NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (FIRST SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ADVANCED FLUID MECHANICS

CODE: CI41111(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

Introduction to concepts of fluid mechanics from both theoretical and applications perspective to the students. The students will have sufficient mathematical and physical background to formulate real life problems in fluid mechanics.

Course Content:

Fundamental concepts and scope. Kinematics of fluid motion. Continuity equation, rotational and irrotational motion, circulation, vorticity, velocity potential and stream function, Methods of solving Laplace's equation. Dynamics of ideal fluids, Euler's equation of motion and their integration. Viscous Laminar flow, derivation of Navier-stokes equations and their solutions for simple problems. Instability of Laminar flow. Theory of boundary layer, boundary layer approximations, Separation, Turbulent flow. Prandtl's mixing length theory, Von Karman similarity hypothesis. Turbulent flow in smooth and rough pipes, velocity equation, Resistance of smooth and artificially roughened pipes. Flow around submerged objects. Types of drag; drag at high velocities, circulation and circulation theory of lift. Compressible flow. Hydraulic models and model techniques. Open channel flow and its classification: Description and types. Energy and momentum equation for prismatic and non-prismatic open channel sections. Critical flow, its computation and application, and depth in channels. Uniform flow : Its computation and application, other uniform flow formulae, conveyance of a channel section, section factor and hydraulic exponent. Gradually varied flow:Basic assumptions, dynamic equation of gradually varied flow, flow profiles, method of singular point and transitional depth. Computation, analytical and graphical methods. Channel transitions in sub-critical and super-critical flow. Spatially varied flow : Basic principles and assumption, dynamic equation for spatially varied flow, analysis of flow profile, methods of numerical integration and the isoclinal method. Rapidly varied flow: Characteristics of the flow, hydraulic jump and jump as an energy dissipater. Flow in channels of non-linear alignment. Discharge measurement techniques in open channels.

Ordinary and partial differential equations; finite difference schemes - implicit and explicit types; method of characteristics; applications with computer programming.

Course Outcome:

The students will be able to get basic knowledge of the applicability of physical laws and it's problems in hydraulics. They will gain the skills to take up research activities involving fluid motions.

Text Book/Reference Book:

1. Maximum 4 numbers of text book/reference books with their complete details (Single Line Spacing with justified)
2. G.K. Bachelor: An introduction to fluid mechanics(Cambridge Univ. Press)
3. Hunder Rose: Advanced mechanics of fluids, 1959-Editor
4. J. O. HIntze: Turbulence (McGraw Hill – 1959)
5. J.L. Lunley: A first course in Turbulence 1972 H. Tennet

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (FIRST SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

NUMERICAL METHODS

CODE: CI40112(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

This course attempts to give a broad background of numerical methods common to various branches. The course covers solution of initial and boundary value problem for ordinary and partial differential equation using different methods. In addition, response surface methodology is discussed to establish relationship between input and output variables and the adequacy of model is tested by various techniques

Course Content:

Initial Value Problems for Ordinary Differential Equations

Single step methods: Taylor series method Euler and modified Euler methods Fourth order Runge-Kutta method for solving first and second order equations Multistep methods: Milne's and Adam's predictor and corrector methods.

Boundary Value Problems in Ordinary And Partial Differential Equations

Finite difference solution of second order, ordinary differential equation, Finite difference solution of one dimensional heat equation by explicit and implicit methods, One dimensional wave equation and two dimensional Laplace and Poisson equations.

Response Surface Method (RSM)

Approximating Response Functions, the Sequential Nature of RSM, Objectives and Typical Applications of RSM, RSM and the Philosophy of Quality Improvement, Product Design and Formulation (Mixture Problems), Robust Design and Process Robustness Studies

Statistical Models

Linear regression models, least square estimators, hypothesis testing in multiple regression, test on individual regression coefficient and group of coefficient, confidance intervals in multiple regression. Prediction of New Response Observations, Model Adequacy Checking, Residual Analysis, Scaling Residuals, Influence Diagnostics, Testing for Lack of Fit, Fitting a Second-Order Model.

Course Outcome:

At the end of this course students will be able to solve initial and boundary value problem and using response surface method they can develop linear and non-linear relationship between different inputs and output.

Text Book/Reference Book:

1. Gerald, C.F, and Wheatley, P.O, "Applied Numerical Analysis", Sixth Edition, Pearson Education Asia, New Delhi, 2002.
2. Balagurusamy, E., "Numerical Methods", Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1999.
3. Burden, R.L and Faires, T.D., "Numerical Analysis", Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.
4. Myers, R.H., Montgomery, D.C., 2002. Response Surface Methodology, Process andProduct Optimization using Designed Experiments. Second ed.. Wiley.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (FIRST SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

REMOTE SENSING & GIS APPLICATIONS IN WATER RESOURCES

CODE: CI41113(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

To teach the principles and applications of remote sensing, GPS and GIS in the context of water resources and the importance of remote sensing and GIS in solving the spatial problems in water resources.

Course Content:

Physics of remote sensing, electromagnetic radiation (EMR), Interaction of EMR with atmosphere, earth surface, soil, water and vegetation; Remote sensing platforms – Monitoring atmosphere, land and water resources - LANDSAT, SPOT, ERS, IKONOS and others, Indian Space Programme.

Satellite Data analysis - Visual interpretation – Digital image processing – Image preprocessing – Image enhancement – Image classification – Data Merging.

Definition – Basic components of GIS – Map projections and co-ordinate system – Spatial data structure: raster, vector – Spatial Relationship – Topology – Geo-database models: hierarchical, network, relational, object oriented models – Integrated GIS database -common sources of error – Data quality: Macro, Micro and Usage level components - Meta data - Spatial data transfer standards.

Thematic mapping – Measurement in GIS: length, perimeter and areas – Query analysis – Reclassification – Buffering - Neighborhood functions - Map overlay: vector and raster overlay – Interpolation – Network analysis –Digital elevation modelling. Analytical Hierarchy Process, – Object oriented GIS – AM/FM/GIS – Web Based GIS

Spatial data sources – 4M GIS approach water resources system – Thematic maps - Rainfall-runoff modelling – Groundwater modeling – Water quality modeling - Flood inundation mapping and Modelling – Drought monitoring – Cropping pattern change analysis –Performance evaluation of irrigation commands. Site selection for artificial recharge - Reservoir sedimentation.

Course Outcome:

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

Text Book/Reference Book:

1. Lillesand, T.M. and Kiefer, R.W., Remote Sensing and Image Interpretation III Edition. John Wiley and Sons, New York. 1993.
2. Burrough P.A. and McDonnell R.A., Principles of Geographical Information Systems,.Oxford University Press. New York. 1998.
3. Ian Heywood Sarah, Cornelius and Steve Carver An Introduction to Geographical Information Systems. Pearson Education. New Delhi, 2002.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (FIRST SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE I: HYDROLOGIC ANALYSIS & DESIGN

CODE: CI41131(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

Introduce the concepts of system approach to hydrological modeling. Analysis of Hydrologic time series and stochastic hydrologic models. Study types and classes of hydrologic simulation models. Design procedures used for safe and effective passage of flood flows and discuss the design methods.

