribution pipe networks design, and analysis- Hardy cross method, Newton Raphsons method, Linear method(including numerical); corrosion prevention ,minimization of water losses , leak detection. Theory and Design of water pumping stations.

Unit 5: Ground Water Treatment (8Hrs.)

Introduction: Definition of groundwater, role of groundwater in hydrological cycle, classification of aquifers, flow and storage characteristics of aquifers, Darcy's law, anisotropy and heterogeneity. Wells and Well Hydraulics: Different types of wells, construction of wells, steady and unsteady state solutions for confined, unconfined and leaky aquifers, effect of boundaries, method of images, pumping test analysis.Groundwater Quality: General problem of contamination of groundwater, sources, remedial and preventive measures, seawater intrusion in coastal aquifers.

Unit 6: Membrane (6 Hrs.)

Theory of Membrane separation, mass Transport Characteristics, Cross Flow filtration, Membrane Filtration, Flux and Pressure drop. Membrane Fouling, Control of Fouling, Pretreatment methods, monitoring of Pretreatment, Langlier Index, Silt Density Index, Chemical cleaning. Microfiltration principles and applications, Ultra filtration principles and applications, Nano Filtration principles and applications, Reverse Osmosis: Theory and design of modules and applications, Electro dialysis and Ion exchange Theory and design.

Text books:

Water Supply Engg by Dr. B.C.Punmia ,LaxmiPublicaiton
Water supply Engg. By S.K. Garge, Khanna Publication.
Raju, B.S.N., "Water Supply and Wastewater Engineering", Tata McGraw Hill Pvt Ltd., New Delhi.

Reference books:

Fair, G.M., Geyer J.C and Okun, Water and Waste water Engineering" Vol II, John Wiley Publications.

Weber W.J., "Physico - Chemical Processes for Water Quality Control".
Peavy, H.S., Rowe and Tchobonoglous,G., "Environmental Engineering", McGraw Hill
World Health Organization, Geneva, Guidelines for Drinking Water Quality, 3rdEdition,Volumes 1-3.
Montgomery, water treatment principles and design, Johnwiley and sons, New York..
Introduction to Environmental Engg, By. P.A. Veslind, PWS, PublishingCompany, Boston, 1997.
Bear, J., "Hydraulics of Ground Water", McGraw. 1979

Seminar II

Teaching Scheme
Credits: 1
Lectures: NA
Laboratory Work: 2Hrs/week

Examination Scheme
In Sem Assessment: NA
End Sem Assessment: NA
Oral Exam : 25 Marks
Total Marks:25

Prerequisite:

Seminar II

The student is required to deliver a seminar in first semester of second year on the topic relevant to latest trends in Water Resources and Environmental Engineering preferably on the topic of sub specialization based on the Electives selected by him/her approved by authority. The student shall submit the seminar report in standard format, duly certified for satisfactory completion of the work by the concerned guide and head of the Department/ Institute.

Intellectual Property Rights

Teaching Scheme
Credits: 1
Lectures: 1Hrs/week
Laboratory Work: NA

Examination Scheme
In semester Exam: 25 Marks

Prerequisite:

Course Objectives:Upon completion of the course students must be able to:

1. Get introduced to the concept of Intellectual property rights
2. Classify patentable and non-patentable inventions.
3. Demonstrate the understanding of IPR issues in cyber world.
4. Demonstrate the understanding of IPR with the help of case studies.

Course Outcomes:The students will be able to:

1. Define concept of Intellectual property rights.
2. Classify patentable and non-patentable inventions
3. Understand the issues of IPR in cyber world
4. Select Patents/ Designs/ Trademarks/ Copyright and analyze them through case studies.

Unit I- Introduction to IPR and Intelligent Property Issues in Cyber space(6 Hrs.)

Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright.Process of Patenting and Development: technological research, innovation, patenting, development, patenting under PCT, patent license, patentable and non-patentable inventions
Domain names and related issues, Copyright in digital media, Patents in cyber world.

Unit II –Patent Rights and Recent Developments in IPR (6 Hrs)

Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.Rights and obligations among co-inventors, co-authors, employers, and licensees.International cooperation on Intellectual Property, Administration of Patent System. New developments in IPR; IPR of Biological Systems, Traditional knowledge Case Studies

Assignments

1. Presentations on
2. Assignment on Process of patent and development
3. Assignment on detail study on inventions which were patentable and non-patentable (case study)

Reference books

1 PrabuddhaGanguly, " Intellectual Property Rights",TataMc-Graw Hill.
2 Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007
3 Robert P. Merges, Peter S. Menell, Mark A. Lemley "Intellectual Property in New"

Lab Practice II

Teaching Scheme
Credits: 3
Lectures: 6Hrs/week
Laboratory Work: NA

Examination Scheme
In Sem Assessment: NA
End Sem Assessment: NA
Oral Exam : 50 Marks
Total Marks:50

Prerequisite:

Unit I: Lab Practice II

The lab. practice-II will be based on completion of assignments / practicals / reports of site visits, confined to the courses in that semester.

The term work will consist of --

i) Visit reports of minimum two site visits, exploring the field aspects for various subjects

ii) The laboratory work report of followingexperiments.....

1. Characteristics of Hydraulic Jump in horizontal and slopingchannel
2. Velocity distribution in open channel flow using pitot tube or currentmeter
3. Assignment on open channel flow simulation software such as HEC RAS/MIKE-21
4. Numerical simulation of 1-D open channel flow usingMATLAB
5. Assignment on floodforecasting
6. Assignment on ground waterhydrology
7. Determination of DO, BOD and COD from WasteWater
8. Determination of organic nitrogen(NH_3)
9. Determination of heavy metal from Waste Water (any heavy metal)
10. Determination of phosphate andnitrate
11. Determination of pH, moisture content of solidwaste.

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Department of Civil Engineering

M.TECH SECOND YEAR - SEMESTER III

Project Management (Institute level Course)

Teaching Scheme
Credits: 3
Lectures: 3Hrs/week
Laboratory Work: NA

Examination Scheme
In Sem Assessment: 50
End Sem Assessment: Marks
Total Marks:50

Prerequisite: Basic understanding of Project Management at UG level

Course Objectives:

1. To impart knowledge of project life cycle.
2. To introduce students to Project Identification Process, Project Initiation, Pre-Feasibility Study and Project feasibility Studies,
3. To construct CPM, PERT network for a project.
4. To introduce students to Steps in Risk Management, Risk Identification, Risk Analysis and Reducing Risks
5. To introduce students to process of project Performance Measurement, Evaluation and closeout.

Course Outcomes:

By the end of the course,

1. Students should be able to understand phases of project life cycle
2. Students should be able to understand the Project Identification Process, Project Initiation, Pre-Feasibility Study and Project feasibility Studies,
3. Students should be able to construct CPM, PERT network for a project.
4. Students should be able to understand the concept of Risk Management
5. Students should be able to understand the process of project Performance Measurement, Evaluation and closeout.

Unit I: Basics of Project Management(4 Hrs.)

Introduction, Need, Project Management Knowledge Areas and Processes, Concept of Organizational Structure and types, The Project Life Cycle (prefably with case study), Essentials Project Management Principles.

Unit–II:ProjectIdentification and Selection(4 Hrs.)

Introduction, Project Identification Process, Project Initiation, Pre-Feasibility Study, Feasibility Studies, Project Break-even point. Case study is preferred

Unit -III: Project Planning(4 Hrs.)

Introduction, Need for Project Planning, Work Breakdown Structure (WBS), LOB, CPM and PERT, Network Cost System, Resource Allocation, Scheduling, Project Cost Estimate and Budgets.

Unit -IV: Project Risk Management and Quality Management(4 Hrs.)

Introduction, Risk, Risk Management, Role of Risk Management in Overall Project Management, Steps in Risk Management, Risk Identification, Risk Analysis, Reducing Risks. Introduction to Quality, Quality Concepts, ValueEngineering.Case study is preferred.

Unit V: Project Performance Measurement, Evaluation and closeout(4 Hrs.)

Introduction, Performance Measurement, Productivity, Project Performance Evaluation, Benefits and Challenges of Performance Measurement and Evaluation, Controlling the Projects. Project Close-out, Steps for Closing the Project, Project Termination, and Project Follow-up.Case study is preferred

Unit VI - Operation Research in Management(4 Hrs.)

Introduction, Operation Research as tool forDecision Support System, Overview of OR ResearchTechniques, Formulation of Linear Programming Problem, Linear Programming Models, Assumptions of Linear Programming, Graphical Method of solving LP problem.Simplex method for solving LP problem.

Text books:

1. Operations Research by Premkumar Gupta and D.S.Hira, S. Chand Publications (2014)
2. Project Management – K Nagrajan – New age International Ltd.
3. Project Management – Ahuja H.N. – John Wiely, New York.
4. Project Management-Planning and Control---Rory Burkey 4th ed.—Wiley,India.

