Shri Rawatpura Sarkar University, Raipur

Examination Scheme & Syllabus

for

M.Tech.(Water Resource Engineering)

Semester-I

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the Session: 2022-23)

Shri Rawatpura Sarkar University, Raipur, Chhattisgarh

Faculty of Engineering

Two Years M.Tech. Programme

Scheme of Teaching and Examination

M.Tech. First Semester Water Resource Engineering

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2022-2023)

S. No.	Course Code	Course Title	L	T	P	Credits	Continuous Evaluation	Sem End Exam	Total	Sem End Exam Duration (Hrs)
1	MENWR101T	Advanced Computational Methodology	3	1	-	4	30	70	100	3
2	MENWR102T	Advanced Hydrology	3	1	-	4	30	70	100	3
3	MENWR103T	Advanced Hydraulics	3	1	-	4	30	70	100	3
4	MENWR104T	Computational & Soft Computing Techniques	3	1	-	4	30	70	100	3
5	MENWR105T	Elective-I	3	1	-	4	30	70	100	3
6	MENWR106P	Water Resources Engineering Lab	-	-	2	1	15	35	50	-
7	MENWR107P	Environmental Engineering Lab	-	-	2	1	15	35	50	-
Total Contact Hr Per Week: 24			**Total Credit: 22**			**Grand Total Marks:**			**600**	

L: Lecture   T: Tutorial   P: Practical

Elective-I

S.NO.	Course Title
1	Hydropower Engineering
2	Basics of Microbiology & Biotechnology
3	Integrated Water Resources Management & Water Harvesting

M.Tech.(Water Resource Engineering)
Semester-I
2022-23

Course Title	Advanced Computational Methodology			
Course Code	MENWR101T			
Course Credits	**L**	**T**	**P**	**TC**
	3	**1**	**-**	**4**
Prerequisites	Engineering Mathematics –I & II			

Course Objectives	**This course will enable students to:-** • Represent the problems mathematically. • Optimize the solution • Analyze the result numerically and linguistically by fuzzy theory. • Emphasize the meaning and purpose of these techniques and their use in solving Engineering Problems.
Course Contents	**UNIT-I** **Graph Theory And Its Application** Basic Terminology. Simple graph. Multi graph, Types of graph .Path .Cycles Eulerian and Hamiltonian graph. Shortest path problem Representation of graph. Trees and their properties. Spanning Tree. Binary Tree. Tree traversal. **UNIT-II** **Fuzzy Sets And Its Application** Fuzzy sets-Basic definitions, α-level sets. Convex fuzzy sets. Basic operations on fuzzy sets. Types of fuzzy sets. Cartesian products, Algebraic products. Bounded sum and difference, t-norms and t-conorms. The Extension Principle- The Zadeh's extension principle. Image and inverse image of fuzzy sets. Fuzzy numbers. Elements of fuzzy arithmetic. **UNIT III** **Cryptography And Its Application** Introduction to the Concepts of Security: The need for security, Security Approaches, Principles of Security, Types of Attacks. Cryptographic Techniques: Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Steganography, Key Range and Key Size, Possible Types of Attacks. DES, RSA, Digital Signature.

	UNIT IV
	Statistical Analysis
	Expectation and variance of random variable. Sampling Distribution. Testing a Hypothesis. Level of significance. Confidence limits. Test of significance for large sample. Central limit theorem. Test of significance for means of two large samples. Sampling Variables-small samples. Student t-distribution, Chi-square test.
	UNITV
	Optimization Techniques
	Dynamic Programming-Deterministic and Probabilistic Dynamic programming. Inventory- Basic characteristics of an inventory system. The Economic order quantity. Deterministic models. Network analysis (PERT/ CPM).
Course Outcomes	**After the completion of course:-** • This is the foundation of research and development in the computational domain of engineering and technology. • As the prerequisite, this will be traced the thought and ideas to design the behavioral tools over the engineering range.
Text Books	1. Calculus of Variations with Applications, Gupta, A.S.-Prentice Hall of India(P)Ltd., New Delhi, 6th print,2006 2. Introduction to Partial Differential Equations, Sankar Rao, .K. - Prentice Hall of India(P) Ltd., New Delhi, 5th print,2004 3. Advanced Engineering Mathematics Jain. R. K, Iyengar .S.R.K.-,Narosa publications 2nd Edition,2006 4. Numerical Methods in Science and Engineering, Grewal, B.S-Kanna Publications, New Delhi. 5. Numerical Methods, Kandasamy. P, Thilagavathy. K and Gunavathy, K-S Chandand Co., Ltd., New Delhi, 5th Edition,2007 6. Theory and problems of Complex Variables with an Introduction to Conformal Mapping and Its applications , Schaum's outline series, Spiegel, M.R-McGraw Hill BookCo.,1987
Reference Books	1. Multi - Objective Optimization Using Evolutionary Algorithms, K. Deb (2003) John Wiley 2. Applied Statistics & Probability for Engineers: Montgomery, Douglas C. & Runger, George C. (2007), 3/e, Wiley India. 3. Parallel distributed processing Vol.1 (1986) Rumelhart, D.E and McClelland, J.L., M I T Press, 1986. 4. Fuzzy logic implementation and applications (1996), Patyra, M. J. and Mlynek Wiley.

M.Tech.(Water Resource Engineering)
Semester-I
2022-23

Course Title	Advanced Hydrology			
Course Code	MENWR102T			
Course Credits	**L**	**T**	**P**	**TC**
	3	**1**	**-**	**4**
Prerequisites	Basic Knowledge Of Hydrology, Open Channel Flow And River Engineering.			
Course Objectives	**This course will enable students to:-** • Understand hydrological processes and apply knowledge for analysis.			
Course Contents	**UNIT I** **The Hydrologic Processes** Precipitation, evaporation, ET, Infiltration, groundwater, and stream flow. Hydrologic measurements and networks. **UNIT II** **Analysis Of Discrete And Continuous Hydrologic Data** Statistical Including Frequency Analysis, Correlation, And Regression Analysis And Multivariate Analysis, Time Series Analysis And Its Applications. **UNIT III** **Hydrograph Analysis Design Storm and its Synthesis** Unit hydrograph, Synthetic Unit Hydrograph and IUH. 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. **UNIT IV** Flood forecasting methods, flood protection and flood plain zoning. Real Time flood forecasting &warning system Atmosphere Phenomenon, WMO standard, Introduction to climate change. **UNIT V** Flood routing methods, Reservoir routing and Channel routing, Hydrologic routing and Hydraulic routing (Muskingum method).			
Course Outcomes	**After the completion of course:-** • Apply the knowledge in the real field situations related to hydrological			

	analysis and modeling
Text Books	1. Chow V T, Maidment David R. and Mays Larry W. "Applied Hydrology", McGraw Hill International editions, New Delhi, 1988. 2. Mutreja K.N. "Applied Hydrology" Tata McGraw-Hill Publishing company Ltd., New Delhi, 1990. 3. Subramanya K, Engineering Hydrology, Third Edition - Tata McGraw-Hill Publishing company Ltd., New Delhi, 2015. 4. Singh Vijay. P, Elementary Hydrology Prentice Hall, INDIA, 1992. 5. Ojha C S P, Bhunya P and Berndtsson P, "Engineering Hydrology" Oxford University Press, Canada, 2008.
Reference Books	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.

M.Tech.(Water Resource Engineering)
Semester-I
2022-23

Course Title	Advanced Hydraulics			
Course Code	MENWR103T			
Course Credits	**L**	**T**	**P**	**TC**
	3	**1**	**-**	**4**
Prerequisites	Basic Knowledge Of Fluid Mechanics And Open Channel Flow			
Course Objectives	**This course will enable students to:-** • Analysis of different types of flow in open channel and Numerical analysis of open channel.			
Course Contents	**UNIT I** Laminar and Turbulent boundary layers, BL on a flat plate, Karman's momentum integral equation, Karman - Pohlhausen's approximate equation, Flow under adverse pressure gradient, turbulent BL over smooth and rough surfaces, Analysis of BL control. **UNIT II** **Turbulent Flow** Reynolds Equations, Semi empirical theories of turbulence, Mixing length, vorticity transport, Karman's similarity theory flow in diverging channels. **UNIT III** Gradually varied flow, Classifications and Computations of Free surface profiles, Hydraulics of Confluence of channels. **UNIT IV** Spatially varied flow, Supercritical flows and Oblique flows, Rapidly varied flow, Hydraulic jump. **UNIT V** Continuity and Dynamic equations of Unsteady flow, Wave propagation and Surge, Method of Characteristics, Finite Difference Method.			
Course Outcomes	**After the completion of course:-** • Apply knowledge in analysis of boundary layer flow, open channel flow and unsteady flow.			
Text Books	1. Garde R. J, Turbulent flows, Wiley, 1994 2. Rouse H., Fluid Mechanics for Hydraulic Engineers , Dover Pub., New york,			