Course Content:

Hydrologic System and Statistical Analysis: Hydrologic cycle – System concept – Hydrologic system Model – Classification of Hydrologic Models – Statistical, Stochastic and Deterministic Approaches – Statistical characteristics of Hydrological Data – Probability distribution of Hydrologic Variables - Correlation Analysis – Developing Prediction Equation by Simple and Multiple Linear Regression – Reliability of the Model

Hydrologic Time Series Analysis: Stochastic Process – Classification – Stationary Process – Time series – Classification – Component of Time series – Method of Investigation – Auto Correlation coefficient – Moving Average Process – Auto Regressive Process - Auto Regressive Moving Average Process - Auto Regressive Integrated Moving Average Process – Thomas Fiering Model – Box Jenkins Model – Model formulation – Parameter Estimation – Calibration and Validation – Application to hydrologic data Generation and Forecasting.

Deterministic Hydrologic Simulation: Classification of Deterministic Model – Black Box, Conceptual and Physically based Models – Rational method - Models of IUH, Nash and Chow-Kulandaiswamy Models – Lumped and Distributed Conceptual Models – Single event and Continuous Conceptual Models – Physically based Models – Model Calibration and Validation.

Design Storm and its Synthesis: Hydrologic Design Scale – Estimating Limiting Value – Hydrologic Design level – Hydrologic Design Data - Hydraulic structure Design methods - Estimation of PMP - Computation of Design Storm - IDF Relationships - Design Flows - Hydrologic Risk, Reliability and Safety Factor.

Hydrologic Design: Hydrologic Design Standard and Criteria - Design storms for Minor and Major hydraulics structures.

Course Outcome:

Students will be able to develop prediction equation between hydrologic variables using simple and multiple linear regression. Students will be able to apply the time series models in hydrologic data generation and forecasting and learn the different types and procedure for calibration and validation of deterministic simulation models.

Text Book/Reference Book:

1. V. T. Chow, David Maidment, and Larry Mays, "Applied Hydrology", McGraw Hill Publications, New York, 1995.
2. Singh, V. P. "Hydrologic Systems", Prentice-Hall Englewood Cliffs, NJ 1989.
3. Jayarami Reddy P., "Stochastic Hydrology", Laxmi Publications, New Delhi 1995.
4. Viessman W Jr and Lewis.G.L.," Introduction to Hydrology (5th ed)" Pearson Education, Inc. 2008.
5. Haan C.T., "Statistical Methods in Hydrology" Iowa State Press 2002.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (FIRST SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE I: WATER MANAGEMENT

CODE: CI41132(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

To learn how to analyze and comprehend basic principle of water resources and its planning and management.

Course Content:

Assessment of Surface and Sub-surface water resources: Hydrologic cycle, ground water resources, surface water resources, water balance, water scarcity.

Water Resources Planning: Planning Concepts and Definitions, Aim of Water Resources Planning, Levels of Water Resources Planning, Measurement of Objectives, Function and Role of Water Resources, Risk and Uncertainty, Phases of Water Resources Planning, Data Requirements for Water Resources Planning.

Water Resources Management: Functions of Water Resources Management, Water Scarcity and its impacts, Water Shortages vs. Water Resources Mmanagement, Water Resources Managementt methods. Water management policy during droughts. Integrated Water Resources Management (IWRM), Definition of IWRM, IWRM Principles.

Irrigation Water Management: Irrigation water requirement, Different types of irrigation practices, components of irrigation system, irrigation scheduling, Development of command area, prediction of effect of water shortage on agriculture crops.

Urban Water Resources Management: Urban hydrologic cycle, major problems, storm water management objectives and limitations; Urban water resources management models; urban storm water management practices; Rain water harvesting.

Course Outcome:

Studentswill be able to start developing master and strategic water resources planningto deal with water Supply/Demand issues including water demand management, reservoir storage and other structural and non-structural methods and also able to know how to implement IWRM in different regions including irrigation water management.

Text Book/Reference Book:

1. D.Whittington and G.Guariso: water management models in practice
2. Hengeveld, H. and C. De Voch.t (Ed)., Role of Water in Urban Ecology, 1982.
3. Martin, P. Wanelista and Yousef, A. Yousef., Storm Water Management, John Wiley and sons, 1993.
4. Neil S. Grigg., Urban Water Infrastructure Planning, Management and Operations, John Wiley and Sons, 1986.
5. Overtens D.E. and Meadows M.E., Storm Water Modelling, Academic Press, New York, 1976.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (FIRST SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE I: SOFT COMPUTING & SIMULATION IN WATER RESOURCES

CODE: CI41133(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

To develop skills of the students in software usage for simulation and water resources management.
To enable the students to understand application of the latest information technology to water resources engineering.

Course Content:

Computing Techniques: Computer methods in water resources - Algorithms and Flowcharts- Computing techniques - Solution to ordinary and partial differential equation using Finite difference and Method of Characteristic- Numerical integration and differentiation Design of digital models - Visual programming - Graphical user interface - Real computing - Interactive model concepts.

Artificial Intelligence: Heuristic search - Knowledge based Expert system concepts - Architecture and applications in Water Resources Management - Expert system shells - Principle of Artificial Neural Network (ANN) - Application of ANN Model to Hydrology and Crop Water Requirement model. Fuzzy Logic concepts and Applications – Genetic Algorithms

Digital Data Management: Data base structure - Data acquisition - Data warehouse - Data retrieval-Data format Attribute - RDBMS - Data analysis - Network data sharing - Statistical Analysis (SYSTAT) - Regression - factor analysis - histogram - scatter diagram - Goodness of fit.

Simulation Software In Water Resources: Surface water models (HMS) - Storm Water Management Models (SWMM) - Water CAD, STORM CAD - Ground Water Flow models - Visual Modflow.

Simulation Models In Irrigation Water Management: Soil moisture simulation models - Basin simulation models, Real time operation models - Water Resources Information System, Management Information System.

Course Outcome:

Students will be able to enhance the computational knowledge in the field of water resources systems and develop the ability to generate simulation models and use the latest intelligent technology and algorithms.

Text Book/Reference Book:

1. Aliev R. Aand Aliev Rashad Soft Computing and its Applications World Scientific Publications Co. Pvt. Ltd. Singapore, 2001.
2. Vijay P Singh, Hydrologic Systems: Rainfall Runoff Modeling, Prentice Hall, 1988.
3. John E. Gribbin, Introduction to hydraulics and hydrology with applications for Storm water Management. DELMAR, Thomson Learning, USA,2002.
4. Remson I, Hornberger G.M. and Moiz F.J., Numerical methods in Sub- Surface Hydrology. Wiley Inter Science, 1985
5. Loucks Daniel P., Jery R Stedinger and Douglas, A. Haith, Water Resources Systems Planning and Analysis. Prentice Hall Inc., Englewood Clifts, New Jersey, 1981.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (FIRST SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE I: RESERVOIR PLANNING & OPERATIONS

CODE: CI41134(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

To develop skills of the students in software usage for simulation and water resources management.
To enable the students to understand application of the latest information technology to water resources engineering.

Course Content:

Introduction:

Concept of Reservoir system-Various methodologies to planning the reservoir: Simulation-Single Objective reservoir planning-Multi objective reservoir planning-Economic Considerations in Water Resources Planning.

Reservoir systems-Deterministic Inflows:

Reservoir sizing; Reservoir capacity using Linear Programming-Reservoir operations-standard operating policies- Optimal operating policies; multi-reservoir systems policies.

Reservoir systems-Random inflow:

Basic Probability theory-Chance Constrained Linear Programming; Concept of Reliability; Stochastic Dynamic Programming.

Recent Modeling Tools:

Artificial Neural networks, Fuzzy inference Systems; Fuzzy Linear Programming, Genetic Algorithm, Particle Swarm Optimization.

Model formulation and Case studies:

Applications-Reservoir systems operated for irrigation, Hydropower, Flood Control and Municipal and Industrial Supplies; Water Quality Control in River Systems; Conjunctive use of ground and surface water; Crop yield optimization.

Course Outcome:

Students will be able to enhance the computational knowledge in the field of water resources systems and develop the abilty to generate simulation models and use the latest intelligent technology and algorithms.

Text Book/Reference Book:

1. Loucks, D.P.and Ellco Van Beek (2005) Water Resources Systems Planning and Management: An introduction to Methods, Models and Applications , UNESCO, Netherlands.
2. Vedula, S.and Mujumdar,p.p.(2005) Water Resources Systems: Modeling Techniques and Analysis; Tata McGraw Hill, New Delhi.
3. Simonovic,S.P.(2009) Managing Water Resources: Methods and Tools for a System Approach, UNESCO Publishing, France.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (FIRST SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE I: CLIMATE CHANGE AND WATER RESOURCES

CODE: CI41135(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

Understanding the climate system, being aware of the impact of climate change on society, Understanding of adaptation in relation to water and climate change, Understanding possible impacts, adaptations and remedies in relation to water resources and climate change.

Course Content:

Climate System:

Definitions- Climate, Climate system, climate change – Drivers of Climate change – Characteristics of climate system components - Greenhouse effect – Carbon cycle – Wind systems - Trade Winds and the Hadley Cell – Ozone hole in the stratosphere - El Nino, La Nina.

Impacts of Climate Change:

Precipitation (including extremes) - water vapor - Snow and land ice - Sea level – Evapotranspiration - Soil moisture - Runoff and river discharge - Patterns of large-scale variability - Influences of hydrological changes on climate - Land surface effects - Projected changes in climate.

Impacts and Responses:

Observed climate change impacts - effects due to changes in the cryosphere - Future changes in water availability and demand due to climate change - Climate-related drivers of freshwater systems in the future - Impacts of climate change on water stress in the future - Impacts of climate change on costs and other socio-economic aspects of freshwater - Freshwater areas and sectors highly vulnerable to climate change - Uncertainties in the projected impacts of climate change on freshwater systems.

Climate Change Adaptation:

Water-related adaptation to climate change in the fields of Ecosystems and biodiversity, - Agriculture and food security, land use and forestry, Human health, water supply and sanitation, infrastructure and Economy (insurance, tourism, industry and transportation) - Adaptation, vulnerability and sustainable development

Climate Change Mitigation Measures:

Sector-specific mitigation - Carbon dioxide capture and storage (CCS) , Bio-energy crops, Biomass electricity, Hydropower, Geothermal energy, Energy use in buildings, Land-use change and management, Cropland management, Afforestation and Reforestation, - Effects of water management policies and measures on GHG emissions and mitigation - Potential water resource conflicts between adaptation and mitigation - Implications for policy and sustainable development.

Course Outcome:

Students will be oriented towards the global climate change and its impact on water resources and understand the climate change phenomenon and its related issues on water, irrigation and its social implications.

Text Book/Reference Book:

1. Jan C. Van Dam, Impacts of Climate Change and Climate Variability on Hydrological Regimes, Cambridge University Press, 2003.
2. Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., 'Climate Change and Water'. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 2008.
3. IPCC Report Technical Paper VI – Climate change and water , 2008.
4. P R Shukla, Subobh K Sarma, NH Ravindranath, Amit Garg and Sumana Bhattacharya, Climate Change and India: Vulnerability assessment and adaptation, University Press (India) Pvt Ltd, Hyderabad.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (FIRST SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE I: SURFACE WATER HDROLOGY

CODE: CI41136(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

This subject aims at making the students to understand the relevance of various components of hydrologic cycle, which are responsible for spatial and temporal distribution of water availability in any region.

Course Content:

Hydrometeorology:

Hydrologic cycle – Global water budget – Practical applications – Hydrometeorology – Constituents of atmosphere – Vertical structure of the atmosphere – general circulation – Transitory system – Air mass – Air front – cyclones – Formation of precipitation – Types and forms of precipitation – Climate and Weather – Meteorological Observations.

Precipitation: Measurement of rainfall – Rain gauges – Radar Measurement of rainfall - Rainfall Hyetograph – Intensity Duration and Frequency analysis – Consistency – Missing data – Rain gauge network – Average depth of rainfall analysis – Spatial analysis using GIS

Abstractions: Water losses - Initial losses – Interception and depression storage – Evaporation – Evaporimeters – Estimation of Evaporation - Evapotranspiration – Field Measurement – Empirical Equations - Infiltration – Infiltrometers – Infiltration Equations - Infiltration Indices.

Streamflow Measurement:

Stage and Velocity Measurement – Gauges – Current meter and Doppler flow velocity meter - Discharge measurement – Area Velocity method - Area Slope method – Discharge Measuring Structures - Dilution Technique – Stage Discharge relationship – Selection of a Stream Gauging Site. .

Runoff and Water Conservation:

Concept of catchment – Linear, Areal and Relief Aspects – Detailed study of Runoff process – Factors affecting Runoff – Hydrograph – Unit Hydrograph – Synthetic Hydrograph –Runoff estimation - Strange and SCS methods – Water Conservation – Rain water and Runoff Harvesting in Rural and Urban Areas - Reservoir Sedimentation.

Course Outcome:

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

Text Book/Reference Book:

1. Chow V.T., Maidment D.R., Mays L.W., "Applied Hydrology", McGraw Hill Publications, New York, 1995.
2. Subramanya K., "Hydrology,Tata McGraw Hill Co., New Delhi, 1994.
3. Patra.K.C, "Hydrology and Water Resources Engineering", Narosa Publications, 2008, 2nd Edition, New Delhi.
4. Jeya Rami Reddy.P, "Hydrology, Laxmi Publications, New Delhi, 2004
5. Larry W. Mays, " Water Resources Engineering", Wiley Publication.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (FIRST SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE II: THEORY OF SEEPAGAE & EARTHEN DAMS

CODE: CI41141(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

To learn the basics of seepage theory and it's analysis for calculation of seepage amount and providing the necessary remedial measures in the earthen dam.

To use the basics of soil mechanics for construction and design of earthen dam.

Course Content:

Seepage analysis and treatment: Seepage analysis, pore pressure, hydraulic heads, flow net in confined and unconfined condition, flow net of earthen dam in different condition – steady seepage and drawdown, graphical method, determination of quantity of seepage, piping phenomenon, application of finite difference and finite element method, conformal mapping, method of foundation treatment to control seepage.

Earth dam: Factors influencing design of earth dam, type of dams, design criteria for various components of earth dams, filters for earth dam, filter design, requirement for the safety of earth dams, stability of earth dam slope -factor of safety, safety against overtopping.

Quality control and failure measures in earthen dam: Embankment construction procedures, quality control, Performances studies of earth dam, instrumentation, causes of failures of earth dams and corrective measures.

Course Outcome:

On completion of this course, the students should be able to draw the flow net and calculate the seepage amount for earthen dam. Students should also able to learn various methods to control the seepage, factors affecting the design of earth dams, causes of failure of earth dam and its measures.

Text Book/Reference Book:

1. Justin J. D., Hinds J. and Creager, P. W. "Engineering for Dams" Volume III, John Wiley & Sons Inc, Chapman & Hall, Ltd, London, 5th Reprint, 1955.
2. George F. Sowers, Hari Lal Sally, "Earth and Rockfill dam engineering", Asia Pub. House, 1962.
3. Harr, M.E. "Ground water and seepage" McGraw Hill Book Co., New York, 1962.
4. Alam Singh "Soil engineering in theory and practice", Volume 2, Asia Publishing House, 1981.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (FIRST SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE II: FLOOD & DROUGHT MANAGEMENT

CODE: CI41142(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

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

Course Content:

Flood Estimation and Routing:

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

Flood Control and Management:

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

Droughts:

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

Drought Assessment:

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

Drought Monitoring and Management:

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

Course Outcome:

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

Text Book/Reference Book:

1. Chow V.T., Maidment D.R., Mays L.W., Applied Hydrology, McGraw Hill Publications, New York, 1995.
2. Vijay P.Singh., Elementary Hydrology, Prentice Hall of India, New Delhi, 1994.
3. Yevjevich V., Drought Research Needs, Water Resources Publications, Colorado State University, USA, 1977.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (FIRST SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE II: WATER POWER & DAM ENGINEERING

CODE: CI41143(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

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

Course Content:

Hydroelectric Power Development:

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

Design of Hydropower Installation:

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

Types of Power House:

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

Embankment Dam Engineering:

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

Concrete Dam Engineering:

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

Course Outcome:

The students will be able to get a basic knowledge of planning and designing hydropower plants.

Text Book/Reference Book:

1. Novak, P., Moffat, A.I.B., Nalluri, C. and Narayanan, R. Hydraulic Structures Unwin Hyman Ltd., London 1989.
2. Dandekar, M.M. and Sharma, K.N. Water Power Engineering Vikas Publishing House, New Delhi 1994.
3. USBR Design of Small Dams Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi 1974.
4. Sharma, H.D. Concrete Dams Metropolitan New Delhi 1981
5. Varshney, R.S. Concrete Dams Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi 1982.
6. Varshney, R.S. Hydro Power Structures – Nem Chand Bros. Roorkee 1973 Guthrie, Brown J. (ed) Hydro Electric Engineering Practice Blackie and Son, Glasgow 1970.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (FIRST SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE II: WATER QUALITY & POLLUTION

CODE: CI41144(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

To understand the idea, methodology and basic tools of water quality modeling, understand the different modelling approaches, their scope and limitations, understand the transport of pollutants in different water bodies.

Course Content:

Water Quality:

Physical and chemical properties of water – Suspended and dissolved solids – EC and pH – Trace constituents – Principles of water quality. - Water quality investigation – Sampling design - samplers – automatic samplers - data collection platforms – Field kits and investigations – Water quality data storage, analysis and inference – Software packages.

Irrigation Water Quality:

Water quality standards – Water quality for irrigation – Salinity and permeability - Irrigation practices for poor quality water – Waste water irrigation: problems and prospects – Saline water irrigation – Future strategies - Water quality indices.

Sources of Water Pollution:

Leaching of agrochemicals – Domestic sewage – characteristics – Water pollutants from industries – Dissolved oxygen sag curve - Non Point Source (NPS) models – Agricultural Non Point Source (AGNPS) pollution model.

Water Pollution Abatement Technologies:

Flow diagram and working principle of Activated sludge process, Trickling filter – Oxidation pond – Aerated lagoons – Advantages disadvantages and suitability – Packaged treatment units, advantages, disadvantages – Reverse osmosis.

Recycling and Reuse of Wastewater:

Reuse of wastewater in agriculture – prevalence and issues from around the world – Pretreatment technologies – Removal of nutrients from treated water – Economic and social dimensions. – Constructed wetlands – reed beds.

Course Outcome:

The student will be able to understand the importance of water quality in water resources and sources of pollution and its treatment and recycling.

Text Book/Reference Book:

1. George Tchobanoglous, Franklin Louis Burton, Metcalf & Eddy, H. David Stense, Wastewater Engineering: Treatment and Reuse, McGraw-Hill, 2002.
2. Mackenzie L Davis, David A Cornwell, Introduction to Environmental Engineering, McGraw-Hill 2006.
3. Stum, M and Morgan, A., Aquatic Chemistry, Plenum Publishing company, USA, 1985.
4. Lloyd, J.W. and Heathcote, J.A., Natural inorganic chemistry in relation to groundwater resources, Oxford University Press, Oxford, 1988.
5. Newmann, E.I., Applied ecology, Blackwell Science ltd., Oxford, 1996.
6. Sithamparanathan, J., Rangasamy, A. and Arunachalam, N., Ecosystem principles and sustainable agriculture, Scitech Publishers, Chennai, 1999.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (FIRST SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE II: TECHNO ECONOMIC ANALYSIS OF WATER DEVELOPMENT

CODE: CI41145(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

To learn the basics of techno economic analysis of water development.
To learn importance of the reservoir planning, water laws and operational strategies.

Course Content:

Development Course Objectives:

Need system, economic and social development, integrated development, multiple purpose of water resource development.

Institutional Studies:

Setup for evaluation implementation, operation water laws, regulation, organizations, and functions data requirement, primary and secondary data, data related to development sectors, environment, and water resource related land and other natural resources. Elements of welfare economics, resources economics, environmental economics, definition of the project resources structure, elucidation of organization, managerial, social, technical, physical, institutional and economics dimensions. Definition of primary and secondary impact, long-term and short-term impacts, identifications of casts and benefits, evaluation research, Course Objective of post implementation, evolution, methodologies, elements of risk

Course Outcome:

On completion of this subject, the students will learn the basics of water resources development and techno economic aspects of water development.

Text Book/Reference Book:

1. James and Lae: Economics of water resource planning, McGraw Hills.
2. Kuiper: Water resource development, planning engineering and economics.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (FIRST SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

IRRIGATION & HYDRAULICS LABORATORY

CODE: CI41121(CI)	L	T	P	Credits
	0	0	3	2

TOTAL MARKS: 125; TOTAL PASS MARKS: 50% of Total Marks; MIN. PASS MARKS (ESE): 25
Teacher's Assessment: 75;End Semester Examination: 50

Course Objective:

1. To compare the result of analytical models introduced in lecture to the actual behavior of real fluid flows
2. To discuss and practice standard measurement techniques of fluid mechanics and their applications
3. To work on small design projects

LIST OF EXPERIMENT:

1. To determine the hydrostatic forces on immersed body.
2. To determine the energy losses in pipes.
3. To calculate the cavitation Number.
4. To determine the coefficient of discharge of Orifice meter & Venturimeter
5. Determination of minor losses due to sudden expansion and contraction in a pipe flow
6. To determine the surface profile and total distribution of a forced & free vortex.
7. To study laminar to turbulent flow and determine lower critical Reynolds number.
8. To estimate the discharge of an ogee spillway.
9. To determine the co-efficient of discharge of a weir.
10. To study centrifugal pump in series and parallel.
11. To study velocity distribution in pipe and to compute the discharge by integrating velocity profile.
12. To find out the co-efficient of evaporation using pan- evaporimeter.
13. To determine the depth of rainfall using rain-gauge.
14. To study the characteristics of Reciprocating Pump for variable speeds.
15. Study the characteristics of Francis turbine.

Course Outcome:

Students who successfully complete this course will have demonstrated, the ability to:

1. Compare the results of analytical models introduced in lecture to the actual behavior of real fluid flows and draw correct and sustainable conclusions.
2. Produce a working model through hands-on experience in fluid mechanics design and explain its operation in terms of what was learned in the course

Manuals/Text Book/ReferenceBook:

1. Fluid Mechanics and Machinery Laboratory-Student reference manual (online) by P.Sundara Kumar,M.Tech (PhD)
2. Experiments in Fluid Mechanics: by Singh Sarbjit , PHI Learning Pvt.Ltd.-2012
3. Fluid mechanics with engineering applications by E.John Finnemore and Joseph B.Franzini (10th Edition)
4. A textbook of fluid mechanics and Hydraulic machines by Dr.R.K. Bansal-Laxmi Publications

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (FIRST SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

REMOTE SENSING & GIS LABORATORY

CODE: CI41122 (CI) | **L T P** | **Credits**
0……0…...3 | **2**

TOTAL MARKS: 125; TOTAL PASS MARKS: 50% of Total Marks; MIN. PASS MARKS (ESE): 25
Teacher's Assessment: 75; End Semester Examination: 50

Course Objective:

1. To provide exposure to students in gaining knowledge on concepts and applications leading to modeling of earth resources management using Remote Sensing
2. To acquire skills in storing, managing digital data for planning and development
3. To acquire skills in advance software which deals various remote sensing data for making it in use

LIST OF EXPERIMENT:

1. Application of ERDAS Imagine in image processing
2. Georeferencing of toposheet and creating vector layers(ArcGIS)
3. Creation of attribute tables and layout preparation (ArcGIS)
4. Creation of Digital Elevation Model using Vertical Mapper.
5. GPS Survey and its data transformation into GIS environment.
6. Converting *.tab file to *.shp & vice versa using Universal Translator.
7. Transformation of Google files to GIS environment.
8. Creation of Theissen diagram for points using ArcGIS.
9. Use of Spatial Analyst tool in deriving flow direction, flow accumulation and watershed delineation.
10. Interpolation of point data to create Spatial Maps.
11. Overlay Analysis using ArcGIS.

Course Outcome:

1. Fully equipped with concepts, methodologies and applications of Remote Sensing Technology
2. Acquire skills in handling instruments, tools, techniques and modeling while using Remote Sensing Technology

Manuals/Text Book/ReferenceBook:

1. "Remote Sensing and GIS Integration-Theories, Methods, and Applications" by Qihao Weng, Ph.D-Mc Graw Hill Publications-2010
2. "Geographic Information System (GIS) in Water Resources Engineering" by Lynn E.Johnson, CRC Press Taylor & Francis Group-2009
3. "Getting Started with ArcGIS by ESRI"-Bob Booth and Andy Mitchell-2001

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (SECOND SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

GROUND WATER HYDROLOGY

CODE: CI41211(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

The objective of this course is to make students understand the basic empirical knowledge of the residence and movement of groundwater, as well as number of quantitative aspects.

Course Content:

Introduction:

Groundwater in Hydrologic Cycle – Occurrence of groundwater – Hydrogeology – Hydrometeorology – soil sample analysis - Water bearing materials - Types of aquifers – parameters of Aquifers – Determination of specific yield and permeability

Groundwater Hydraulics:

Groundwater Movement - Darcy's law and its limitations - Stream lines and flow net analysis – Potential flow theory – Discharge and draw down for various condition of groundwater flow - Principles of groundwater flow and its equation – Dupuit – Forchheimer assumptions – Influent and Effluent streams - Evaluation of well loss parameters – Partial penetration of wells – Interference of wells – Collector wells and Infiltration galleries.

Pumping Test Analysis:

Determining aquifer parameters for unconfined, leaky and non-leaky aquifers – steady and transient conditions - Slug test – Locating hydro geological boundaries – Image well theory – Determination of well characteristics and specific capacity of wells – Well characteristics of large diameter wells.

Well Design and Construction:

Well design criteria – Construction of wells – Well drilling methods – Filter design – Artificial and natural packing – Well castings and screens – Production test – Maintenance of production wells.

Special Topics:

Methods of artificial groundwater recharge – Groundwater assessment and balancing – Seawater intrusion in coastal aquifers – Land Subsidence - Wells in hard rock areas.

Course Outcome:

Students will be able to understand aquifer properties and its dynamics after the completion of the course. It imparts exposure towards well design and practical problems of ground water aquifers.

Text Book/Reference Book:

1. Todd D.K., Groundwater Hydrology, John Wiley & Sons, Inc, New York, 1976.
2. Bear J., Hydraulics of Groundwater, McGraw-Hill, New York, 1979.
3. Bouwer H., Groundwater Hydrology, McGraw-Hill, New York, 1978.
4. Driscoll, Groundwater and Wells, Johnson Filtration Systems, Inc., 1986.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (SECOND SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

DESIGN OF HYDRAULIC STRCUTURES

CODE: CI41212(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

The main objective of this course is to integrate the hydraulics and water resources background by involving the students in water structures design applications and also to develop understanding of the basic principles and concepts of analysis and design of hydraulic structures.

Course Content:

Introduction

An Introduction to Storage, Diversion, Conveyance and Distribution structures; Reservoirs behind dams and pond area behind barrages: determination of capacities (influence of sedimentation). Dead and Live storages.

Design of storage structures:

Spillway and Non-overflow sections and their design, Types of spillways, Flow characteristics of gated/ungated spillways, Types of energy dissipators Influence of tail water rating curve on choice of energy Dissipater, Backwater curve analysis for reservoirs.

Diversion structures:

Barrages and weirs on permeable foundations, Barrage components: Glacis, Rigid apron, Flexible (concrete block) apron, Design consideration of barrages for surface and sub-surface flows. Causes of failure, Bligh's and Lane's creep theory, Khosla's theory and method of independent variables, standard profiles, corrections, exit gradient, plotting of HGL, Design of d/s and u/s protection works, length of pucca concrete floor.

Canal structures:

Head regulator, Cross regulator and Falls, Canal section design (unlined and lined); in cutting and filling, Aqueducts; Superpassage; Syphon Aqueducts, Distribution structures for conveying water from canals to irrigation fields, Canal capacity determination from field water requirements. Design considerations for cross drainage works: Fluming the canal. Design of Channel Transition.

Course Outcome:

Students will be able to understand various types of hydraulic structures and advanced concepts for analysis and design of hydraulic structures.

Text Book/Reference Book:

1. Grishin MM: Hydraulic Structures, Vol-I & II.
2. Serge Lelliavsky: Design text book in civil engineering, Vol-I & II.
3. Punmia B.C, Pande B.B, Irrigation and Water Power Engineering, Laxmi Publications Pvt.
4. Garg S, Irrigation and Hydraulic Structures,Khanna Publishers, New Delhi.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (SECOND SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

SYSTEM ANALYSIS IN WATER RESOURCES

CODE: CI41213(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

Students will be introduced to application of systems concept to water resources planning and management. Optimization technique for modeling water resources systems and advanced optimization techniques to cover the socio-technical aspects will be taught.

Course Content:

System Concepts: Definition, classification, and characteristics of systems - Scope and steps in systems engineering - Need for systems approach to water resources and irrigation.

Linear Programming: Introduction to operations research - Linear programming, problem formulation, graphical solution, solution by simplex method - Sensitivity analysis, application to design and operation of Reservoir, Single And Multipurpose Development Plans - Case Studies.

Dynamic Programming: Bellman's optimality criteria, problem formulation and solutions - Application to design and operation of reservoirs, Single and multipurpose reservoir development plans - Case studies.

Simulation: Basic principles and concepts - Random variant and random process - Monte Carlo techniques - Model development - Inputs and outputs - Single and multipurpose reservoir simulation models - Case studies.

Advanced Optimization Techniques: Integer and parametric linear programming - Goal programming models with applications Discrete differential dynamic programming and incremental dynamic programming - Linear decision rule models with application - Stochastic dynamic programming models.

Course Outcome:

At the completion of the course the students will be able to understand the system behaviors and know how to apply the various simulation and optimization techniques to resolve the various socio-technical aspects of water resources systems.

Text Book/Reference Book:

1. Gupta P.K and Man Mohan, Problems in Operations Research (Methods and solutions). Sultan Chand and sons, New Delhi, 1995
2. Hiller F.S and Liebermann G.J., Operations Research CBS Publications and distributions. New Delhi, 1992.
3. Chaturvedi. M.C., Water Resources Systems Planning and Management. Tata McGraw Hill, New Delhi, 1997.
4. Mays L.W., and Tung YK, Hydro systems Engineering and Management. McGraw Hill Inc., New York, 1992.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (SECOND SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE III: CONSTRUCTION PLANNING AND MANAGEMENT (OPEN ELECTIVE)

CODE: CI40271(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

Construction industry is second largest job provider, next to service industry. Construction management shall equip the students with effective management tools for effectively managing construction sites.

Course Content:

Objectives and functions of project management, project feasibility reports, Planning for construction projects, Cost control in construction-importance, objectives of cost control, cost control systems. Economics of Project management, Economic analysis of engineering projects, economic studies, sensitivity analysis, Introduction to Management Information System (MIS)- definition, outline of MIS. Scheduling Job layout and Line of balance, project management through networking PERT, CPM, Importance, causes of Accidents safety measures, responsibility for safety, safety benefits to various parties. Quality control in construction: Importance, Elements of quality, Quality Assurance Techniques, Quality Control Circles. Total Quality Management in construction, Introduction, Elements of TQM, Approaches to total quality, difference between traditional management and TQM, Applications and constants of TQM in construction process. Economic analysis of engineering projects, economic studies, sensitivity analysis, Introduction to Management Information System (MIS)- definition, outline of MIS.Classification of construction equipments, earth moving equipments, hauling equipments, hoisting equipments, aggregate and concrete production equipments, pile driving equipments, time and motion studies, waiting line theory, Need for mechanisation, financing aspects, factors affecting selection of construction equipments, cost of owning and operating the construction equipment, role of operation research in equipment management, equipment maintenance.

Course Outcome:

With the knowledge of the subject and field experience, students should be able to understand various important aspects related to construction projects like phases of construction projects along with their importance. They shall be able to discharge their duties as a project manager at site. They shall be able to plan, schedule and control various construction resources like Men, materials and equipments increasing overall performance of their company.

Text Book/Reference Book:

1. Chitkara, 'Construction project management', McGraw Hills.
2. Jha, 'Construction project management', Pearson.
3. S. Seetharaman, 'Construction Engineering and Management' Umesh Publications.
4. Construction Planning Equipment and Methods – Peurify/ Schexnayder, McGraw Hill.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (SECOND SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE III: WATERSHED CONSERVATION AND MANAGEMENT

CODE: CI41231(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

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

Course Content:

Watershed Concepts:

Introduction – Significance – Geology – Soil – Morphological Characteristics – Elements – Land Capability Classification – Delineation – Codification – Factors Influencing Watershed Development

Soil Conservation Practice:

Types of Erosion – Wind Erosion: Causes, Factors, Effects and Control – Water Erosion: Types, Factors, Effects – Engineering Measures for Erosion Control in Agricultural and Non-Agricultural Lands – Estimation of Soil Loss

Water Harvesting and Conservation:

Water Harvesting Techniques – Design of Small Water Harvesting Structures – Types of Storage Structures – Yield from a Catchment – Losses of Stored Water

Watershed Management:

Strategies – Identification of Problems – Watershed Development Plan – Entry Point Activities –– Concept of Priority Watersheds – Agroforestry – Grassland Management – Wasteland Management – Watershed Approach in Government Programmes –Developing Collaborative know how – People's Participation – Evaluation of Watershed Management

Watershed Assessment Models:

Regulation and Restoration – A Brief Description and Significance of Watershed Models: SWAT, TMDL, AGNPS, BASINS, CREAMS –Case Studies

Course Outcome:

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

Text Book/Reference Book:

1. Debarry A. Paul, Watersheds, Wiley and Sons, 2004.
2. Devanport E. Thomas, Watershed Project Management Guide, Lewis Publishers, London, 2003.
3. Ghanashyam Das, Hydrology and Soil Conservation engineering, Prentice Hall of India Private Limited, New Delhi, 2000.
4. Glenn O. Schwab, Soil and Water Conservation Engineering, John Wiley and Sons, 1981.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (SECOND SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE III: RIVER ENGINEERING

CODE: CI41232(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

To understand theoretical concepts of water and sediment movements in rivers and also to inculcate the benefits of fluvial system to the society.

Course Content:

River Functions:

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

River Hydraulics:

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

Fundamental relationships for flow and transport, Diffusion and Dispersion, Transport process in Rivers, Lakes and Reservoirs, Estuaries.

River Mechanics:

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

River Surveys and Model:

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

River Management:

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

Course Outcome:

Students will be able to appreciate the complex behavior of rivers and also they will gain the skills to take up research activities in river engineering.

Text Book/Reference Book:

1. JansonPL.Ph., LvanBendegamJvanden Berg, Mdevries A. Zanen (Editors), Principles of River Engineering – The non tidal alluvial rivers – Pitman, 1979.
2. Pierre Y. Julien ., River Mechanics ,Cambridge University Press, 2002.
3. K.L Rao , INDIA's WATER WEALTH – Orient Longman Ltd., 1979
4. Mechanics of Sediment transportation and Alluvial stream problem by R.J. Garde and K.G RangaRaju – New Age Int. Publications.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (SECOND SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE III: ENVIRONMENTAL IMPACT ASSESSMENT OF WATER RESOURCES PROJECT

CODE: CI41233(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

This course is aimed to have knowledge of various issues Environmental related issues by studying the Environmental Protection Act's and Environmental Protection Rules.

Course Content:

Environmental Issues:

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

EIA Fundamentals:

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

Environmental Impacts:

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

Methods of EIA:

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

Environmental Management:

In-stream ecological water requirements - Public participation in environmental decision making – Sustainable water resources development – Ecorestoration – Hydrology and global climate change

Course Outcome:

Students will be able to fully understand the IEE and EIA Regulatory Framework as specified in EPA and EPR, and the steps and process involved in IEE and EIA and conduct IEE/EIA in a team and be familiar with the principles and procedures of EIA, tools and techniques used in identification and analysis of impacts, suggest appropriate mitigation measures and prepare environmental management plans.

Text Book/Reference Book:

1. Canter, L.W., Environmental Impact Assessment. McGraw Hill International Edition, New York. 1995.
2. Barathwal, R.R., Environmental Impact Assessment. New Age International Publishers, New Delhi. 2002.
3. Petts, J., Handbook of Environmental Impact Assessment, Vol., I and II, Blackwell Science London. 1999.
4. Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Inter Science, New Jersey. 2003.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (SECOND SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE III: WATER SUPPLY DISTRIBUTION SYSTEM AND BURIED PIPELINES

CODE: CI41234(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

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

Course Content:

Water Supply Systems:

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

Hydraulic Principles and Network Parameters:

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

Storm Water Distribution and Buried Pipes:

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

Reliability Assessment and Design:

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

Software Applications:

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

Course Outcome:

The students will be able to get a basic knowledge of the design of pipe networks and also they will be able to analyze pipe network problems using computer software.

Text Book/Reference Book:

1. Bhave P. R, Optimal design of water distribution networks, Narosa publishing House, New Delhi, 2003
2. Bajwa. G. S, Practical handbook on Public Health Engineering, Deep publishers, Shimla 2003
3. Manual on water supply and treatment, CPHEEO, Ministry of Urban Development, GOI, New Delhi, 1999
4. B.A. Hauser, practical hydraulics Hand Book, Lewis Publishers, New York, 1991

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (SECOND SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE IV: STOCHASTIC HYDROLOGY

CODE: CI41241(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

The objective of this course is to introduce the concepts of probability theory and stochastic processes with applications in hydrologic analysis and design. Modeling of hydrologic time series with specific techniques for data generation and hydrologic forecasting will be dealt with.

Course Content:

Introduction to Random Variables (RVs).
Probability Distributions.
Properties of Random Variables.
Parameter Estimation.
Commonly used Distributions in Hydrology.
Hydrologic Data Generation.
Introduction to Time Series.
Purely stochastic Models; Markov Processes.
Spectral Density; Analysis in the Frequency Domain.
Auto Correlation and Partial Auto Correlation.
Auto Regressive Moving Average Models (Box - Jenkins models - model identification; Parameter estimation ; calibration and validation; Simulation of hydrologic time series ; Applications to Hydrologic Forecasting - case studies).

Course Outcome:

The students will be to analyze hydrological and climatological data using advance statistical methods, perform quality control of data and classify types of hydrological time series, perform frequency analysis of extreme values of precipitation, floods, low flow, perform goodness-of-fit testing, stochastic modelling of hydrological processes at spatial and temporal domain.

Text Book/Reference Book:

1. Hann, C.T., "Statistical Methods in Hydrology", First East- West Press Edition, New Delhi, 1995.
2. Clarke, R.T., "Statistical Models in Hydrology", John Wiley, Chinchester, 1994.
3. Bras, R.L. and Rodriguez-Iturbe , "Random Functions and Hydrology", Dover Publications, New York, USA, 1993.
4. Jayarami Reddy: Stochastic Hydrology, Laxmi Publications, Delhi.

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (SECOND SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE IV: PLANNING, ANALYSIS AND DESIGN OF CONCRETE DAMS

CODE: CI41242(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

The aim of the course is to provide the students an overview on planning, analysis and design of concrete dams.

Course Content:

Investigation and planning for Concrete dams:

Introduction, Selection of dam site, Types of reservoir and zones of storage, Types of dam, Construction material.

Rock Mechanics and dam foundation design:

Introduction of Dam foundation investigation methods, Foundations design method, Foundation treatment, and Foundation analysis.

Gravity dams:

Dam parameters, Forces acting on dam, Types of load, Elementary Profile of gravity dam, Methods of stability analysis, Gravity analysis, Internal stress calculation.

Hollow and cored Gravity dams:

Introduction of hollow gravity dams, cored gravity dam.

Buttress Dams:

Types of buttress dams, Economical profile, and Design principle of buttress dam.

Arch Dams:

Development and layout of arch dams, Types of arch dams, Design of an arch dam.

Instrument and strain analysis: Necessity of instruments, Measurements, Instruments and planning of installation.

Course Outcome:

At the end of the course, outcomes are expected to have an overall understanding of the behavior, analysis and design for gravity dams in order to enable them to plan and direct the construction activity appropriately and also there will be a clear appreciation of how design methodology for concrete gravity dams has evolved in the recent years.

Text Book/Reference Book:

1. R.S.Varshney: Concrete Dams.
2. Justin, Hinds, Creager Et Al: Engineering for dams, Wiley Eastern.
3. Jansen, Robert B, Advanced Dam Engineering for design, construction, and rehabilitation

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (SECOND SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE IV: WATER POLICIES, LAWS AND RIGHTS

CODE: CI41243(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

To learn the basics of water law, in a context of historical development and evolving recognition of issues related to human and ecological needs of water and also to understand how the policies, laws and judicial approaches tackle the recent water issues.

Course Content:

Water Rights-Doctrines/Principles:

Introduction – Policy, Law, Bill, Act, Rules, Notifications – Nature of Rights: Natural Rights – Customary Rights – Doctrine of Riparian Rights – Doctrine of Prior Appropriation – Doctrine of Equality – Doctrine of Equitable Apportionment – Public Trust Doctrine – Doctrine of Inter-Generational Equity –Absolute Ownership Theory

Water in Indian Constitution and Other Statutes:

History of Water Laws in India: Pre-Constitutional Water Laws – Constitutional Provisions: Article 14, Article 21, Directive Principles of State Policy, Fundamental Duties, State List-Entry 17 – 73rd and 74th amendments, Article 262 – Water Conflicts and Tribunals – Post-Constitutional Water Laws – National-Level Enactments.