Reference books:

1. Project Risk Management - Bruce Barkley- McGraw-Hill, 2004.

French Language

Teaching Scheme
Credits: 2
Lectures: 2Hrs/week
Laboratory Work: NA

Examination Scheme
In Sem Assessment: 50
End Sem Assessment:
Total Marks:50

Unit I: Ecole de francais, Paris (4 Hrs.)

Salutations,presentation,se presenter ,presenterquelqu'un ,les nationalites,lesproffessions,lesquestions,lesreponses,Au telephone, au revoir.

L'Alphabet,leschiffers 0 to 50, les articles define, indefini,lespresentateurs,c'est/cesont, quelquesverbes,lespronomstonique.

Unit–II:Autour de l'ecole (4 Hrs.)

Les espaces de l'ecole,communiquer en classe,rediger un employ du temps,Lesprepositions,lespluriels,l'articlecontracte,lepresentateur " Il y a" quelquesverbes,leschiffres 50 to 100 , les parfumes, la Tour Eiffel, La SNCF.

Unit -III:La vie quotidienne (4 Hrs.)

Int Les moments de la journee, la vie quotidienne,lesloisirs, envoyer un courriel,fixer un rendezvous au telephone,fixerl'heure ,l'endroit,pourune reunion, parler des prix,direl'heure,faire des projets pour la soiree.La negation,lepronoms "on",lespresentateurs "voici , voila",lepronomtonoque. Le calendrier,lesmois,l'annee,lefromage ,le vin.roduction, Need for Project Planning, Work Breakdown Structure (WBS), LOB, CPM and PERT, Network Cost System, Resource Allocation, Scheduling, Project Cost Estimate and Budgets.

Unit -IV: Unerandonnee (4 Hrs.)

Aller au pique-nique,lesendroitstouristiques,lesloisirs , demander /indiquer un chemin,demander la direction,lecorp. Le future proche,l'interrogation, les infinitifs,la questions negative,quelquesverbes.

Unit V: Au restaurant, Au supermarche(4 Hrs.)

Allimentation,faires les courses,commander au restaurant,acheter desvetementsdans un magasin.

Les articles partitifs,les expressions de quantite,lesadjectifs,l'imparfait,quelquesverbes.

Unit VI -Preparatifs d'un voyages(4 Hrs.)

Preparer un voyage, A la gare, le voyage,vocabulaire de la gare et dutrain.Lepasserecent,lefuture,lesadjectifspossessifs,lesadjectifsdemonstr atifs,quelquesverbes,lacomparaison,ilfaut

Text books:

1. Jumelage by ManjiriKhandekar
2. RupaLuktuke

Project Stage I

Teaching Scheme
Credits: 3
Lectures:
Laboratory Work: 16Hrs/week

Examination Scheme
In Sem Assessment: NA
End Sem Assessment: NA
Oral Exam : 100 Marks
Total Marks:100

Prerequisite: Fluid Mechanics at UG level including Kinematics, Dynamics, laminar and turbulent flow, differential and integral Calculus

Course Objectives:

Course Outcomes:
By the end of the course,

Project Stage I

Project Stage-I is the integral part of the dissertation project. The project should be based on the knowledge acquired by the students during the coursework and should contribute to the needs of the society. The project aims to provide an opportunity of designing and building complete system or subsystems in an area where the students like to acquire specialized skills.

The student shall complete the part of the project that will consist of problem statement, literature review: project overview, scheme of implementation (Mathematical Model/block diagram/PERT chart, etc)and Layout & Design of setup. As a part of project stage I, the student shall deliver a presentation on advancement in Technology pertaining to selected topic.

The student shall submit the report of project work completed partly in standard format approved by the University.

M.TECH SECOND YEAR - SEMESTER IV

Project Stage II

Teaching Scheme
Credits: 25
Lectures: NA
Laboratory Work: 25Hrs/week

Examination Scheme
In Sem Assessment: NA
End Sem Assessment:100Marks
Oral Exam : 100 Marks
Total Marks:200

Prerequisite:
Course Objectives:

Course Outcomes:
By the end of the course,

Project Stage II

Project Work Stage-II: In Project Work stage –II, the student shall complete the remaining part of the project which will consist of the fabrication of set up required for the project, work station, conducting experiments and taking results, analysis and validation of results and conclusions.

The student shall prepare the duly certified final report of the project work in standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute.