Shri Vaishnav Vidyapeeth Vishwavidyalaya

Master of Technology (Water Resources Engineering)

SEMESTER II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCE 3201	DCS	DESIGN OF STORAGE STRUCTURES	60	20	20	30	20	3	1	2	5

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 Objectives: The students (A) will be able to design the different Storage Structures (B) according to condition and nature of work (C) efficiently & economically (D)

Course Outcomes:

1. Explain the different Storage structures and their utilization according to the work
2. Design different Storage structures like Gravity Dam, Earth Dam, etc.
3. Identify the different theories which are required according to the field conditions
4. Design Spillways and Energy Dissipaters

Syllabus:

UNIT I

INTRODUCTION: Storage scheme and their components, Types of structures used.
RESERVOIR PLANNING AND INVESTIGATION: Review of reservoir planning and investigation aspects, Reservoir sedimentation, Measurement of sediment yield, Trap efficiency, Distribution of sediment, Life of reservoir, sedimentation control.
DAM: General, Selection of type of dam, Site selection, Economic size, Geological investigations, Engineering properties of foundations, Foundation treatment, River diversion aspects for construction of dam.

UNIT II

EARTH DAM: Introduction, Foundation for earth dams, Causes of failure, Design criteria, Prevention of embankment corrosion, Seepage through dams, Pheratic line, Stability of slopes, Seepage control through foundations, Drainage in earth dams, Selection of type of earth dam, Foundation treatment, Maintenance of earth dams.
ROCK FILL DAMS: Definition and types, Foundation requirements and treatment, Membrane cut-off, Embankment design.

UNIT III

GRAVITY DAMS: General, Profile shape, Force s acting on gravity dam and their estimation, Earthquake forces and their effects, I.S. load combination, Design concepts and criteria, Gravity method of stability analysis, Stress analysis, Internal stresses, Openings in gravity dams and stress concentration around opening, Design of galleries and shafts, Joints and keys in gravity dams, Design of high dams.

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Joint Registrar
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya

Master of Technology (Water Resources Engineering)

SEMESTER II

UNIT IV

SPILLWAYS: Need, Functioning, Capacity determination, Detailed design of ogee spillways, Introduction to design of siphon, Chute, Side channel and Shaft spillways, Considerations of side walls.

GATES AND VALVES: Types of control gates, Control valve, Spillway gates and their functioning, Introduction to design of radial gates, Introduction to design aspects of arch and

UNIT V

ENERGY DISSIPATING DEVICES: Necessity, Location and types of energy dissipaters, Hydraulic jump type and bucket type dissipaters, Design of I.S. stilling basins, Type I to IV, Design of solid and slotted roller buckets, Design of trajectory bucket type of dissipaters.

Text Books:

1. Concrete dams by R.S. Varshnay
2. Earth & Rock fill dams by Bharat Singh & H.D. Sharma
3. Irrigation Engineering by Raghunath

Reference Books:

1. Concrete dam by H.D. Sharma
2. Hand book of dam design by Golze

List of Practical's:

1. Detailed drawing of various structural systems as per the syllabus.

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Joint Registrar
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya

Master of Technology (Water Resources Engineering)

SEMESTER II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCE 3202	DCS	WATER RESOURCES SYSTEM ENGINEERING	60	20	20	30	20	3	1	2	5

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 Objective The students (A) will be able to design the different Water Resources System (B) according to condition and nature of work (C) efficiently & economically (D)

Course Outcomes:

1. Explain the Concept and components of a water resources system.
2. Design and analysis of problem in water resources engineering
3. Review and analysis of various Mathematical programming techniques
4. Design and optimization analysis of Reservoir components
5. Analysis of Reservoir operation problems and Flood control problem

Syllabus:

UNIT I

INTRODUCTION: Introduction to water resources planning, Concept of a system, Terminology and Definition of terms, Need of system analysis of water resources problems, System approach, Characteristics of system analysis applications.

PROBLEM IN WATER RESOURCES ENGINEERING: Development problem, Design problem, Operational problems, Statistical application, stochastic processes and water storage, Storage control problems.

Evolution of time streams of benefits and coasts, Project sizing interest and discount rate, Determination of net economic benefit discounting technique, Cost estimation procedures, Basic investment, Timing problem.

UNIT II

MATHEMATICAL PROGRAMMING TECHNIQUES: Review of various Mathematical programming techniques viz. Method of Lagrangian multipliers, linear programming, Dynamic programming, Integer programming, Goal programming, Simulation and search methods.

Introduction, The Monte Carlo method, Generation of synthetic stream flow data, Case studies.