	1961
	3. Schlisting H, Gersten K., Boundary layer theory,8th edition, Springer Publication,2000
	4. Fox &Mc Donald, Introduction to Fluid Mechanics, , John Wiley 2013.
	5. Chaudhary Hanif M., Open Channel flow, Prantice-Hall of India Pvt. Ltd. New Delhi, 1993.
Reference Books	1. Chow V T, Open Channel Hydraulics, McGraw-Hill Book company, International editions, NewDelhi,1973.
	2. Subrmanya K, Flow in open channels, Second edition, Tata McGraw-Hill Publishing Company Ltd.,New Delhi, 2001
	3. Srivastava Rajesh, Flow through open channels, Oxford University press, New Delhi, 2008.

M.Tech.(Water Resource Engineering)
Semester-I
2022-23

Course Title	Computational & Soft Computing Techniques				
Course Code	**MENWR104T**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**Basic Knowledge of Soft Computing Methods**.				
Course Objectives	**This course will enable students to:-** • Educate the students to know about computing techniques • Develop the different numerical technique and logic like ANN, Fuzzy • Educate the students on aspects data management • Develop the model Applications for monitoring and management of Environment				
Course Contents	**UNIT I** **Computing Principles** Introduction to Computing techniques –Algorithms and Flowcharts, Numerical methods -Solution to ordinary and partial differential equation using Finite difference and Finite element method , Numerical integration and differentiation, Design of digital models for Environmental applications. **UNIT II** **Artificial Intelligence** Knowledge based Expert system concepts -Principle of Artificial Neural Network (ANN) –Neural Network Structure –Neural Network Operations –ANN Algorithm -Application of ANN Model to Environmental field –Genetic Algorithms **UNIT III** **Fuzzy Logic** Fuzzy sets, fuzzy numbers, fuzzy relations, fuzzy measures, fuzzy logic and the theory of uncertainty and information; applications of the theory to inference and control, clustering, and image processing -Network analysis models. **UNIT IV** **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.				

	UNIT V **Environmental Modeling Using MATLAB** Introduction to MATLAB Software –Environmental modeling principles and MATLAB Applications–Pollutants transport, decay and degradation modeling using MATLAB. Case studies.
Course Outcomes	**After the completion of course:-** • Ability to understand the computing techniques. • Ability to apply the principle of soft computing for solving Environmental problems • Ability to assess the Environmental Impacts using ANN and Fuzzy logic. • Ability to employ modern advanced computing tools in environmental studies
Text Books	1. Aliev R. A, and Aliev Rashad, "Soft Computing and its Applications", World Scientific Publications Co. Pte. Ltd. Singapore, 2014. 2. Chepra S. C. and Canele R. P., "Numerical Methods for Engineers", McGraw-Hill, a business unit ofThe McGraw-Hill Companies, Inc., 1221 Avenue of the Americas, New York, NY 10020. 6th Edition 2014.
Reference Books	1. Data-Driven Modeling: Using MATLAB in Water Resources and Environmental Engineering, Springer; 2014 edition. 2. Kotteguda, N.T., and Renzo Resso, Statistics, "Probability and Reliability for Civil and Environmental Engineers", McGraw Hill Companies Inc., New York, 2008. 3. Mathews J. H. and Fink K.D., "Numerical methods using MATLAB", Pearson Education 2010.

Course Title	**Hydro Power Engineering**			
Course Code	**MENWR105T (Elective-I)**			
Course Credits	**L**	**T**	**P**	**TC**
	3	**1**	**-**	**4**
Prerequisites	**Basic knowledge of hydrology, fluid mechanics, and open channel hydraulics.**			
Course Objectives	**This course will enable students to:-** • Gain the knowledge of hydropower, thermal power and to analyse its potential at different sites.			
Course Contents	**UNIT I** Planning of hydropower development, Hydropower potential. Operation of power plants for peak and base load, Characteristics of power market, Integration of various types of plants, Augmentation of power plants, Pump storage plants, Small hydro power. **UNIT II** Design of hydropower installation components – intake structures, water conductor systems, tunnels, surge-tanks, penstocks, valves and anchor-blocks hydro mechanical parts. **UNIT III** Turbines and their foundations, Turbines and their performances Introduction to structural and geotechnical aspects of powerhouse design, Types of powerhouse – Underground, Semi-Underground. **UNIT IV** Gates, stilling basins, spillways. Hydropower plants efficiencies, power distribution. **UNIT V** Reservoir operation for hydropower generation in a multipurpose projects, Basin scale hydro power generation in a multipurpose projects, Basin scale hydropower development, Mathematical models for reservoir sizing and opera.			
Course Outcomes	**After the completion of course:-** • Apply the knowledge in the area of hydropower and thermal engineering.			

Text Books	1. M.M. Dandekar and K.N. Sharma, Water Power Engg., Vikas Publishing House, New Delhi. 2. R.S. Varshney, Hydropower Structures, Nem Chand and Bros., Roorkee.
Reference Books	1. A.K. Keshari, Water power Engineering, new age publishers, New Delhi.

Course Title	**Basics of Microbiology & Biotechnology**			
Course Code	**MENWR105T (Elective-I)**			
Course Credits	**L**	**T**	**P**	**TC**
	3	**1**	**-**	**4**
Prerequisites	**Basic knowledge of Environmental Engineering I & II.**			

Course Objectives

This course will enable students to:-

- Objective of the Master's Program in Microbiology is to equip the students to gain bimolecular knowledge and analytical skills at an advanced level.

- Program emphasizes to apply knowledge acquired about prokaryotic and eukaryotic cellular processes, interaction of microorganisms among themselves, with physical and chemical agents and higher order organisms in environment and biological systems to various conditions.

- The laboratory training in addition to theory is included so that the students will acquire the skills to qualify for a broad range of positions in research, industry, consultancy, education and public administration, or for further education in a doctoral program.

- Students will be able to address broad range of fields including biopolymer chemistry, marine biochemistry, environmental biotechnology, food science, microbiology, microbial genetics, molecular biology and systems biology.

Course Contents

UNIT I
Basic Concepts
Spontaneous generation, Germ theory of diseases, Cell theory. Contributions of Antonie van leuwenhoek, Joseph Lister, Robert Koch, Louis Pasteur, Edward Jenner, John Tyndall,Sergei N. Winograd sky, Selman A waksman, Alexander Flemming, Paul Erlich, Fannie Hesse, Elie Metchnikoff, Kary Mullis.

UNIT II
Sterilization And Disinfection
Definitions, Principles. Methods of sterilization- Physical methods (Heat, Filtration), Radiation and Chemical methods. Control of sterilization and Testing of sterility.

UNIT III
Microscopy
Principles, Light microscope, Phase Contrast, Dark field, Bright field, Fluorescent,

Interference microscope (Stereo microscope), Confocal, Inverted microscope, and Electron microscope (TEM and SEM). Measurement of Microorganisms- Micrometry. Staining- Simple, Gram staining, Negative staining, Capsule staining, Spore staining, Flagellar staining, Nuclear staining and Acid fast staining.

UNIT IV
Microbiological Media, Composition And Types
Selective and differential media Growth curve and growth kinetics. Influence of environmental factors for microbial growth. Nutritional groups of bacteria, overview Estimation of Microbes- Direct Microscopic count, Turbid metric assay, TVC- Indirect Method- CO_2 liberation- Protein estimation- Development of pure culture methods. Cell ultra structure: Peptidoglycan structure and synthesis. Cytoplasmic matrix and components: Inclusion bodies, Maintenance and Preservation of cultures.

UNIT V
Taxonomy
Principle and its types (Classical approach– Numerical, Chemical, Serological and Genetic). Bacterial taxonomy – Bergey's manual of Systematic Bacteriology (Eubacteria and Archae bacterium).

Course Outcomes	**After the completion of course:-** • State of art knowledge about various methodological and analytic approaches that are used within the specialization. • Knowledge of the leading edge in a chosen specialized area of Microbiology, based on own research experience from a master's project and international literature. • Can compete in national level competitive exams such as NET-JRF or GATE or International exams such as GRE-TOEFEL and can pursue career in higher studies.
Text Books	1. Prescott, L.M J.P. Harley and C.A. Klein 1995. Microbiology 2nd edition Wm, C. Brown publishers. 2. Michael J. Pelczar, Jr. E.C.S. Chan, Moel : Microbiology McGraw Hill Book R. Krieg, 1986Company
Reference Books	1. Stainer R.Y. Ingraham J.L. Wheolis H.H and Painter P.R. 1986 The Microbial world, 5th edition. 2. Eagle Works Cliffs N.J. Prentica Hall.

M.Tech.(Water Resource Engineering)
Semester-I
2022-23

Course Title	Integrated Water Resources Management & Water Harvesting
Course Code	MENWR105T (Elective-I)

Course Credits	L	T	P	TC	
	3	1	-	4	

Prerequisites	Basic knowledge of Water Resources Management & Irrigation Management.

Course Objectives	**This course will enable students to:-** Students will be introduced to the role of disciplines of ecology and socio-economic play in Management of water resources.

Course Contents	**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–Non-market 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 & 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** **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.
Course Outcomes	**After the completion of course:-** • Students will gain knowledge about economic aspects of water and also broad understanding of the complexities of dealing with water resources problems.
Text Books	1. Technical Advisory Committee, Integrated Water Resources management, Technical Advisory 2. Committee Background Paper No: 4. Global water partnership, Stockholm, Sweden. 2002. 3. Technical Advisory Committee, Poverty Reduction and IWRM, Technical Advisory Committee 4. Background paper no: 8. Global water partnership, Stockholm, Sweden, 2003.
References Books	1. Technical Advisory Committee, Regulation and Private Participation in Water and Sanitation section, Technical Advisory Committee Background paper No: 1. Global water partnership, Stockholm, Sweden, 1998. 2. Technical Advisory Committee, Dublin principles for water as reflected in comparative assessment of institutional and legal arrangements for Integrated Water Resources Management, Technical 3. Advisory Committee Background paper No: 3. Global water partnership, Stockholm, Sweden. 1999.

Course Title	Water Resources Engineering Lab
Course Code	MENWR106P

Course Credits	L	T	P	TC	
	-	-	2	1	

Prerequisites	Basic knowledge of Water Resources Management & Engineering Hydrology.

Course Objectives	**This course will enable students to:-** 1. Compare the result of analytical models introduced in lecture to the actual behavior of real fluid flows. 2. Discuss and practice standard measurement techniques of fluid mechanics and their applications. 3. Work on small design projects.

Course Contents	**List of Experiments** 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 Outcomes	**After the completion of course:-** • Compare the results of analytical models introduced in lecture to the actual behavior of real fluid flows and draw correct and sustainable conclusions. • 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.
Text Books	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
Reference Books	1. Fluid mechanics with engineering applications by E. John Finne more and Joseph B.Franzini (10thEdition) 2. A textbook of fluid mechanics and Hydraulic machines by Dr.R.K. Bansal-Laxmi Publications

Course Title	Environmental Engineering Lab
Course Code	MENWR107P

Course Credits	L	T	P	TC	
	-	-	2	1	

Prerequisites	Basic knowledge of Environmental Engineering I&II

Course Objectives	**This course will enable students to:-** • Familiarize with the physico chemical characterization of water and wastewater.

Course Contents	**List of Experiments** 1. Measurement of pH, Electrical conductivity and Turbidity of water samples 2. Determination of Chlorides in water. 3. Determination of Iron and Fluoride in water 4. Determination of Acidity and Alkalinity of water. 5. Determination of Sulphate in water. 6. Determination of hardness of water 7. Determination of nitrate & TKN in water (demo) 8. Determination of residual chlorine of water 9. Determination of total dissolved solids 10. Determination of optimum coagulant dosage 11. Determination of Ammonia Nitrogen in wastewater. 12. Coagulation and Precipitation process for treating waste water 13. Determination of suspended, volatile fixed and settles able solids in wastewater. 14. B.O.D. test 15. C.O.D. test 16. Determination of Calcium, Potassium and Sodium. 17. Heavy metals determination -Chromium, Lead and Zinc. (Demonstration only)

Course Outcomes	**After the completion of course:-** • The students completing the course will have the ability to use the techniques, skills and modern instruments to determine the quality of water and wastewater.

Text Books	1. Water Supply Engineering, Environmental Engineering Volume -I by Dr. B.C. Punmia.

Reference Books	1. Standards Methods for the Examination of Water and Wastewater, 17th Edition, WPCF, APHA and AWWA, USA, 1989.