



**Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore**  
**Choice Based Credit System (CBCS) in Light of NEP-2020**  
**M. Tech (Common for all Engineering branches)**  
**(2021-2023)**

COURSE CODE	CATEGORY	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*					
MTRM301	AECC	Research Methodology in Engineering	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 Educational Objectives (CEOs):**

1. The course has been developed with orientation towards research related activities and recognizing the ensuing knowledge as property.
2. To analyze and evaluate research works and to formulate a research problem to pursue research.
3. To develop skills related to professional communication and technical report writing.

**Course Outcomes:**

At the end of the course, students will demonstrate their ability to:

1. Understanding and formulation of research problem.
2. Apply quantitative and qualitative methods used in engineering research.
3. Analyze interpret and evaluate data that relate to engineering problems.
4. Develop skills related to professional communication, technical report writing and publishing papers.
5. Act professionally, autonomously, ethically and in teams to produce a professional product.

**Syllabus**

**Unit-I**

**Introduction to Research Methodology:** - An overview of Research process, Types of research; Approaches to research, Importance of criticism in Literature review, identifying research gaps; Formulation of research problem; Research design,

**Data:** Primary and secondary data-sources, advantages/disadvantages; Sampling and primary data collection, sampling size, random and structured sampling

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#### Unit-II

**Measurement and Scaling Techniques:** - Types of scales, Criteria for good measurement, Attitude measurement - Likert's scale, Semantic differential scale, Thurstone-equal appearing interval scale.

**Statistical Tools for Data Analysis:** - Measure of central tendency, Measures of dispersion, Correlation and Regression, Formulation of hypothesis, Type I & Type II error, Parametric test, non-parametric test.

#### Unit-III

**Research Methods I** - Use of computer software in research and understanding the limitations. Multi-attribute decision making methods, Data envelopment analysis, Grey relational analysis etc., Multidisciplinary research problems, Synthesis of disciplinary research findings; Reliability and sensitivity analysis.

#### Unit-IV

**Research Methods II** - Modeling and simulation of engineering problem; Mathematical modeling-formulation, calibration, validation, application; measurement design – validity, reliability, scaling and sources of error. Mathematical programming methods, Numerical analysis, Optimization techniques, Design of laboratory experiments and field tests.

#### Unit-V

**Academic Writing Skills and Presentation** - Layout of a Research paper, research report, Thesis structure, Impact factor of Journals, Ethical issues related to publishing, Plagiarism and Self-Plagiarism. Reference Management Software like Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism. Guidelines on how to write research papers. Content of Poster presentation, Power point presentation, Oral presentation

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**Text Books -**

1. C.R. Kothari, 2012. Research Methodology Methods and Techniques, 3/e, Vishwa Prakashan,
2. Montgomery, Douglas C., 2007. Design and Analysis of Experiments (Wiley India).
3. Chawla, D. and Sodhi, N., 2011. Research methodology: Concepts and cases. Vikas Publishing House.

**Reference:**

1. Donald H.McBurney, "Research Methods", 5th Edition, Thomson Learning, ISBN: 81-315-0047.
2. Donald R. Cooper, Pamela S. Schindler, "Business Research Methods", 8/e, Tata McGraw-Hill Co. Ltd.,
3. Timothy J. Ross, "Fuzzy Logic with Engg Applications", , Wiley Publications, 2nd Ed[d]
4. Thiel D.V. "Research Methods for Engineering", Published by Cambridge University Press, UK
5. P.J. van Laarhoven & E.H. Aarts, "Simulated Annealing: Theory and Applications" (Mathematics and Its Applications).

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MTCE 3201	DCC	Design of Storage Structures	60	20	20	30	20	2	0	2	3

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**Course Educational Objectives (CEOs):**

The students will be able to design the different Storage Structures according to condition and nature of work efficiently & economically

**Course Outcomes (COs):**

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**

**06 Hrs.**

**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.

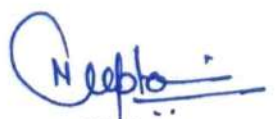
**UNIT II**


**06 Hrs.**

**Earth Dam:** Introduction, Foundation for earth dams, Causes of failure, Design criteria, Prevention of embankment corrosion, Seepage through dams, Phreatic 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.

  
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**UNIT III**

**05 Hrs.**

**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.

**UNIT IV**

**06 Hrs.**

**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**

**06 Hrs.**

**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. Varshney, Oxford & IBH Publishing Co. Pvt. Ltd.
2. Earth & Rock fill dams by Bharat Singh & H.D. Sharma, Sarita Prakashan
3. Irrigation Engineering by Raghunath, Wiley, 2011

**Reference Books:**

1. Concrete dam by H.D. Sharma, Central Board of Irrigation and Power
2. Hand book of dam design by Golze, Van Nostrand Reinhold Company

**List of Practical:**

Detailed drawing of various structural systems as per the syllabus.

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MTCE 3202	DCC	Water Resources System Engineering	60	20	20	30	20	2	1	2	4

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\***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):**

The students will be able to design the different Water Resources System according to condition and nature of work efficiently & economically.

**Course Outcomes (COs):**

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 problems

**Syllabus:**

**UNIT I**

**09 Hrs.**

**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 costs, Project sizing interest and discount rate, Determination of net economic benefit discounting technique, Cost estimation procedures, Basic investment, Timing problem.

**UNIT II**

**08 Hrs.**

**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.

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MTCE 3202	DCC	Water Resources System Engineering	60	20	20	30	20	2	1	2	4

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**UNIT III**

**08 Hrs.**

**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.

**UNIT IV**

**09 Hrs.**

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

**UNIT V**

**08 Hrs.**

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. Murthy V.N.S. Advanced Foundation Engineering Geotechnical Engineering Series, CBS
2. Planning & analysis of water resources system by Loucks, Stedinger & Haith, Prentice Hall

**Reference Books:**

1. Stochastic Water Resources Technology by N.T. Kottegoda, Palgrave Macmillan
2. Water Resources Systems by Vedula & Majumdar, Tata McGraw-Hill Education

**List of Practical:**

Detailed drawing of various structural systems as per the syllabus.

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MTCE 3203	DCC	Stochastic Hydrology	60	20	20	0	0	2	1	0	3	

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**Course Educational Objectives (CEOs):**

The students will be able to analyses and solve problems stochastic hydrology according to condition and nature of work efficiently & economically.

**Course Outcomes (COs):**

At the end of the course the student will be able to:

1. Analyse hydrologic data
2. Perform frequency analysis of hydrologic extremes
3. Apply multivariate analysis in hydrologic systems
4. Analyse hydrologic time series
5. Develop models for synthesis of hydrologic variables

**Syllabus:**

**UNIT I**

**07 Hrs.**

**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**

**08 Hrs.**

**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.

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**UNIT III**

**08 Hrs.**

**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**

**09 Hrs.**

**Time Series Modelling:** Analysis of hydrologic time series, Cross correlation, Serial correlation, Variance and Covariance, Spectral Analysis, First order Markov process, Multi site Markov model.

**UNIT V**

**08 Hrs.**

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. Haan T. C., Statistical Methods in Hydrology, East West Publishers
2. Kotteguda, N.T., Stochastic Water Resources Technology, The Macmillan Press, New York,

**Reference Books:**

1. Kotteguda, N.T., and Resso, R., Statistics, Probability and Reliability for Civil and Environmental Engineers, Blackwell Publishing, UK
2. Rajib Maity, Statistical Methods in Hydrology and Hydroclimatology, Springer Nature Singapore Pte Ltd., 2018

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MTCE 3204	DCC	Irrigation Water Management	60	20	20	0	0	2	1	0	3

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**Course Educational Objectives (CEOs):**

The students will be able to identify the different techniques of water management and apply the best techniques of allocation according to condition and nature of work efficiently & economically.

**Course Outcomes (COs):**

At the completion of the course the students will be able

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**

**07 Hrs.**

**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**

**08 Hrs.**

**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 meter gates, Tracer method.

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### UNIT III

**08 Hrs.**

**Irrigation Scheduling:** Delivery system, Delivery by rotation, Continuous supply, Rotation planning, Operation of canals and branches, Night irrigation, Improvement in irrigation efficiencies, Diversion scheme.

### UNIT IV

**09 Hrs.**

**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

**08 Hrs.**

**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. Majumdar, D.K., Irrigation Water Management, Prentice Hall of India, New Delhi, 2000
2. Michael, B.A.M., Irrigation, Vikas Publishing House Pvt. Ltd. New Delhi.
3. Murthy, V.V.N., Land and Water Management Engineering, Kalyani Publishers, Ludhiana.

### Reference 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

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