

Program Outcomes (POs)

- PO1:** An ability to independently carry out research /investigation and development work to solve practical problems
- PO2:** An ability to write and present a substantial technical report/document
- PO3:** Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
- PO4:** Students should be able to cope with changing technological environment to meet the challenges emanating out of Climate change and Environment

Note: Program may add up to three additional POs.

Program Educational Objectives (PEOs)

The Program Educational Objectives (PEOs) are as follows:

- PEO1:** To prepare the students as one of the problems solving engineers/technologists in water, land and environmental fields.
- PEO2:** To generate technical man power at advanced level to maintain and manage the existing infrastructure of water, land and environment of the nation.
- PEO3:** To impart technical training to the students that empowers them to withstand changing technological environment in order to cope with the natural climate change and environment.
- PEO4:** To develop the students' personality in such a manner that they become responsible citizens in the society.

M.TECH (Water and Environmental Technology - Regular)
SEMESTER-I

PROGRAMME CORE-I / 1WETPC01
SURFACE WATER HYDROLOGY

COURSE OUTCOMES

The student is expected to

- CO1:** To learn about precipitation and its measurement, analysis and interpretation.
- CO2:** Know about abstractions to rainfall, infiltration, evaporation and transpiration along with their estimation and derivation of unit hydrograph from hydrograph.
- CO3:** Gain Knowledge about floods, its estimation, combat floods and flood routing.
- CO4:** Familiarize with surface water pollution, causes, effects and remedial measures.
- CO5:** Acquire knowledge about disasters and its management, conservation of water and climate change and its impact on water resources.

PROGRAMME CORE-II/1WETPC02
GROUND WATER HYDROLOGY

COURSE OUTCOMES

The student is expected to

- CO1:** To understanding the fundamentals concepts of groundwater for its storage movement governing laws with field and laboratory estimation of hydraulic properties.
- CO2:** Derivation of flow of Water through porous media its governing equations and estimation of aquifer parameters with various types of pumping tests in tube wells and open wells.
- CO3:** Application of ground water exploration techniques by using geophysical methods such as electrical resistivity methods and seismic refraction method to explore groundwater.
- CO4:** Practicing various groundwater management techniques such as artificial recharge, conjunctive use basin management and control of sea water intrusion.
- CO5:** To understand the groundwater pollution, remediation and modeling of the aquifer with respect to flow model and transport model.

PROGRAMME ELECTIVE –I/ 1WETPE03
ADVANCED FLUID MECHANICS

COURSE OUTCOMES

The student is expected to

- CO1:** Inculcate knowledge on description of fluid motion, stream and velocity potential, their properties and applications.
- CO2:** Develop understanding on the dynamics of Ideal fluids, applications to one dimension problems and evaluate the problems on pipe bend, venturimeter and orifice meter.
- CO3:** Imbibe the equations of real fluids like Navier Stokes equation, Stokes flow and Hagen Poiseuille flow.
- CO4:** Acquire knowledge on boundary layer flow for various expressions and equation on laminar and turbulent boundary, Integral momentum and boundary layer separation.
- CO5:** Grasp the basic idea of turbulence in fluid flow.

PROGRAMME ELECTIVE –I/ 1WETPE03
WATER QUALITY MODELLING AND MANAGEMENT

COURSE OUTCOMES

The student is expected to

CO1: Become familiar with water quality standards, contamination of water along with contaminant transport mechanism.

CO2: Know about sources of water, water quality models and eutrophication.

CO3: Gain knowledge about solute transport models and contaminant transport in unsaturated flows.

CO4: Learn about different mechanisms like advection, dispersion and different models like dual porosity model and numerical models.

CO5: Acquire knowledge about water quality management, control including groundwater remediation

PROGRAMME ELECTIVE –I/ 1WETPE03
FINITE ELEMENTS IN WATER RESOURCES ENGINEERING

Course Outcomes:

Upon successful completion of course the students will be able to:

1. Ability to know about ordinary and partial differential equations and finite difference methods
2. Ability to know application of various hydrodynamic techniques to steady and unsteady flows
3. Ability to know application of finite element method to steady and unsteady flows
4. Ability to perform computer programming of these computational methods

PROGRAMME ELECTIVE –II/ 1WETPE04

WATER RESOURCES SYSTEMS ANALYSIS

COURSE OUTCOMES:

The student is expected to

CO1: To develop objective function and constraints for various water resources optimization problems.

CO2: To develop linear programming models for water resources problems by using graphical and simplex and revised simplex techniques, to carry out sensitivity analysis and post optimality analysis.

CO3: To develop and solve forward and backward recursive dynamic programming models.

CO4: To understand optimization and simulation concepts and modeling and also apply simulation techniques in water resources problems.

CO5: To understand the fundamentals of economic theory as applied to water resources.

PROGRAMME ELECTIVE –II/ 1WETPE04
RIVER BASIN MANAGEMENT

COURSE OUTCOMES

The student is expected to

CO1: To learn know about forecast of river flows, routing the flow and river confluences.

CO2: To understand river confluences and its balance, reservoir routing and aggregation of water users.

CO3: Be familiar with management of different irrigation structures, water conservation and concerned technological innovations.

CO4: Have thorough understanding of judicious water allocation for various purposes and reservoir operation.

CO5: Gain knowledge about soil erosion and sedimentation, control measures and catchment treatment.

PROGRAMME ELECTIVE –II/ 1WETPE04
WEB GIS

COURSE OUTCOMES:

The student will be able to

CO1: Comprehend basic programming including HTML & CSS to implement high quality web mapping applications.

CO2: Familiarize with the usage of Java Script for form validation of web page

CO3: Gain an understanding of the basic concepts of programming using web GIS

CO4: Have the basic knowledge of techniques to distribute, process and display geographical data in the Internet environment, and

CO5: Develop the skill for publishing the geospatial data

PROGRAMME ELECTIVE –II/ 1WETPE04
ENVIRONMENTAL ENGINEERING-I

COURSE OUTCOMES

The Student is expected to

- Estimation of design population and water demand
- Identify the water source and select proper intake structure
- Characterization of water for drinking, industry and construction
- Design of water treatment plant for a village/city
- Selection and design of an ideal distribution system

CORE/ 1A01

RESEARCH METHODOLOGY AND IPR

COURSE OUTCOMES:

Students will be able to

- CO1: Understand research problem formulation.
- CO2: Analyze research related information
- CO3: Follow research ethics
- CO4: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- CO5: Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasize the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- CO6: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

AUDIT COURSE -1/ 1A02

ENGLISH FOR RESEARCH PAPER WRITING

COURSE OUTCOMES:

Students will be able to:

- CO1: Understand that how to improve your writing skills and level of readability CO2: Learn about what to write in each section
- CO3: Understand the skills needed when writing a Title
- CO4: Ensure the good quality of paper at very first-time submission

AUDIT COURSE -1/ 1A02

DISASTER MANAGEMENT

COURSE OUTCOMES:

Students will be able to:

- CO1: Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- CO2: Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- CO3: Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflicts situations.
- CO4: Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

AUDIT COURSE -1/ 1A02
SANSKRIT FOR TECHNICAL KNOWLEDGE

COURSE OUTCOMES:

- Students will be able to
CO1: Understand basic Sanskrit language.
CO2: Understand Ancient Sanskrit literature about science & technology.
CO3: Develop logic instudents being a logical language.

AUDIT COURSE -1/ 1A02
VALUE EDUCATION

COURSEOUTCOMES:

- Students will be able to
CO1: Gain knowledge of self-development
CO2: Learn the importance of Human values
CO3: Develop the overallpersonality

LAB 1/ 1WETL05
HYDRAULICS AND HYDROLOGY LABORATORY

COURSE OUTCOMES

Students are expected to

CO1: Explore the groundwater using electrical resistivity and seismic methods.

CO2: Identify civil utility using Ground Penetrating Radar.

CO3: Determine of aquifer characters using pumping tests and well logging techniques.

CO4: Study the characteristics curves and specific energy curves.

CO5: Determine the frictional losses, coefficient of discharge and surface profiles coordinates.

LAB 2/ 1WETL06
ENVIRONMENTAL LABORATORY

COURSE OUTCOMES

Students will be able to

- CO1: Perform common environmental experiments relating to water and wastewater quality, and know which tests are appropriate for given environmental problems.
- CO2: Statistically analyze and interpret laboratorial results.
- CO3: Understand and use the water and wastewater sampling procedures and sample preservations.
- CO4: Demonstrate the ability to write clear technical laboratorial reports.
- CO5: Understand the impact of biological parameters on wastewater.

SEMESTER-II

PROGRAMME CORE-III/2WETPC07

GEOSPATIAL APPLICATIONS IN WATER RESOURCES

COURSE OUTCOMES

The Student is expected to

- CO1: Develop the knowledge on basic concepts of remote sensing, elements involved in remote sensing, its energy sources and interaction with earth's surface features and foundations of remote sensing.
- CO2: Comprehend the concepts of Geographical Information System (GIS), components of GIS, types and data structures.
- CO3: Understand how the data sets are acquired and developed, and can carry out the preprocessing of data inputs.
- CO4: Improve the learning on global positioning system (GPS), factors influencing GPS, GPS signal characteristics, mathematical model and GPS applications.
- CO5: Identify the importance of Remote sensing and GIS in various applications like water resources, drought assessment, flood plain zoning etc.

FLUVIAL HYDRAULICS

COURSE OUTCOMES

The student is expected to

- CO1: To learn about types of flows and flow profiles, varied flow analysis and computation.
- CO2: Understand dam break analysis, formation of jump on sloping channels, surges and its types.
- CO3: Know about different methods of dimensional analysis and its applications.
- CO4: Gain knowledge about different dimensionless members and their model laws and flow fields in which they are applicable, kinds of similarity and types of models and scale effect.
- CO5: Be thorough with design of alluvial channels, different theories and their relative merits and demerits.

URBAN HYDROLOGY

COURSE OUTCOMES

The student is expected to

- CO1: To know about impact of urbanization on urban runoff urban water sub systems, urban hydrologic cycle.
- CO2: Learn modeling of storm water, probabilistic and statistical approaches of analysis of storm water data.
- CO3: Understand urban drainage systems, sewers, components, design considerations, infiltration and exfiltration in sewers, field investigations and control measures.
- CO4: Be well acquainted with storm water management, monitoring run off, quantity and quality, measures to mitigate damaging effects of urban storm runoff.
- CO5: Be familiar with maintenance of urban drainage systems, pump stations, illicit connections, limitations and regulations.

PROGRAMME ELECTIVE-III/2WETPE09
ENVIRONMENTAL IMPACT ASSESSMENT

COURSE OUTCOMES

The Student is expected to

- CO1: Understand the basic concept of EIA, important steps in EIA and systematic approach for using EIA as a planning Tool for Major project activities.
- CO2: Identify the EIA methodologies and criteria for selection of EIA methodology.
- CO3: Recognize the impact of development activities and land use on soil and groundwater resources and assess the impact significance on landfills and human habitation.
- CO4: Identify and interpret the projects which create impacts on surface water environment, surface water quality, Impact significance on water resources project.
- CO5: Understand the concept of environment audit, its objective, different types of audit and experience on site activities and gain technical knowledge during the field visit to industries.

PROGRAMME ELECTIVE-IV/2WETPE10
SUSTAINABLE WATER RESOURCES DEVELOPMENT

COURSE OUTCOMES

The student is expected to

- CO1:** To know about frame work for sustainable development of water Resources keeping global water crises in view.
- CO2:** To learn virtual water, national water policy, national water mission along with the challenges in the development of sustainable development of water resources.
- CO3:** To be thorough sustainable water resources management in local, regional and global perspective including the challenges to achieve sustainable water use and management.
- CO4:** To gain knowledge regarding water economics, options for water conservation and private sector involvement in water resources management.
- CO5:** To be well versed with water act, government policies on water conservation and the measures for sustainable water resources.

PROGRAMME ELECTIVE-IV/2WETPE10
CLIMATE CHANGE ADAPTATION AND MITIGATION

COURSE OUTCOMES

The Student is expected to

- CO1: Understand the basic concept of climate change and its impacts on earth and India.
- CO2: Evaluate the climate risk for different sectors.
- CO3: Develop an adaptation plan for various sectors and prioritize the measures based on impact and cost-benefit analysis.
- CO4: Propose mitigation measures; carry out carbon emission reduction and cost benefit analysis.
- CO5: Understand the international and national policies on climate change along with sources of finance for implementing CCA and CCM measures.

PROGRAMME ELECTIVE-IV/2WETPE10
ENVIRONMENTAL ENGINEERING-II

PROGRAMME ELECTIVE-IV/2WETPE10
PYTHON SCRIPT PROGRAMMING

COURSE OUTCOMES:

The student will have exposure to

CO1: Fundamentals of PYTHON

CO2: Familiar with various elements of Python script programming, namely OOPS

CO3: Integration of Modules and regular expression in PYTHON.

CO4: Data base programming

CO5: With abovementioned background they will be able to develop small application

CONSTITUTION OF INDIA

COURSE OUTCOMES:

Students will be able to

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- CO1: Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- CO2: Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- CO3: Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- CO4: Discuss the passage of the Hindu Code Bill of 1956.

PEDAGOGY STUDIES

COURSE OUTCOMES:

Students will be able to understand:

CO1: What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?

CO2: What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?

CO3: How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

AUDIT COURSE-2/2A03
STRESS MANAGEMENT BY YOGA

COURSE OUTCOMES:

Students will be able to:
CO1: Develop healthy mind in a healthy body thus improving social healthalso
CO2: Improve efficiency

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

COURSE OUTCOMES:

Students will be able to

CO1: Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life

CO2: The person who has studied Geeta will lead the nation and mankind to peace and prosperity

CO3: Study of Neetishatakam will help in developing versatile personality of students.

GIS AND IMAGE PROCESSING LABORATORY

COURSE OUTCOMES

The Student is expected to

CO1: Identify and generate different types of maps using GIS software.

CO2: Prepare the maps for the delineated catchment area using GIS.

CO3: Carry out geometric correction of satellite data using ground control points (GCPs), and preparing mosaics of satellite images.

CO4: Generate Digital Elevation Models (DEM) and NDVI from satellite image of AOI.

CO5: Prepare Land use/land cover maps using unsupervised and supervised classification algorithms.

WATER RESOURCES MODELLING LABORATORY

COURSE OUTCOMES:

The Student is expected to

CO1: Apply the concept of geomatics for watershed analysis and rainfall-runoff modeling using SWAT.

CO2: Execute Evapotranspiration modeling using CROPWAT.

CO3: Identify harvesting structures in given area.

CO4: Priority watershed maps, flood maps including inundated areas, Surface water body maps, drought maps and their analysis.

CO5: Design the pipe distribution network and model the groundwater resources.

CORE/2WET13
MINI PROJECT WITH SEMINAR

COURSE OUTCOMES:

CO1: Students will get an opportunity to work in actual industrial environment if they opt for internship.

CO2: In case of mini project, they will solve a live problem using software/analytical/computational tools.

CO3: Study different techniques used to analyze complex systems

CO4: Students will learn to write technical reports.

CO5: Students will develop skills to present and defend their work in front of technically qualified audience.

SEMESTER-III
PROGRAMME ELECTIVE –V/3WETPE14
APPLICATION OF SOFT COMPUTING TECHNIQUES

COURSE OUTCOMES:

Upon completion of this course students will be able to:

1. List the facts and outline the different process carried out in fuzzy logic and ANN.
2. Apply Soft computing techniques to solve character recognition, pattern classification, regression and similar problems.
3. Explain the concepts of soft computing and familiar with various computing software.
4. Evaluate various techniques of soft computing to defend the best working solutions.

PROGRAMME ELECTIVE –V/3WETPE14
ADVANCED NUMERICAL METHODS

COURSE OUTCOMES:

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

- 1:** Familiarize with finite precision computation, numerical solutions of nonlinear equations in a single variable.
- 2:** Familiarize with numerical interpolation and approximation of functions, numerical integration and differentiation.
- 3:** Familiarize with numerical solution of ordinary differential equations.
- 4:** Familiarize with calculation and interpretation of errors in numerical methods

PROGRAMME ELECTIVE –V/3WETPE14
SOLID AND HAZARDOUS WASTE MANAGEMENT

COURSE OUTCOMES

The student is expected to

- CO1: To know about solid and hazardous waste transportation, environmental laws and analysis of hazardous waste.
- CO2: Learn waste recovery processes, cradle to grave concept of handling hazardous waste.
- CO3: Understand disposal of hazardous waste both on surface and underground and waste minimization and hazardous waste remediation technologies.
- CO4: Be familiar with collection transportation treatment and safe disposal of both biological and electronic waste and be conversant with reuse and recycling of wastes, recovery of by products and energy audit.
- CO5: Gain knowledge about waste land characteristics and its remediation, different kinds of pollution of soils, remediation methods.

PROGRAMME ELECTIVE –V/3WETPE14

HYDRO POWER ENGINEERING

COURSE OUTCOMES

The student is expected to

- CO1: To know about hydropower systems, types, different load studies, pondage and storage.
- CO2: Understand different intake structures, layout of a hydropower plant, penstock, design and anchorages.
- CO3: Learn about water hammer, analysis, solution of linearized equations.
- CO4: Be familiar with surge tanks, types, working, computations and stability analysis.
- CO5: Be well acquainted with power houses, arrangement, selection of type, criteria for fixing dimensions, layout of underground power houses, stability and merits.

PROGRAMME ELECTIVE –V/3WETPE14

MICRO IRRIGATION TECHNOLOGIES

COURSE OUTCOMES:

The student is expected to

- CO1: The design of an irrigation system.
- CO2: Know about design of drip and sprinkler irrigation systems.
- CO3: Understand the concepts of land scaping.
- CO4: Gain knowledge on automation and fertigation.
- CO5: Familiarize with operation and maintenance of irrigation systems.

PROGRAMME ELECTIVE –V/3WETPE14
DESIGN OF HYDRAULIC STRUCTURES

COURSE OUTCOMES:

Upon completion of this course students will be able to:

1. Enhance knowledge on various concepts of hydro power generation and types of Hydel plants.
2. Select type of hydraulic structure and estimate tidal power, capacity and water load lines throughout various hydraulic structures.
3. Perform structural design and analyze the various aspects of different hydraulic structures.
4. Be able to select the type of dam, design and to construct.

WEB DEVELOPMENT

COURSE OUTCOMES:

The students will have exposure to

CO1: Fundamentals of HTML5.

CO2: Various types of tags in HTML5.

CO3: Familiarization with CSS3.

CO4: Concepts and working knowledge in DotNet.

CO5: Concepts and creation of web services.

OPEN ELECTIVE/3WETOE15

BUSINESS ANALYTICS

COURSE OUTCOMES:

Students will be able to

CO1: Demonstrate knowledge of data analytics.

CO2: Think critically in making decisions based on data and deep analytics.

CO3: Use technical skills in predicative and prescriptive modeling to support business decision-making.

CO4: Translate data into clear, actionable insights.

OPEN ELECTIVE/3WETOE15

OPERATIONS RESEARCH

COURSE OUTCOMES:

The student should be able to

CO1: Students should be able to apply the dynamic programming to solve problems of discrete and continuous variables.

CO2: Students should be able to apply the concept of non-linear programming

CO3: Students should be able to carry out sensitivity analysis

CO4: Student should be able to model the real world problem and simulate it.

OPEN ELECTIVE/3WETOE15
ENVIRONMENTAL STATISTICS

COURSE OUTCOMES

The Student is expected to

CO1: Understand the data, sampling procedures, descriptive and inferential statistics in environmental data

CO2: Use R and MS Excel for basic statistical analysis for environmental data

CO3: differentiate discrete and continuous probabilities and its application in environmental science, carry out various test and hypothesis

CO4: use correlation, regression and analysis of various in R and Excel for interpreting environmental data and use it for decision making

CO5: Understand the concept of spatial statistics and use it for environmental data for decision making

DISSERTATION-I

DISSERTATION WORK REVIEW-I

COURSE OUTCOMES:

CO1: Students will be exposed to self-learning various topics.

CO2: Students will learn to survey the literature such as books, national/international refereed journals and contact resource persons for the selected topic of research.

CO3: Students will learn to write technical reports.

CO4: Students will develop oral and written communication skills to present and defend their work in front of technically qualified audience.

DISSERTATION WORK REVIEW-II/3WET16

COURSE OUTCOMES:

- CO1: Students will be able to use different experimental techniques.
- CO2: Students will be able to use different software/ computational/analytical tools.
- CO3: Students will be able to design and develop an experimental set up/ equipment/test rig.
- CO4: Students will be able to conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them.
- CO5: Students will be able to either work in a research environment or in an industrial environment.
- CO6: Students will be conversant with technical report writing.
- CO7: Students will be able to present and convince their topic of study to the engineering community.

Eligibility Criteria:

