



Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Technology and Science
Choice Based Credit System (CBCS) in Light of NEP-2020
M.Tech. in Civil with Water Resources Engineering
(2021-2023)

COURSE CODE	CATE-GORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCE 3105(1)	DSE	Ground water Hydrology	60	20	20	0	0	3	0	0	3

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit.

***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

To learn fundamentals of groundwater flow and the hydraulics of different kinds of wells along with Conjunctive use of ground water with other fresh water sources

Course Outcomes (COs):

1. To understand the basic concepts, principles and application of the analysis and preliminary investigation of ground water resources.
2. Apply groundwater flow equations to confined and unconfined aquifers.
3. Ability to conduct groundwater well construction and design under various circumstances.
4. Able to decide on conjunctive water use, including ability to identify competing water demands, allot ground water usage according to yield of existing aquifer.

Syllabus:

UNIT I

9 Hrs.

Introduction to Ground Water Resources, Ground Water Investigations: Ground water Flow and Aquifer properties: Porosity, Specific Yield and its determination, Coefficient of storage, Permeability and Transmissibility, characteristics of aquifers, ground water exploration.

UNIT II

09 Hrs.

Well Hydraulics: Darcy's Law, volume, elasticity of aquifers, Hydrogeological boundaries, Flow from and to streams, Numerical Analysis of water levels, Drawdown, Non leaky anisotropic artisan aquifer, water table aquifer, Leaky aquifer, Boundary conditions, salt water encroachment.

UNIT III

09 Hrs.

Water Well Design and Construction: Grain size distribution curves, Production wells, Screens and Castings, Production well specifications, Production well construction, Collector wells, Open wells, Computation of Discharge from wells.

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UNIT IV

09 Hrs.

Ground Water Recharge and Runoff: Recharge by vertical leakage, Artificial Recharge, ground water models, ground water runoff.

Quality of Ground Water: Chemical analysis, Dissolved constituents and gases, Absorption and sulphate reduction, Physical and Bacterial analysis.

UNIT V

09 Hrs.

Hydrology Systems Analysis: Ground water modelling, Development and Management of Aquifers: Ground water development problems, Ground water use, ground water rights, ground water legislation, land subsidence due to ground water withdrawal.

Text Books:

1. Ground Water by Raghunath, New Age publishers; Third edition
2. Ground Water Hydrology by Todd, Wiley India Pvt Ltd; Third edition, 2011

Reference Books:

1. Ground Water by Walton, McGraw-Hill Inc
2. Analysis of pumping test data by ILRI publications

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MTCE 3105(2)	DSE	River Engineering	60	20	20	0	0	3	0	0	3	

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit.

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Course Educational Objectives (CEOs):

To learn the river dynamics and its morphology, engineering and management issues and solutions.

Course Outcomes (COs):

1. The student knows the terminology used in river engineering and understand the various physical processes in river.
2. To understand the maintenance, mechanism and operation of river.
3. Learn the mathematical analysis of river in various situations, its calibration and validation.
4. Learn the planning, management, and analysis of river flood by using remote sensing and GIS.

Syllabus:

UNIT I

09 Hrs.

Sediment Transport Processes: Incipient motion of sediment particles; Regimes of flow; Resistance to flow and velocity distribution in alluvial streams; transport of bed, suspended and total load

UNIT II

10 Hrs.

River Morphology: Plan form variations and river channel pattern; Meandering and braided stream characteristics; River equilibrium, river dynamics and adjustments to stream power
River Training Techniques: Principles of stabilisation and rectification of rivers, riverbank stability analysis, spur / groyne, stream bank armouring, guide banks, submerged vanes, porcupine and jack jetty systems, gabions; Bandalling, surface and bottom panels

UNIT III

08 Hrs.

Inland Navigation Channel Development: Fairway dimensions and maintenance, canalization, navigation locks and terminals

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UNIT IV

09 Hrs.

River Models: Mathematical modelling - types, mathematical formulation, numerical procedures, calibration and validation; Scale modelling – types, principles of similitude and dimensional analysis, model verification, limitations

UNIT V

09 Hrs.

Flood Management and Remote Sensing Applications: Flood control planning, flood plain zoning and other non – structural measures, use of satellite imageries and topo sheets for DEM generation for flood plain zone mapping

Text Books:

1. Blazejewski, R., Pilarczyk, K.W., River Training Techniques: Fundamentals, Techniques and Applications, A. A. Balkema, Rotterdam.
2. Cunge, J. A., Practical Aspects of Computational River Hydraulics, Pitman Advance Pub. Program.
3. Garde, R. J. and Rangaraju, K. G., Mechanics of Sediment Transportation and Alluvial Stream Problems, New Age International (P) Ltd. Revised Reprint 3rd Edition.

Reference Books:

1. Julien, Pierre, Y., River Mechanics”, Cambridge University Press.
2. Peterson, Margaret, S., River Engineering”; Prentice Hall.
3. Shen, H. W., “Modeling of Rivers, John Wiley and Sons.

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MTCE 3105(3)	DSE	Environmental Impact Assessment of water Resources Projects	60	20	20	0	0	3	0	0	3

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit.

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Course Educational Objectives (CEOs):

The aim of the course is to learn the National and international theory, the practical process, terminology and methods of performing an EIA of water resources projects.

Course Outcomes (COs):

At the completion of the course the students will be able

1. To understand the necessity and importance of environmental impact assessment of various water resource project.
2. Learn the list and comply with the environmental clearance procedures in India.
3. Understand environmental impact predictions, evaluation and mitigation.
4. Review, monitor and audit EIA reports for decision-making.

Syllabus:

UNIT I

09 Hrs.

Introduction: Human concern; Need for environmental impact assessment (EIA); Requirements and levels of EIA; Potential impacts of water resource development projects

UNIT II

08 Hrs.

EIA Procedure: Screening, baseline data, scoping, terms of reference (TOR) Environmental Clearance: Guidelines, acts and legislations, codes and country practices.

UNIT III

09 Hrs.

Environmental Flow: River as habitat, downstream direct and indirect uses, criteria and methods of assessment, Soil and Water Quality Management: Effect of project development on soil and water quality, water logging, soil salinity, and contamination, remedial measures

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UNIT IV

09 Hrs.

Rehabilitation: Submergence effects, rehabilitation guidelines, planning, and procedures.
Monitoring: Parameters to be monitored, frequency of monitoring, reporting procedures

UNIT V

08 Hrs.

Simulation Exercises and Case Studies on Environmental Impact Assessment of Water Resources projects.

Text Books:

1. Govt. of India, "Environmental Impact Assessment of Development Projects", Ministry of Environment and Forests.
2. Canter, L. W., "Environmental Impact Assessment", McGraw Hill
3. Govt. of India, "EIA Notification 2006", Ministry of Environment and Forest.
4. Bureau of Indian Standards, "Parameters for EIA of Water resources Project", IS 5442:2004.

Reference Books:

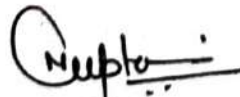
1. Charles H. Eccleston, Environmental Impact Assessment: A Guide to Best Professional Practices, CRC Press.
2. N. S. Raman, A. R. Gajbhiye, S. R. Khandeshwar, Environmental Impact Assessment, I K International Publishing House Pvt. Ltd.



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MTCE 3205(1)	DSE	Regional water Resources planning and Economic	60	20	20	0	0	3	0	0	3

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Course Educational Objectives (CEOs):

The students will be able to understand integrated water resource management based on the economical condition and nature of basin with consideration of supply and demand.

Course Outcomes (COs):

1. Global key challenges in development of IWRM
2. Principle of planning for water resource projects
3. Concept of basin economy – Economic view of water issues in project development
4. Demand and supply of water in IWRM
5. Concept international and national law in water management project.

Syllabus:

UNIT I

08 Hrs.

Context for IWRM: Water as a global issue: key challenges and needs – Definition of IWRM within the broader context of development – Complexity of the IWRM process – Examining the key elements of IWRM process.

UNIT II

09 Hrs.

Water Economics: Economic view of water issues: economic characteristics of water good and services – Nonmarket monetary valuation methods – Water economic instruments, policy options for water conservation and sustainable use – Case studies. Pricing: distinction between values and charges – Private sector involvement in water resources management: PPP objectives, PPP options, PPP processes, PPP experiences through case studies – Links between PPP and IWRM.

UNIT III

09 Hrs.

Water Supply and Health Within the IWRM Consideration: Links between water and human health: options to include water management interventions for health – Health protection and promotion in the context of IWRM – Health impact assessment of water resources development.

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UNIT IV

08 Hrs.

Agriculture In the Concept of IWRM: Water for food production: 'blue' versus 'green' water debate – Virtual water trade for achieving global water security – Irrigation efficiencies, irrigation methods and current water pricing

UNIT V

09 Hrs.

Water Legal and Regulatory Settings: Basic notion of law and governance: principles of international and national law in water management. Understanding UN law on non-navigable uses of international water courses – Development of IWRM in line with legal and regulatory framework.

Text Books:

1. Czech Thomas V., Principles of water resources: history, development, management, and policy. John Wiley and Sons Inc., New York.
2. Planning & analysis of water resources system by Loucks, Stedinger & Haith
3. Water Resources system by Vedula & Majumdar

Reference Books:

1. Water Resources Management Plan: Hagerman Fossil Beds National Monument by Idaho.
2. Designing Water Disaster Management Policies: Theory and Empirics by Chennai Gopala krishnan

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MTCE 3205(2)	DSE	Advanced Hydrological Modeling	60	20	20	0	0	.3	0	0	3

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Course Educational Objectives (CEOs):

Student will learn modeling strategies what are the methods of regional parameterization, what are the issues to be studied in using hydrological model in climate change study and coupling the hydrological model with climate model.

Course Outcomes (COs):

1. Understand the objective modelling in ground water.
2. Review numerical methods for Stream & aquifer.
3. Learn the advanced concept of channel routing.
4. Get idea of choosing structural models and its applications

Syllabus:

UNIT I

08 Hrs.

Modelling Strategies: Objectives, Choice of model, Conclusions, and prospects.

Soil Water Modelling: Simple water balance models, Complex models, Remote sensing of soil moisture model application of forestry.

UNIT II

09 Hrs.

Ground Water Modelling: Review of numerical methods, Finite difference formulation of leaky aquifers, Stream –Aquifer interaction, Finite element application to ground water modelling.

UNIT III

08 Hrs.

Lumped Catchment Models: The catchment, Lumped models, Development of conceptual model, the institute of hydrology model, Model selection criteria, Model fitting techniques, Application of conceptual model to hydrological forecasting.

UNIT IV

08 Hrs.

Variable Source Area Models: Concept, Studies of watershed process, The model VSAS 1 and VSAS 2 model.

Distributed Models: Nature of distributed models, Choice of model structure, Application of model.

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UNIT V

09 Hrs.

Advanced Concepts in Channel Routing: Empirical models, Linearized models, Hydrological models, viz. Storage routing, Muskingham, Muskingham cunge, Lag and Route, Simplified hydraulic models, Finite element models, Dynamic wave model, Routing in channel networks.

Text Books:

1. Mathematical models in hydrology by Clarke, FAO publication No. 19
2. Hydrological modeling of Watersheds by C.T. Haan, American Society of Agricultural Engineers, Michigan
3. Hydrological modeling by V.P. Singh (Vol. I & II)

Reference Books:

1. Simulation modelling and analysis (SIE) by Averill Law
2. System Modelling and Simulation by V P Singh

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MTCE 3205(3)	DSE	Finite Element Applications in Water resources	60	20	20	0	0	3	0	0	3

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Course Educational Objectives (CEOs):

To provide the fundamental concepts of the theory of the finite element method.

Course Outcomes (COs):

1. To obtain an understanding of the fundamental theory of the FEA method
2. To develop the ability to generate the governing FE equations for systems governed by partial differential equations
3. To understand the use of the basic finite elements for structural applications using truss, beam, frame, and plane elements
4. To understand the application and use of the FE method for heat transfer problems.

Syllabus:

UNIT I **08 Hrs.**
Introduction: Finite difference method (FDM), finite element method (FEM), advantages of FEM over FDM and matrix algebra.

UNIT II **09 Hrs.**
Basics of FEM: Steps, formulation of element equations, shape functions for triangular elements, load and strain displacements, stress strain relations, variational principles.

UNIT III **08 Hrs.**
Weighted Residual Methods: Collocation, sub-domain, Galerkin's and least square. Applications of FEM; Dams and seepage problems, Software Applications: Case studies, data preparation, processing and result reporting for field problems.

UNIT IV **09 Hrs.**
Shape Functions: Linear elements, element equations, iso-parametric elements, Hermite polynomial, Jacobian matrix, numerical integration, two dimensional, Lagrangian, triangular and trapezoidal elements.

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UNIT V

09 Hrs.

Solution Techniques: Axis metric problems - element equations, stiffness matrix, boundary conditions; Direct and Iterative methods, band solver and frontal solution techniques.

Text Books:

1. Desai, C. S., and Abel, J.E., "Introduction to Finite Element Method", Van Nostrand Reinhold Company.
2. Hinton, E. and Owen, D.R. J., "Finite Element Programming", Academic Press.
3. Norrie, D.H.; De Vries, G., "Introduction to Finite Element Analysis", Academic Press.

Reference Books:

1. Buchanan, Finite element Analysis (Schaum Outline S), TMH
2. Krishnamurthy, Finite element analysis, TMH)
3. Tirupathi, R. Chandrupatla and Belegundu, Ashok D. "Introduction to Finite Elements in Engineering", Pearson Education.
4. Zienkiewicz, O.C., "The Finite Element Method", McGraw Hill.

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