Water Laws-Surface Water and Groundwater:

Overview of State Acts with Case Laws: Irrigation: The Indian Easements Act – Land-Related Legislation –Tanks – Irrigation Management – Cess – Protection of Water Sources – Groundwater – Drinking and Domestic Water Supply – Industrial Use – Water Pollution – Torts and Crimes

Policies Governing Water:

National Water Policy – National-Level Commissions – Irrigation Management Transfer Policies and Activities – Legal Registration of WUAs – Legal Changes in Water Allocation, Resource Mobilization and Dispute Resolution – Role of Local Institutions – Community Based Organizations – Water Policy Reforms: India, the Philippines, Bangladesh, and Indonesia

Transnational Legal System:

International Law Commission – International Treaties and Protocols – Trans boundary Water Conflicts: Indus Waters Treaty – India-Nepal Treaty – Indo-Bangladesh Cooperation – Sharing of Nile and Mekong River Basins

Course Outcome:

Students will be able to apply knowledge in legal perspective of Water Resources Management would be strengthened. Critical analysis of water conflicts is made possible, which could reveal the gaps that need to be filled up.

Text Book/Reference Book:

1. Ali, Mohammed, George E. Radosevich and Akbar Alikhan, Water Resources Policy for Asia The Netherlands: A.A. Balkema, 1987.
2. Brewer, J., S. Kolavalli, A. H. Kalru, G. Naik, S, Ramnarayan, K.V. Raju
3. and R. Sakthivadivel, Irrigation Management Transfer In India – Policies and Performance, Oxford and IBH Publishing Company, New Delhi,1999.
4. Bruns, Bryan Randolph and Ruth S. Meinzen-Dick. Ed. Negotiating Water

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M.TECH. CIVIL (SECOND SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE IV: GROUND WATER MODELLING AND MANAGEMENT

CODE: CI41244(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

To introduce the students with the application of management models to estimate the groundwater quantity and qualities and also students will understand the inputs, system parameters, policy, variables and outputs of a groundwater management models.

Course Content:

Groundwater Prospecting:

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

Groundwater Flow Model:

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

Contaminant Transport Model:

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

Model Development:

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

Groundwater Management Model:

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

Course Outcome:

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

Text Book/Reference Book:

1. Anderson M.P., and Woessner W.W., Applied Groundwater Modelling : Simulation of flow and advective transport, Academic Press, Inc., 1992
2. Fetter C.W., Contaminant Hydrogeology, Prentice Hall, 1999
3. Rushton K.R., Groundwater Hydrology : Conceptual and Computational Models, Wiley, 2003
4. Elango L. and Jayakumar, R. Modelling in Hydrology, Allied Publishers Ltd., 2001

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (SECOND SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

ELECTIVE IV: RELIABILITY ENGINEERING (OPEN ELECTIVE)

CODE: CI40272(CI)	L	T	P	Credits
	3	1	0	4

TOTAL MARKS: 150; TOTAL PASS MARKS: 60; MIN. PASS MARKS (ESE): 40

Teacher's Assessment: 20; First Examination: 15; Second Examination: 15; End Semester Examination: 100

Course Objective:

Introduction to the concepts of uncertainty and reliability, Probability basics and random variables, Simulation techniques, Reliability analysis, Reliability-based design, System reliability, Introduction to advanced concepts.

Course Content:

General introduction to structural safety and reliability. Concept of uncertainty in reliability based analysis and design.

Random variables. Probability axioms and probability functions. Conditional probability. Common probability distributions. Correlation between random variables. Random vectors and functions of random variables.

Reliability Methods, Failure Surface & Definition of Reliability in Std. Normal Space (Cornell's Reliability Index), First Order Reliability Method (FORM) Hasofer-Lind's Definition of Reliability Rackwitz-Fiessler Algorithm Asymptotic Integral, Second Order Reliability Method (SORM).

Course Outcome:

Students will able to understand the concept related to the probability models and how to evaluate structural reliability using different methods.

Text Book/Reference Book:

1. Andrzej S. Nowak & Kevin R. Collins, "Reliability of Structures", McGrawHill.
2. R. Ranganathan, "Reliability Analysis and Design of Structures", Jaico.
3. Robert E. Melchers, "Structural Reliability Analysis and Prediction", John Wiley & Sons.
4. Haldar A &Mahadevan S. Reliability Assessment Using Stochastic Finite Element Analysis, John-Wiely& Sons Inc., New York, USA, 2000.

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M.TECH. CIVIL (SECOND SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

WATER SUPPLY ENGINEERING COMPUTATIONAL LABORATORY

CODE: CI41221(CI)	L	T	P	Credits
	0	0	3	2

TOTAL MARKS: 125; TOTAL PASS MARKS: 50% of Total Marks; MIN. PASS MARKS (ESE): 25
Teacher's Assessment: 75; End Semester Examination: 50

Course Objective:
To learn the hydraulic concepts and their relationship to water transport in treatment plants, pipelines and distribution networks.

LIST OF EXPERIMENT:

1. Design of triangular concrete channel with equal side slopes using FlowMaster.
2. Design of a network with auto design using StormCAD.
3. Design a culvert using CulvertMaster's quick calculator.
4. Computation of pond inflow using PondPack.
5. Analysis of simple distribution network of a source reservoir from which water is pumped into two-loop pipe network using EPANET.
6. Calculate the diameter of each pipe, the flow and velocity in each pipe and pressure in each node using EPANET.
7. Modelling drainage system serving a residential area using SWMM.

Course Outcome:
An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

Manuals/Text Book/ReferenceBook:

1. "Computer Application in Hydraulic Engineering" ,Bentley Institute Press ,Haestad Methods Water Solutions 2007.
2. "Storm Water Management ModelUser's Manual Version 5.1" United StatesEnvironmental ProtectionAgency

NATIONAL INSTITUE OF TECHNOLOGY RAIPUR

M.TECH. CIVIL (SECOND SEMESTER)

Specialization in

Water Resources Development & Irrigation Engineering

COMPUTER APPLICATION LABORATORY

CODE: CI41222(CI)	L	T	P	Credits
	0	0	3	2

TOTAL MARKS: 125; TOTAL PASS MARKS: 50% of Total Marks; MIN. PASS MARKS (ESE): 25
Teacher's Assessment: 75; End Semester Examination: 50

Course Objective:

To provide the keen knowledge to students about all computer applications using in water resources engineering
To make the student strong enough to deal all type of water resources problems

LIST OF EXPERIMENT:

1. To study various application of GIS in water resources.
2. To identify the locations for formulating the reservoirs within watershed.
3. To determine the availability of water in watershed.
4. To determine the peak discharge and plotting of Hydrograph.
5. To analyze the flow in river system.
6. To study the various parameters of sub-surface flow.
7. To study the Ground water flow modeling.
8. To determine the maximum floodplain encroachments.
9. To design the hydraulic structure using MATLAB approach.
10. To identify the artificial ground water recharge sites for confined and unconfined aquifers.
11. To forecast the climate data through statistical approach.

Course Outcome:

Student will be able to get full knowledge on various computer applications and their usage in water resources engineering
Student will be able to do research in various area of water resource engineering through soft computing techniques

Manuals/Text Book/ReferenceBook:

1. Getting Started with ArcGIS by ESRI"-Bob Booth and Andy Mitchell-2001
2. "US Army Corps, HEC-HMS, River Analysis- Applications Guide"- version 4.1 January 2010
3. Visual MODFLOW-Student version tutorial Guide-Online version