UNIT III

DETERMINISTIC RIVER BASIN MODELING: Reservoir capacity, Determination, Mass diagram analysis, Sequent peak analysis, Optimization analysis, Capacity expansion problem using integer programming and Dynamic programming models.

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Joint Registrar
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya

Master of Technology (Water Resources Engineering)

SEMESTER II

UNIT IV

Reservoir operation problem, Deterministic and Stochastic D.P. model, Reservoir storage yield models, Flood control problem, Modal synthesis, Case Studies.

UNIT V

Model for optimal cropping pattern, Irrigation planning modal, Resources inputs, Crop diversification, Annual costs, Annual net income and net benefits, Irrigation operation model, Case studies.

Text Books:

1. Planning & analysis of water resources system by Loucks, Stedinger & Haith
2. Stochastic water resources technology by N.T. Kottegoda
3. Water Resources system by Vedula & Majumdar

Reference Books:

1. Planning & Analysis of Water Resources Systems by Loucks, Stedinger & Haith.
2. Stochastic Water Resources Technology by N.T. Kottegoda.
3. Water Resources Systems by Vedula & Majumdar.

List of Practical's:

1. Detailed drawing of various structural systems as per the syllabus.

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Joint Registrar
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya

Master of Technology (Water Resources Engineering)

SEMESTER II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	Th	T	P	CREDITS
MTCE 3203	DCS	STOCHASTIC HYDROLOGY	60	20	20	0	0	3	1	0	4

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 Objectives: The students (A) will be able to analyses and solve problems stochastic hydrology (B) according to condition and nature of work (C) efficiently & economically (D)

Course Outcomes:

1. Explain the Concept and terminologies of stochastic hydrology.
2. Design and analysis of concepts of probability and probability distribution.
3. Estimation of parameters for probability distribution
4. Testing of hypothesis and analysis of various confidence intervals
5. Analysis of hydrologic time series and spectral analysis
6. Analysis of autoregressive modeling, and their limitations.

Syllabus:

UNIT I

INTRODUCTION: Definition and terminologies, Stochastic and time series models, Characteristics of annual periodic, Multi-Variate and intermittent hydrologic time series.

PROBABILITY AND STATISTICS: Basic concepts of probability and probability distribution, Samples and population, Properties of random variables, Moments and expectations for univariate distribution random variables, Tendency, Peakedness, Moments of expectations for jointly distributed random variables.

UNIT II

PROBABILITY DISTRIBUTION: Discrete probability distributions viz. Binomial, Poisson, Exponential distributions, Continuous probability distribution viz. Normal, Lognormal, Extreme value type 1 and 3, Pearson, Log Pearson type 3 and Gamma distributions.

PARAMETER ESTIMATION: General methods of parameter estimation, Method of moments, Maximum likelihood, Probable weighted moment method.

UNIT III

CONFIDENCE INTERVALS AND HYPOTHESIS TESTING: Confidences interval, Mean and Variance of normal distribution, One side confidence intervals, Hypothesis testing for different cases, Chi-Square goodness of fit test, The Kolmogorov-Smirnov test, D-Index test.

UNIT IV

TIME SERIES MODELLING: Analysis of hydrologic time series, Cross correlation, Serial

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Joint Registrar
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore

correlation, Variance and Covariance, Spectral Analysis, First order Markov process, Multi site Markov model.

UNIT V

Autoregressive modelling, First and second order models for annual and on of periodic time series, Description of ARMA modelling of annual and periodic time series, Limitations, Auto regressive integrated moving average modelling of time series, Multiplicative ARIMA modelling of periodic time series, Pre-Treatment of historical data model selection and application.

Text Books:

1. Stochastic hydrology by Rani Raddy
2. Statistical methods in hydrology by C.T. Haan
3. Hydrologic time series modeling by Sales & Delleur

Reference Books:

1. Frequency & risk analysis by G.W. Kile
2. Frequency analysis, NIH publication

Shri Vaishnav Vidyapeeth Vishwavidyalaya

Master of Technology (Water Resources Engineering)

SEMESTER II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCE 3204	CD	WATER MANAGEMENT	60	20	20	0	0	3	1	0	4

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 Objectives:
The students (A) will be able to identify the different techniques of water management and apply the best techniques of allocation (B) according to condition and nature of work (C) efficiently & economically (D)

Course Outcomes:

1. Explain the different techniques of water management and its utilization according to the work
2. Analyze the on farm development procedure for irrigation purpose
3. Analyze various irrigation scheduling and find the best suited system
4. Identify the best suited irrigation water application method
5. Access the quality of irrigation water

Syllabus:

UNIT I
INTRODUCTION: General, surface water sources, Ground water sources, Need for planned utilization of water resources, Economics of water resources utilization.
IRRIGATION REQUIREMENT: Soil water plant atmospheric relationship, Irrigation efficiency, Water requirements of field crops, Evapo-transpiration, Effective rainfall, Field capacity and its determination, Wilting coefficient, Crop planning, Cropping pattern, Criteria for irrigation scheduling.

UNIT II
ON FARM DEVELOPMENT: Introduction, On farm development, Land consolidation, Water courses pipe system, Field drains, Land grading and field layout, Maintenance of water courses. Planning for release of water in conveyance system, Method of water measurement, Weirs, Parshall flume, Orifices and metergates, Tracer method.

UNIT III
IRRIGATION SCHEDULING: Delivery system, Delivery by rotation, Continuous supply, Rotation planning, Operation of canals and branches, Night irrigation, Improvement in irrigation efficiencies, Diversion scheme.

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Joint Registrar
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya

Master of Technology (Water Resources Engineering)

SEMESTER II

UNIT IV

WATER APPLICATION METHOD: Evaluation of basic variables and Efficiencies in irrigation methods, Border irrigation, Check basin irrigation, Furrow irrigation, Sprinkler irrigation, Drip irrigation, Sub-Surface method.

DRAINAGE: Introduction, Surface, Sub-Surface and vertical drainage, Conjunctive use of ground and surface water.

UNIT V

QUALITY OF IRRIGATION WATER: Introduction, Quality of water from different sources, Estimation of Quality parameters for irrigation water and their suitability, Management of irrigation with saline water, Choice of crops and varieties, Use of manures and fertilizers.

Operation and management of water courses and drainage channels, Gated structures, Tail escapes.

Text Books:

1. Irrigation Engg. By A.M. Michael
2. Crop water requirements FAO publication No. 24
3. Yield response to water FAO publication No. 39

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Joint Registrar
Shri Vaishnav Vidyapeeth
Vishwavidyalaya Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya

Master of Technology (Water Resources Engineering)

SEMESTER II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	Th	T	P	CREDITS
MTCE 3205	DCS	REGIONAL WATER RESOURCES PLANNING & ECONOMIC	60	20	20	-	-	3	1	-	4

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 Objectives: The students (A) will be able to understand integrated water resource management (B) based on the economical condition and nature of basin (C) with consideration of supply and demand (D)

Course Outcomes:

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

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

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

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.

UNIT IV

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Joint Registrar
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya

Master of Technology (Water Resources Engineering)

SEMESTER II

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

WATER LEGAL AND REGULATORY SETTINGS: Basic notion of law and governance: principles of international and national law in the area of 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. 2003.
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 Chennat Gopala krishnan

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Joint Registrar
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya

Master of Technology (Water Resources Engineering)

SEMESTER II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	Th	T	P	CREDITS
MTCE 3206	DCS	ADVANCED HYDROLOGICAL MODELING	60	20	20	-	-	3	1	-	4

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 Objectives: Student will learn modeling strategies (A)what are the methods of regional parameterization, (B) what are the issues to be studied in using hydrological model in climate change study (C) and coupling the hydrological model with climate model(D)

Course Outcomes:

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

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

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

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

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.

UNIT V

ADVANCED CONCEPTS IN CHANNEL ROUTING: Empirical models, Linearized models,

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Joint Registrar
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya

Master of Technology (Water Resources Engineering)

SEMESTER II

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
3. Hydrological modeling by McCuen
4. 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

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Joint Registrar
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya

Master of Technology (Water Resources Engineering)

SEMESTER II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCE 3207	DCS	FINITE ELEMENT APPLICATIONS IN WATER RESOURCES	60	20	20	0	0	3	1	0	4

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

Course Outcomes:

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
Introduction: Finite difference method (FDM), finite element method (FEM), advantages of FEM over FDM and matrix algebra.

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

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

UNIT V
Solution Techniques: Axis metric problems - element equations, stiffness matrix, boundary

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Joint Registrar
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore

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. 1972.
2. Hinton , E. and Owen, D.R. J., "Finite Element Programming", Academic Press. 1977
3. Norrie, D.H.; De Vries, G., "Introduction to Finite Element Analysis", Academic Press. 1978
4. Tirupathi, R. Chandrupatla and Belegundu, Ashok D. "Introduction to Finite Elements in Engineering", Pearson Education. 2002
5. Zienkiewicz, O.C., "The Finite Element Method", McGraw Hill.

Reference Books:

1. Buchanan, Finite element Analysis (schaum Outline S), TMH
2. Krishnamurthy, Finite element analysis, TMH)

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Joint Registrar
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore