Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.SU/Engg./NEP-2020/65/2025

It is hereby inform to all concerned that, the syllabus prepared by the Board of Studies and recommended by the Dean, Faculty of Science & Technology, the Hon'ble Vice-Chancellor has been accepted **the First & Second Year M.E. (Civil) Water Resources Engineering as per Norms of National Education Policy – 2020 under the Faculty of Science & Technology run to the Affiliated Colleges,** Dr.Babasahcb Ambcdkar Marathwada University in his emergency power under section 12(7) of the Maharashtra Public Universities Act, 2016 on the behalf of Academic Council as appended herewith. This is effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Chhatrapati Sambhajinagar
-431 004.
Ref.No.SU/Engg/2025/12811-19
Date:- 23.01.2025.

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Deputy Registrar
Academic (Syllabus) Section.

Copy forwarded with compliments to :-

1] The Principal of all concerned Colleges,
Dr. Babasaheb Ambedkar Marathwada University,

2] The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.

3] The Incharge Director,

4] The Section Incharge [Computer Unit-1 and Unit 2],

5] The In-charge,[E-Suvidha Kendra],
Board of Examinations & Evaluation,Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajinagar.

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Dr. Babasaheb Ambedkar Marathwada University,

Chhatrapati Sambhajinagar-431004 (MS), India.

M.E (Civil) Water Resources Engineering

Revised Program Structure and Details Syllabus

(In line with New Education policy 2020)

(Effective from Academic Year 2024-2025 & onwards)

08/08/2025

Department of Civil Engineering

Department of Civil Engineering.

Head of Civil Engg. Dept.
Govt. College of Engineering

Dr. Babasaheb Ambedkar Marathwada University, Sambhajinagar.

M.E (Civil) Water Resources Engineering

Full Time Four Semester Program

Credit distribution structure for Two Years PG / One Year PG Diploma in Water Resource Engineering

Year (2 Yr.PG)	Level	Semester (2 Yr.)	Major		RM	OJT	RP	Cumulative Credits	Degree
			Mandatory	Elective					
I	6.0	Semester - I	14	4	4	2	-	24	PG diploma (after 4 years degree)
		Semester - II	19	3	-	2	-	24	
Cumulative Credits for PG Diploma			**33**	7	**4**	**4**	-	**48**	
Exit option: PG Diploma (40 Credits) after Four Year UG Degree									
II	6.5	Semester - III	12	-	-	-	-	12	PG degree after 4 year UG
		Semester - IV	12	-	-	-	-	12	
cumulative Credits for 1 Yr. PG Degree			48	-	-	-	-	48	
cumulative Credits for 2 Yr. PG Degree			**72**	-	-	-	-	**72**	
2 years for semester PG degree (72 Credits) after 4 year UG degree OR 1 year 2 semester PG diploma (48 Credits) after 4 year UG degree									

F.Y. M.E. Syllabus Structure w.e.f. 2024-25 (NEP 2020 Based Curriculum)

M.E (Water Resources Engineering)

Semester - I

Course Code	Course Name	Teaching Scheme Contact (Hours/Week)			Examination Scheme and Marks							Credits			
		Theory	Tutorial	Practical	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	TH	TW/PR	TUT	Total
MWR 601	Research Methodology & IPR	3	1	-	15	15	10	60	-	-	100	3	-	1	4
MWR 602	Engineering Hydrology & Hydrologic Systems	3	1	-	15	15	10	60	-	-	100	3	-	1	4
MWR 603	Ground Water Engineering	3	1	-	15	15	10	60	-	-	100	3	-	1	4
MWR 604	Advanced Fluid Mechanics	3	1	-	15	15	10	60	-	-	100	3	-	1	4
MWR 641	Program Elective	3	1	-	15	15	10	60	-	-	100	3	-	1	4
MWR 621	Lab - I (Engineering Hydrology & Hydrologic Systems)	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MWR 622	Lab - II (Computational and Statistical Methods)	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MWR 624	Technical Presentation	-	-	4	-	-	-	-	-	50	50	-	2	-	2
MWR 625	Constitution of India	-	-	-	-	-	50	-	-	-	50	-	-	-	-
Total (Semester - I)		**15**	**5**	**8**	**75**	**75**	**100**	**300**	**50**	**50**	**650**	**15**	**4**	**5**	**24**

*** Elective Course**

Programe Elective	Elective I	Elective II
Program Elective - (MWR 641,MWR 642,)	Water Supply System	Techniques of Water Application

***Note: Candidates Are required to opt the elective course (Program Elective I, II) From the same group as mentioned above.**

F.Y. M.E. Syllabus Structure w.e.f. 2024-25 (NEP 2020 Based Curriculum)

M.E (Water Resources Engineering)

Semester - II

Course Code	Course Name	Teaching Scheme Contact (Hours/Week)			Examination Scheme and Marks							Credits			
		Theory	Tutorial	Practical	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	TH	TW/PR	TUT	Total
MWR 651	Hydraulic Structure	3	1	-	15	15	10	60	-	-	100	3	-	1	4
MWR 652	Water Resource System Planining & Management	3	1	-	15	15	10	60	-	-	100	3	-	1	4
MWR 653	Land & Water Management	3	1	-	15	15	10	60	-	-	100	3	-	1	4
MWR 691	Program Elective	3	1	-	15	15	10	60	-	-	100	3	-	1	4
MWR 693	Open Elective	3	-	-	15	15	10	60	-	-	100	3	-	1	4
MWR 671	Lab - I (Hydraulic Structure)	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MWR 672	Lab - II (Land & Water Management)	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MWR 674	Mini Project	-	-	2	-	-	-	-	-	50	50	-	1	-	1
MWR 675	In-plant Training / OJT	-	-	4	-	-		-	50	-	50	-	2	-	2
	Total (Semester - II)	**15**	**4**	**10**	**75**	**75**	**50**	**300**	**100**	**50**	**650**	**15**	**5**	**4**	**24**

*** Elective Course**

Programe Elective	Elective I	Elective II
Program Elective - (MWR 691, MWR 692,)	Neuro Fuzzy Applications	Environmental Evaluation of Water Resource Developent

***Note: Candidates Are required to opt the elective course (Program Elective I, II) From the same group as mentioned above.**

Open Elective

Open Elective (MWR 693, MWR 694, 1,2)	Water Power Engineering	Computational and Statistical Method

*** OJT / IPT - To be done for 2 week for 2 credit**

S.Y. M.E. Syllabus Structure w.e.f. 2024-25 (NEP 2020 Based Curriculum)

M.E (Water Resources Engineering)

Semester - III

Course Code	Course Name	Teaching Scheme Contact (Hours/Week)			Examination Scheme and Marks							Credits			
		Theory	Tutorial	Practical	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	TH	TW/PR	TUT	Total
MWR 720	MOOC Course	3	_	-	-	-	-	-	-	-	100	3	-	-	3
MWR 721	Dissertation Part I	-	-	18	-	-	-	-	100	100	200	-	9	-	9
Total (Semester - III)		**3**	**0**	**18**	**-**	**-**	**-**	**-**	**100**	**100**	**300**	**3**	**9**	**-**	**12**

S.Y. M.E. Syllabus Structure w.e.f. 2024-25 (NEP 2020 Based Curriculum)

M.E (Water Resources Engineering)

Semester - IV

Course Code	Cource Name	Teaching Scheme Contact (Hours/Week)			Examination Scheme and Marks							Credits			
		Theory	Tutorial	Practical	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	TH	TW/PR	TUT	Total
MWR 771	Dissertation Part II	-	-	24	-	-	-	-	150	150	300	-	12	-	12
Total (Semester - IV)		**0**	**0**	**24**	**-**	**-**	**-**	**-**	**150**	**150**	**300**	**-**	**12**	**-**	**12**

MSE - Mid Semester Exam, ESE - End Semester Examination, TH - Theory, OR - Oral, TA - Teacher Assessment, TW - Term Work< PR - Practical, Tut - Tutorial

Total Credits = SEM I + SEM II + SEM III + SEM IV

= 24+24+12+12

= 72

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester I)	
Course Code: MWR 601 **Course: Research Methodology & IPR** **Teaching Scheme:** **Theory: 03 Hrs/week** **Tutorial: 01 Hrs/week.**	**Credits: 3-1-0** **Mid Semester Examination I : 15 Marks** **Mid Semester Examination II : 15 Marks** **Teacher Assessment:10 Marks** **End Semester Examination: 60 Marks** **End Semester Examination. (Duration): 3 Hrs**

CourseObjectives:

- To guide students from understanding foundational research concepts to critically formulating research problems, culminating in the adept creation of comprehensive research plans and literature reviews.
- To develop a comprehensive understanding of various research methods, both qualitative and quantitative
- Tofacilitatestudentsinanalyzing,evaluating,andcreatingresearch proposals.
- To attain mastery in data collection methods, sampling, data analysis techniques, and result interpretation for robust research outcomes.
- To equip students with the skills to proficiently create and present diverse research reports, encompassing various formats, oral delivery, technical writing, and ethical awareness regarding plagiarism.

CourseOutcomes:

Aftercompletingthe coursestudentswillable to

CO 1	Develop the ability to comprehend core research concepts, define key elements Like variables and hypotheses, and critically evaluate literature to identify research
CO 2	Justify their chosen research methods and explain their advantages and limitations.
CO 3	Create well-structured research proposals that include clear research objectives, methods, and expected outcomes.
CO 4	Proficient in using data analysis techniques relevant to their chosen research methods, such as statistical analysis for quantitative research or thematic analysis for qualitative research.
CO 5	Create comprehensive research reports in diverse formats, such as academic papers, presentations, and technical reports.

Unit Content Hours:

UNIT 1	**A. Introduction to RM:** Meaning of Research, Objectives of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Defining the Research Problem, Selecting the Problem, Technique Involved in Defining a Problem, Research Design, Important

UNIT 1	Concepts Relating to Research Design, Developing a Research Plan, Literature review.**(08Hrs)**
	B. Methods of Research: Qualitative and quantitative methods of research like Historical, case study, ethnography, exposit facto, documentary and content analysis, survey (Normative,descriptive,evaluativeetc.) field and laboratory experimental studies. Characteristics of methods and their implications in research area.**(06 Hrs)**
UNIT 2	**A. Development of research proposal:** Research proposal and its elements Formulation of research problem-criteria of sources and definition Development of objectives and characteristics of objectives. Development hypotheses and applications.**(06 Hrs)**
	B. Methods of data collection: Concept of sampling and other concepts related to sampling. Probability and non-probability samples, their characteristics and implications. Tools of data collections, their types, attributes and uses. Redesigning, research tools-like questionnaire, opinionnaire, observation, interviews, scales and tests etc.**(06 Hrs)**
UNIT 3	**A. Methods of data analysis:**Analysis of qualitative data based on various tools. Analysis of quantitative data and its presentation with tables, graphs etc. Statistical tools and techniques of data analysis-measures of central tendency, dispersion. Decision making with hypothesis testing through parametric and non-parametric tests. Validity and delimitations of research findings. **(06 Hrs)**
	B. Interpretation and Report Writing: Meaning of Interpretation, Techniques of Interpretation, Significance of Report Writing, Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing aResearchReport,Writingatechnicalpaper,plagiarismandits implications. **(08 Hrs)**

ReferenceBooks:-

1. Garg B.L., Karadia R., Agarwal F. and Agarwal U.K., An introduction to Research Methodology, RBSA Publishers, 2002.
2. Kothari C.R., Research Methodology: Methods and Techniques. New Age International, 1990.
3. Merriam S.B., Tisdell E.J., Qualitative Research: A Guide to Design and Implementation, 4th edition, John Wiley & Sons, 2016.
4. Creswell J.W., Research Design: Qualitative, Quantitative and Mixed Methods Approaches, 4th edition, SAGE Publications, Inc, 2014.
5. Olsen C., Devore J., Peck R., Introduction to Statistics and Data Analysis, 5thedition, Brooks/Cole, 2015.
6. Panneerselvam R., Research Methodology,2ndedition, PHI Learning,2014.

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester I)	
Course Code: MWR 602 **Course: Engineering Hydrology And Hydrologic Systems** **Teaching Scheme:** **Theory: 03 Hrs/week** **Tutorial: 01 Hr/week.**	**Credits: 3-1-0** **Mid Semester Examination I : 15 Marks** **Mid Semester Examination II : 15 Marks** **Teacher Assessment: 10 Marks** **End Semester Examination: 60 Marks** **End Semester Examination. (Duration): 3 Hrs**

Prerequisite:Basic understanding aboutEngineering Hydrology And Hydrologic Systems

Course Objectives:

- **To give and overview of Hydrologic cycle.**
- **To explain the details of Applications of remote sensing and GIS in hydrology.**
- **To give and overview of Hydrologic Statistic.**
- **To explain the details of Rain falls Run off Analysis**
- **To give and overview of Hydrologic Flood Routing.**
- **To explain the details of Hydrograph Analysis.**

Course Outcomes:

upon completion of this course student will be able to

CO1	Understand and overview of Hydrologic cycle.
CO2	Overview the details of Applications of remote sensing and GIS in hydrology.
CO3	Analys and overview of Hydrologic Statistic.
CO4	Develop the details of Rain falls Run off Analysis.
CO5	Explain and overview of Hydrologic Flood Routing.
CO6	Introduce the details of Hydrograph Analysis.

Unit content Hours:

UNIT 1	**A. Introduction** Linear and nonlinear systems, Lumped and Distributed Systems,Physical and systems Approach, Systems concept, Deterministic and Stochastic Systems, Time Invariant Systems, Hydrologic cycle, Nature of Problems in Engineering Hydrology. **(6Hrs)**

UNIT 1	**B. Applications of remote sensing and GIS in hydrology** Applications of remote sensing and GIS in hydrology: Geomorphologic hydrological Land use and soil mapping using remote sensing, Evaluation of water resources potential using remote sensed data, Areal Assessment of floods Inundated Areas, Soil moisture areas and pollution of River Waters, Watershed Management Using Remote Sensing Techniques, Concepts of Geographical information Systems (GIS) and its Application in Hydrologic Studies. **(8Hrs)**
UNIT 2	**A. Hydrologic Statistic** Hydrologic Statistic: Probabilistic Treatment of Hydrologic Data, Frequency and Probability Functions, Statistical parameters, Frequency analysis, annual maximum and partial duration series models, regional frequency analysis, Design flood.**(6Hrs)**
	B. Rain falls: Run off Analysis Rain falls: Run off Analysis: Review of rational Methods, Conceptual Model, Clark and Nash Models Derivation of Unit Hydrograph for ungauged catchments, Synthetic unit Hydrograph. **(6Hrs)**
UNIT 3	**A. Hydrologic Flood Routing** Hydrologic Flood Routing: Reservoir routing, channel routing, estimation of flood routing models, flood forecasting, analog models, real time flood forecasting, Design Flood. **(6Hrs)**
	B. Hydrograph Analysis Hydrograph Analysis: Infiltration, Effective Rainfall, Runoff, Runoff components, direct Runoff Hydrograph. Unit Hydrograph Theory: Linear Time Invariant System, Response Functions of Linear Systems, Derivation of Non-Parametric Unit Hydrograph from Single Storm and Multi Storm Events, S-Curve Hydrograph, Instantaneous Unit Hydrograph.**(8Hrs)**

Reference Books:-

1. Chow, V.T. Maidment, D.R. and Mays, L.W. (1988), "Applied Hydrology". McGraw Hill Inc. N. York.
2. Singh, V.P. (1985), "Hydrologic Systems", Prentice Hall, N. York.
3. Singh, V.P. (1992), "Elementary Hydrology", Prentice Hall of India, N Delhi.
4. Haan C.T. (1995), "Statistical Methods in Hydrology", East West Press, New Delhi.
5. Viessman, W, Lewis, G.L. and Knapp, J.W. (1989), "Introduction to Hydrology", Harper and Row Publications Inc. Singapore.

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester I)	
Course Code: MWR 603 **Course: Ground Water Engineering** **Teaching Scheme:** **Theory: 03 Hrs/week** **Tutorial: 01 Hr/week.**	**Credits: 3-1-0** **Mid Semester Examination I : 15 Marks** **Mid Semester Examination II : 15 Marks** **Teacher Assessment: 10 Marks** **End Semester Examination: 60 Marks** **End Semester Examination. (Duration): 3 Hrs**

Prerequisite: Basic understanding aboutGround Water Engineering

Course Objectives:

- **To Understand Estimation of the groundwater recharge.**
- **To introduce the importance of Water well design and well drilling.**
- **To UnderstandGroundwater management.**
- **To explain the details of Well Hydraulics.**
- **To give and overview of Groundwater modeling.**
- **To develop an understanding of the Hydrogeology.**

Course Outcomes:

upon completion of this course student will be able to

CO1	Introduce Estimation of the groundwater recharge
CO2	Explain the importance of Water well design and well drilling
CO3	Develop an understanding of Groundwater management
CO4	Understand the details of Well Hydraulics
CO5	Overview of Groundwater modeling
CO6	Understanding of the Hydrogeology.

Unit content Hours:

UNIT 1	**A. Introduction** Estimation of the groundwater recharge, Resent progress groundwater Legislation, groundwater Geochemical process, Dissolved constituents in groundwater, Flow net by graphical Contraction, Saturated – Unsaturated flow net. **(08Hrs)**

UNIT 1	**B. Water well design and well drilling** Water well design and well drilling: Well screen, development and completion of wells, rotary drilling and rotary percussion drilling, maintenance of wells.**(06Hrs)**
UNIT 2	**A. Groundwater management** Groundwater management: Conjunctive use, alternative basin yields, artificial recharge of groundwater, groundwater quality, case study.**(06Hrs)**
	B. Well Hydraulics Aquifers and aquifer parameters, Darcy's law, hydraulic conductivity and its characteristics, Dupuit's equation, groundwater flow direction, steady groundwater flow, groundwater flow equation, estimation of aquifer parameters from pumping test data, graphical techniques and their limitations, groundwater well losses, interference among wells, potential flow, image well theory and its applications in groundwater flow.**(08Hrs)**
UNIT 3	**A. Groundwater modeling** Groundwater modeling: Groundwater flow, mathematical analog and digital modeling case studies, regional groundwater modeling. **(06Hrs)**
	B. Hydrogeology Porosity and permeability of Rocks, Groundwater in Igneous, Metamorphic Sedimentary rocks and non indurated sediments, hydro geological regions of India, surface and subsurface geophysical methods for groundwater explorations.**(06Hrs)**

Reference Books:-

1. Garg, S.P. (1993) "Groundwater and Tube Wells", Oxford and IBH Publishing Co. N. Delhi.
2. 2. Raghunath, H.M. (1992) "Groundwater" Wiley Eastern Ltd., N. Delhi.
3. Todd, D.K. (1995), "Groundwater Hydrology", John Wiley & Sons, Singapore.

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester I)	
Course Code: MWR 604 **Course: Advanced Fluid Mechanics** **Teaching Scheme:** **Theory: 03 Hrs/week** **Tutorial: 01 Hr/week.**	**Credits: 3-1-0** **Mid Semester Examination I :15 Marks** **Mid Semester Examination II : 15 Marks** **Teacher Assessment: 10 Marks** **End Semester Examination: 60 Marks** **End Semester Examination. (Duration):3 Hrs**

Prerequisite: Basic understanding aboutFluid Mechanics

Course Objectives:

- **To Understand the Fundamentals of Fluid Mechanics.**
- **To introduce the importance of Computational Fluid dynamics.**
- **To Understand Potential Flow.**
- **To explain the details of Differential analysis of fluid flow.**
- **To give and overview of Turbulence in Fluid Flow.**
- **To develop an understanding of the Design of Testing of Models.**

Course Outcome:

upon completion of this course student will be able to

CO1	Introduce the Fundamentals of Fluid Mechanics.
CO2	Understand the importance of Computational Fluid dynamics.
CO3	Analyze Potential Flow.
CO4	give and overview of Differential analysis of fluid flow..
CO5	Explain the details of Turbulence in Fluid Flow..
CO6	Develop an understanding of the Design of Testing of Models.

Unit content Hours:

UNIT 1	**A. Fundamentals of Fluid Mechanics** Survey of Fluid Mechanics, Structure of Fluid mechanics based on Rheological, Dilatational, Temporal Variation, Fluid Type, Motion Characteristics and spiral Dimensionality Considerations, Fundamental Idealizations and Descriptions of Fluid motion, Quantitative definition of Fluid and flow, Reynolds Transport Theorem, Mass Momentum and energy conservation Principles for Fluid Flow. Frictionless Irrotational Motions, **(08Hrs)**

UNIT 1	**B. Computational Fluid dynamics** Introduction and fundamentals, equation of motions, solution procedure, grid generation, and boundary conditions, laminar, turbulent and open channel flow, CFD calculations.**(06Hrs)**
UNIT 2	**A. Potential Flow** Approaches in Solving Fluid Flow Problems, 2-dimensional Stream Function and Velocity Potential Function in Cartesian and Cylindrical Polar Coordinate Systems, Standard patterns of Flow, Sources, Sink, Method of images in Solving Groundwater Flow problems, methods of Conformal Transformations, Pressure loss due to Friction in a pipe. **(08Hrs)**
	B. Differential analysis of fluid flow Study of Local Behavior, Differential Approaches in Analysis Viscous Flows, Equation of Motion of Viscous flow, Navier – Stokes Equations, Exact and approximate solution of N-S equations, Hele Shaw Flow, Creeping Flow past a sphere, Boundary layer concepts, Prandtl's Boundary Layer Equations, Laminar Boundary Layer Along a Flat Plate, Integral Momentum Equation, Blasius Solution.**(08Hrs)**
UNIT 3	**A. Turbulence in Fluid Flow** Origin of Turbulence, Statistical analysis of turbulence, Reynolds equations for turbulence, Theories of Turbulent shear Stresses, Velocity distribution in smooth and rough pipes, Resistance coefficients for pipes, turbulent boundary layer and boundary layer separation.**(06Hrs)**
	B. Design of Testing of Models Design of an experiment, Dimensional Analysis, Complete set of Dimensional Analysis, Practical Significance of Key Modeling Parameters, Design of Model and model tests.**(06Hrs)**

Reference Books:-

1. Valentine, H.R. (1970), "Applied Hydrodynamics", International Text Butterworth.
2. White, F.M. (1980), "Viscous Fluid Flow", McGraw Hill Pub. Co. N. York
3. Yalin, M.S. (1971) "Theory of Hydraulic Models", McMillian Co.
4. Mohanthy A.K. (1993) Fluid Mechanics", Prentice Hall of India, New Delhi.
5. Rouse H. (1957) "Advanced Fluid Mechanics", John Willey & Sons, N. York.

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester I)	
Course Code: MWR 641 **Course: Program Elective I** **Water supply Systems** **Teaching Scheme:** **Theory: 03 Hrs/week** **Tutorial: 01 Hr/week.**	**Credits: 3-1-0** **Mid Semester Examination I : 15 Marks** **Mid Semester Examination II : 15 Marks** **Teacher Assessment: 10 Marks** **End Semester Examination: 60 Marks** **End Semester Examination. (Duration): 3 Hrs**

Prerequisite: Basic Knowledge of Water Supply Systems

Course Objectives:

- **To Understand Water RequirementsSources of water, water Supply.**
- **To introduce the importance of Water Softening.**
- **To Understand Iron and Manganese Removal.**
- **To explain the details of Conventional Treatment processes of water.**
- **To give and overview of Reduction of Dissolved Salt in water.**
- **To develop an understanding of the Test and Oduor of water.**

Course Outcome:

upon completion of this course student will be able to

CO1	Develop an understanding ofWater Requirements Sources of water, water Supply.
CO2	Understand the importance of Water Softening.
CO3	Introduce Iron and Manganese Removal.
CO4	Give and overview of Conventional Treatment processes of water.
CO5	Explain the details of Reduction of Dissolved Salt in water.
CO6	Understand the Test and Oduor of water.

Unit content Hours:

UNIT 1	**A. Introduction** Water Requirements, Sources of water, water Supply, water Supply Considerations Water Quality, Drinking Water Standards, Secondary Standards Toxics, Water Pollutants, Quality Criteria for surface Water purpose of Water Treatment -Selection of Water processes. **(08Hrs)**

	B. Water Softening Lime Soda Process, Variations-Ion Exchange Softening and Nitrate Removal.**(06Hrs)**
UNIT 2	**A. Iron and Manganese Removal** Iron Corrosion, Water Stabilization -Cathodic Protection.**(06Hrs)**
	B. Conventional Treatment processes Sedimentation, type of sedimentation, Zone Setting, Filtration, Gravity Granular, Media Filtration, Head Losses, Back Washing and Media Filtration, Head Losses, Back Washing and Media Fluidization, Pressure Filters -slow sand Filters, Coagulation and flocculation Coagulants, Coagulant aids, Rapid Mixing Devices, Disinfection Methods Fluoridation, De fluoridation. **(08Hrs)**
UNIT 3	**A. Reduction of Dissolved Salt** Distillation, Reverse Osmosis, Electrolysis Transportation and Distribution of Water: Aqueducts, Hydraulic Consideration, Design of Transportation System, Distribution Reservoirs and Service Storage.**(06Hrs)**
	B. Test and Oduor Method of control, Aeration, Adsorption and Control of Algae Growth.**(06Hrs)**

Reference Books:-

1. ViessmanJr.,mark J Hsmmer (1990) Water Supply and Pollution Control. McGraw International Edition.
2. Peavy, H.S.Row, D.R.and Techbanaglous, G(1995) Environmental Engineering McGraw International Edition.
3. Fair, Geyer, okun (1990) Water Supply Engineering John Wiley.

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester I)	
Course Code: MWR 642 **Course: Program Elective II** **Techniques of Water Application** **Teaching Scheme:** **Theory: 03 Hrs/week** **Tutorial: 01 Hr/week.**	**Credits: 3-1-0** **Mid Semester Examination I : 15 Marks** **Mid Semester Examination II : 15 Marks** **Teacher Assessment: 10 Marks** **End Semester Examination: 60 Marks** **End Semester Examination. (Duration): 3 Hrs**

Prerequisite: Basic Knowledge of Water Supply Systems

Course Objectives:

- **To Understand Conveyance through open channel.**
- **To introduce the importance of Cross- drainage works and regulating structures.**
- **To Understand General concept of hydraulic design.**
- **To explain the details of Lift irrigation.**
- **To give and overview of Drip irrigation.**
- **To develop an understanding of the Sprinkler irrigation.**

Course Outcome:

upon completion of this course student will be able to

CO1	Introduce the importance of Conveyance through open channel.
CO2	UnderstandCross- drainage works and regulating structures.
CO3	Analys General concept of hydraulic design.
CO4	Give and overview of Lift irrigation.
CO5	Explain the details ofDrip irrigation.
CO6	Overview an understanding of the Sprinkler irrigation.

Unit content Hours:

UNIT 1	**A. Conveyance through open channel** Conveyance through open channel , Lined and unlined channels, types of lining and economics of lined channels.**(6Hrs)**
	B. Cross- drainage works and regulating structures Cross- drainage works and regulating structures Types of C.D . works work such as aqueducts, super passage canal siphons and culverts. There layout and hydraulic design concept. **(6Hrs)**

UNIT 2	**A. General concept of hydraulic design** Main head regulators, cross regulators and distributary head regulators . Their layouts and hydraulic design considerations. Conveyance through closed conduit system, elements, controlling devices, general concept of hydraulic design. **(8Hrs)**
	B. Lift irrigation Lift irrigation General Concepts, element of lift irrigation schemes. Design consideration involved in intake well, jack well, rising main and distribution system, Concept of economics.**(8Hrs)**
UNIT 3	**A. Drip irrigation** Drip irrigation – General Concept, advantages and disadvantages . Components of system types of sprinklers, design co0ncepts.**(6Hrs)**
	B.Sprinkler irrigation Sprinkler irrigation : General concept , advantages and disadvantages. Component of the system types of sprinklers, design concepts. **(6Hrs)**

Reference books :-

1. Israelsen Henson – " Irrigation Principal and Practice" John Wiley.
2. Cuenca , R.H.- " Irrigation system design " Prentice Hall.
3. Khushani–" Irrigation system design- Voi. III Oxford and IBH.

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester I)	
Course Code: MWR 621 **Course:Lab - I (Engineering Hydrology & Hydrologic System)** **Teaching Scheme:** **Practical: 02 Hrs/week**	**Credits: 0-0-1** **Term Work :- 25 Marks**

Performance of experiment based on studies is expected by the candidate during lab - I work. Any five following experiment are required to perform in the laboratory:

1. **Flow around immersed lamina using Helshaw model.**
2. **Study on electric analogy apparatus.**
3. **Verification of Bernoulli's equation.**
4. **Study of hydraulic jump.**
5. **Determination of discharged coefficient of standing wave flume.**
6. **Verification of stroke's law.**
7. **Study of water hammer phenomenon.**
8. **Water quality analysis for various parameters.**

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester I)	
Course Code: MWR 622 **Course:Lab - II (Computational and Statistical Methods)** **Teaching Scheme:** **Practical: 02 Hrs/week**	**Credits: 0-0-1** **Term Work : 25 Marks**

Prerequisite: None

Course Objective:

To be able to analyse and perform experiment on Computational and Statistical Methods

Content:

The lab work consist of the assignment/experiment related to Computational and Statistical Methods

The assignment of term work shall be done based on the following

- **Continuous assessment**
- **Performing the experiment in the laboratory**
- **Oral examination conducted on the syllabus and term work mentioned above.**

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester I)	
Course Code: MWR 624 **Course: Technical Presentation** **Teaching Scheme:** **Theory: 03 Hrs/week**	**Credits: 0-0-2** **PR/OR : 50 Marks**

Prerequisite: Not applicable

Course Outcomes:

upon completion of this course student will be able to

CO1	Understand the principles of effective technical presentations.
CO2	Develop and structure technical content for presentations.
CO3	Enhance speaking and delivery skills.
CO4	Use visual aids and technology effectively.
CO5	Manage Q&A sessions and handle audience questions.
CO6	Gain confidence in presenting technical information.

Detailed Syllabus

Session 1: Introduction to Technical Presentations

Course overview and expectations

Importance of technical presentations

Elements of a successful presentation

Session 2: Audience Analysis Understanding your audience Tailoring your content to the audience Identifying audience needs and interests

Session 3: Content Development Creating clear objectives Organizing technical content Using effective transitions

Session 4: Visual Aids and Technology Designing effective slides

Using multimedia and visuals

Avoiding common design mistakes

Session 5: Speaking and Delivery Skills

Techniques for effective speaking

Body language and non-verbal communication Managing nerves and anxiety

Session 6: Rehearsal and Feedback

The importance of practice Peer and self-assessment Receiving constructive feedback

Session 7: Handling Q&A Sessions Preparing for questions Strategies for answering questions

Dealing with challenging questions

Session 8: Final Presentations

Each participant delivers a technical presentation

Peer and instructor feedback

Reflection and improvement plans

Session 9-16: Repeat Sessions 1-8 with in-depth practice, refining skills, and incorporate feedback.

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester I).	
Course Code: MWR 625 **Course:Constitution of India** **Teaching Scheme:** **Theory: 03 Hrs/week**	**Credits: 0-0-0** **Teacher Assessment: 50 Marks**

Prerequisite: Basic Knowledge of Water Supply Systems

Course Objectives:

The learning objective of the constitution of India course are

- **To understand the Indian constitution.**
- **To identify the importance of fundamental rights as will as Fundamental duties.**
- **To understand the functioning of union, state and local government in Indian Central system.**
- **To learn procedure and effect of emergency, composition and activities of election commission and amendment.**

Course Outcome:

upon completion of this course student will be able to

CO1	Understand and explain the significance of Indian constitution.
CO2	Exercise his/her Fundamental rights in a proper sense at the same time identify responsibility in nation building.
CO3	Analysis the Indian political system, the power and function of the union, state and local government in details.
CO4	Develop the details of Rain falls Run off Analysis.
CO5	Understand the electoral process, emergency provision and amendment procedure.

Unit content Hours:

UNIT 1	**A. Introduction to Indian constitution** Constitution meaning of the term - the making of the Indian constitution - sources and constitutional history - philosophy of constituent assembly - citizenship, preamble, fundamental rights and duties, directive principles of state policy.**(8Hrs)**

UNIT 1	**B. Executive, legislative and judiciary** Union government and its administration structure: present and voice present: role, power and position, PM and council of ministers, cabinet and central secretary, Lok Sabha, Rajya Sabha, the Supreme court and High court: power and functions **(6Hrs)**
UNIT 2	**A. The State and the union territories** State government and its administration: governor - role and position - CM and council of ministers, state secretaries: organization, structure and function - relation between the union and the states. **(6Hrs)**
	B. Local administration District administration head - role and importance, municipalities - Mayor and role of elected representative - Panchayati raj: functions PRI : Zilla panchayat, elected officials and their roles - block level organization Hierarchy, **(6Hrs)**
UNIT 3	**A. Village administration** village level - role of elected and appointed officials - importance of Grass - root democracy . laws for village under Indian constitution , duties of - grampachayat samiti. **(6Hrs)**
	B. Emergency provisions and election commission Emergency: proclamation of emergency, types of emergencies - election commission: role of Chief Election Commissioner - State election commission - functions of commission for the welfare of SC/ST/OBC and women.**(8Hrs)**

Reference Books:

1. J.C. Johari Indian government and politics Hans.
2. J.Raj Indian government and politics.
3. M.V. Pyle Indian constitution Durga Das Basu, Human rights in constitutional law.

Faculty of Science & Technology Syllabus of M.E (Water Resources Engineering) (Semester II)	
Course Code: MWR 651 **Course: Hydraulic Structures** **Teaching Scheme:** **Theory: 03 Hrs/week** **Tutorial: 01 Hr/week.**	**Credits: 3-1-0** **Mid Semester Examination I - 15 Marks** **Mid Semester Examination II : 15 Marks** **Teacher Assessment: 10 Marks** **End Semester Examination: 60 Marks** **End Semester Examination. (Duration): 3 Hrs**

Prerequisite: Basic understanding about Hydraulic Structures

Course Objectives:

- **To explain the details of Counter fort and hollow dams.**
- **To give and overview of basic concept of probability.**
- **To explain the details of Instrumentation in dams.**
- **To give and overview of Earth dams.**
- **To explain the details of Spillways.**
- **To explain the details of Outlets through dams.**

Course Outcome:

upon completion of this course student will be able to

CO1	Give and overview of Counter fort and hollow dams.
CO2	Explain the details of basic concept of probability.
CO3	Analys the details of Instrumentation in dams.
CO4	Introduce of Earth dams.
CO5	Understand the details of Spillways.
CO6	Overview of Outlets through dams.

Unit content Hours:

UNIT 1	**A. Masonry and concrete dams** Masonry and concrete dams: Evaluation of theory of design, Earth quake forces on dami and water mass, up-lift force. Strengthening and raising of dams, High dams. Arch dams - Development of arch dams, equations of cylindrical shells, general concepts about trial load method and elastic shell method.**(8Hrs)**
	B. Counter fort and hollow dams Counter fort and hollow dams: Genesis of the style, pros and cons. General stability of the dam. Rock fills dams: General Design principles, methods of constructions and compaction.**(6Hrs)**

UNIT 2	**A.Instrumentation in dams** Instruction in dams. **(6Hrs)**
	B. Earth dams Earth dams: calculation and control of seepage through dam and foundation. Drainage of earth dams, design of filters, design of earth dams.**(6Hrs)**
UNIT 3	**A. Spillways** Spillways: Determination of capacity, Types, ogee, side channel, chute, shaft, siphon, etc. general layout and elements, Basic Principles of hydraulic design. Energy dissipation arrangements. Spillway Gates Types such as Tainter, drum, vertical lift, automatic gates. General discussion about layout, elements and basic principles of design.**(8Hrs)**
	B. Outlets through dams Outlets through dams - Pressure and non-pressure outlets, types, layouts, general arrangement and components, nature of flow in outlets, head losses, hydraulic considerations involved in the design of high head outlets.**(6Hrs)**

Reference Books :-

1. Creager, Justin, Hinds - "Engineering for dams Vol. I, II, III.

2. Sharma, H.D. "Concrete Dams"

3. Garg, S.K. (1988) "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, Delhi.

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester II)	
Course Code: MWR 652 **Course: Water Resources Systems Planning and Management** **Teaching Scheme:** **Theory: 03 Hrs/week** **Tutorial: 01 Hr/week.**	**Credits: 3-1-0** **Mid Semester Examination I : 15 Marks** **Mid Semester Examination II : 15 Marks** **Teacher Assessment: 10 Marks** **End Semester Examination: 60 Marks** **End Semester Examination. (Duration): 3 Hrs**

Prerequisite: Basic understanding aboutWater Resources Systems Planning and Management

Course Objectives:

- **To Understand Estimation of the Objectives of water resources systems**
- **To introduce the importance of Methods of Systems Analysis**
- **To Understand Economic Analysis of Water Resources Systems**
- **To explain the details of Water Quantity Management**
- **To give and overview of Water Quality Management**
- **To develop an understanding of the Legal Aspects of water & Environment Systems**

Course Outcome:

upon completion of this course student will be able to

CO1	Introduce the importance of the Objectives of water resources systems.
CO2	Understand Estimation of Methods of Systems Analysis.
CO3	Explain the details of Water Resources Systems.
CO4	Understand Economic Analysis of Water Quantity Management.
CO5	Develop an understanding of Water Quality Management.
CO6	Give and overview of the Legal Aspects of water & Environment Systems.

Unit content Hours:

UNIT 1	**A. Introduction** General Principles of Systems Analysis to Problems in Water Resources Engineering, Objectives of water resources systems Socio - Economic Characteristics.(**6Hrs**)
	B. Methods of Systems Analysis Methods of Systems Analysis: Linear Programming Models, Simplex Method, Sensitivity Analysis, Dual Programming, Dynamic Programming Models,

	classical optimization techniques, Non-Linear Programming, Gradient Techniques., Genetic algorithm, Stochastic Programming, Simulation, Search techniques, Multi objective optimization.(**8Hrs**)
UNIT 2	**A. Economic Analysis of Water Resources Systems** Economic Analysis of Water Resources Systems: Principles of Engineering Economy, Capital, Interest and Interest rate, Time Value of Money, Depreciation, Benefit Cost Evaluation, Discounting Techniques, Socio-Economic Analysis.(**6Hrs**)
	B. Water Quantity Management Water Quantity Management: Surface water storage requirements, storage capacity and yield, reservoir design, water allocations for water supply, irrigation, hydropower and flood control reservoir operations, planning of an Irrigation system, irrigation scheduling, groundwater management, conjunctive use of surface and subsurface water resources, Design of water conveyance and distribution systems.(**8Hrs**)
UNIT 3	**A. Water Quality Management** Water Quality Management: Water Quality Objectives and Standards, Water Quality Control Models, Flow Augmentation, Wastewater Transport Systems, River Water Quality Models.(**6Hrs**)
	B. Legal Aspects of water & Environment Systems Legal Aspects of water & Environment Systems: Principles of Law Applied to Water Rights and water allocation, water laws. Environmental protection law.. Environmental constraints on Water Resources Development.(**6Hrs**)

ReferenceBooks:-

1. Loucks, D.P., Stedinger, J.R. and Haith, D.A. (1982) "Water Resources Systems Planning and Analysis", Prentice Hall Inc. N. York.

2. Chaturvedi, M.C. (1987), "Water Resources Systems Planning and Management", Tata McGraw Hill-Pub. Co., N. Delhi.

3. Hall W.A. and Dracup, J.A. (1975), "Economics of Water Resources Planning", McGraw Hill publication N Delhi.

4. James, L.D. and Lee (1975) "Economics of water resources planning", McGraw : Hill Inc. N York.

5. Kuiper, E. (1973) "Water Resources Development, Planning, Engineering and economics", Buttersworth, London.

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester II)	
Course Code: MWR 653 **Course: Land and Water Management** **Teaching Scheme:** **Theory: 03 Hrs/week** **Tutorial: 01 Hr/week.**	**Credits: 3-1-0** **Mid Semester Examination I : 15 Marks** **Mid Semester Examination II : 15 Marks** **Teacher Assessment: 10 Marks** **End Semester Examination: 60 Marks** **End Semester Examination. (Duration): 3 Hrs**

Prerequisite: Basic understanding aboutLand and Water Management Course

Objectives:

- **To Understand Physical and chemical properties of soil.**
- **To introduce the importance of Irrigation Management.**
- **To Understand Soil-Plant-Water relationships.**
- **To explain the details of Watershed management.**
- **To give and overview of Water Harvesting Technique.**
- **To develop an understanding of the Irrigation Development in India.**

Course Outcome:

upon completion of this course student will be able to

	CourseOutcomes
CO1	Introduce the importance of Physical and chemical properties of soil.
CO2	UnderstandIrrigation Management.
CO3	Develop an understanding of Soil-Plant-Water relationships.
CO4	Explain the details of Watershed management.
CO5	Overview of Water Harvesting Technique.
CO6	Analys the Irrigation Development in India.

Unit content Hours:

UNIT 1	**A. Physical and chemical properties of soil** Physical and chemical properties of soil, soil profile, soil aeration, classification of Irrigable Soils, Soil survey, soil management.**(6Hrs)**
	B. Irrigation Management Irrigation Management: Land Grading and Field Layout, Cropping patterns,

	Fertilizers, On-farm developments, Diagnostic analysis of irrigation system, water application methods, Rotational water distribution, Micro Irrigation, Water Logging and Salt Problems, Reclamation and Management of Salt affected Soils, Drainage, Participatory Irrigation Management.**(8Hrs)**
UNIT 2	**A. Soil-Plant-Water relationships** Soil-Plant-Water relationships, Capillary and non capillary pores, water relation of soils, infiltration, Hydraulic conductivity, water movement through soils, Soil water potential, soil moisture constants, plant water relations, rooting characteristics.**(6Hrs)**
	B. Watershed management Watershed management: Objectives, water conservation and harvesting, soil erosion-principles and causes, estimation of soil loss, universal soil loss equation- control and conservation, Land capability classification.**(6Hrs)**
UNIT 3	**A. Water Harvesting Technique** Watershed development ridge to valley concept, water harvesting technique for life saving irrigations, land treatment, drainage line treatment, role of geology, design of structure, estimation of water harvested, impact on environment, hydrology of micro watershed, case study.**(8Hrs)**
	B.Irrigation Development in India Irrigation Development in India, Planning of Irrigation projects, command area development programme,**(6Hrs)**

ReferenceBooks:-

1. Murthy, V.V.N. (1999) "Land and Water Management Engineering", Kalyani Publishers, Ludhiana.

2. Scwabe G.O., Fagmeir, D.D. and Eliot W.J. (1995) "Soil and Water Management Systems", Jhn Wiley and Sons, N York. :

3. Michael, B.A.M. (1990) "Irrigation", Vikas Publishing House Pvt. Ltd. N Delhi.

4. Asawa, G.L. (1995) "Irrigation Engineering", New Age International Pub. Co. N Delhi.

5. Suresh, R.L. (1999) "Soil and water conservation engineering", standard publishing Co. Delhi.

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester II)	
Course Code: MWR 691 **Course: Program Elective I** **Neuro Fuzzy Applications** **Teaching Scheme:** **Theory: 03 Hrs/week** **Tutorial: 01 Hr/week.**	**Credits: 3-1-0** **Mid Semester Examination I : 15 Marks** **Mid Semester Examination II : 15 Marks** **Teacher Assessment: 10 Marks** **End Semester Examination: 60 Marks** **End Semester Examination. (Duration): 3 Hrs**

Prerequisite: Basic understanding about Neuro-Fuzzy Applications.

Course Objectives:

- **To UnderstandBasic concepts of Neural Networks and Fuzzy logic**
- **To introduce the importance of Neuro-Fuzzy Modeling**
- **To Understand Fundamental concepts of Artificial Neural Networks**
- **To explain the details of Fuzzy Reasoning and Fuzzy Interference**
- **To give and overview of Neural Network Models**
- **To develop an understanding of the Fuzzy Set Theory**

Course Objectives:

upon completion of this course student will be able to

CO1	Introduce the importance of Neural Networks and Fuzzy logic.
CO2	Understand Basic concepts of Neuro-Fuzzy Modeling.
CO3	Explain the details of Fundamental concepts of Artificial Neural Networks.
CO4	Understand Fuzzy Reasoning and Fuzzy Interference.
CO5	Overview of Neural Network Models.
CO6	Develop an understanding of the Fuzzy Set Theory.

Unit content Hours:

UNIT 1	**A. Introduction** Introduction: Basic concepts of Neural Networks and Fuzzy logic, differences between conventional computing and Neuro-Fuzzy computing, characteristics of Neuro-Fuzzy computing.**(8)**
	B. Neuro-Fuzzy Modeling Neuro-Fuzzy Modeling :Neuro-Fuzzy computing, Hydrologic modeling Time series, Analysis and Modeling, Water Management.**(6)**

UNIT 2	**A. Fundamental concepts of Artificial Neural Networks** Fundamental concepts of Artificial Neural Networks: Model of a neuron, activation functions, neural processing, Network architectures, learning methods.(6)
	B. Fuzzy Reasoning and Fuzzy Interference Fuzzy Reasoning and Fuzzy Interference: Fuzzy rules, Fuzzy reasoning, Fuzzy Inference systems, Fuzzy modeling, Applications of Fuzzy reasoning and modeling in Civil Engineering problems.(6)
UNIT 3	**A. Neural Network Models** Neural Network Models: Feed forward Neural Network, Back propagation algorithm, Applications of Feed forward networks, Recurrent networks, Hopfield networks, Hebbian learning, self-organizing networks, unsupervised learning, competitive learning.(8)
	B. Fuzzy Set Theory Fuzzy Set Theory: Basic definitions and terminology and membership functions formulation and parameters, basic operations of fuzzy sets complement, intersection, vision, t-norm and T-conor. (6)

ReferenceBooks:-

1. Jang, JSR, C.T. Sun and E. Mizutan (1997), "Neuro-Fuzzy and Soft Computing", Prentice Hall, N.J.

2. Simon Haykin, (1993), "Neural Networks, A Comprehensive Foundation", McMilĺan College Publishing Company.

3. Kosko, B. (1997), "Neural Networks and Fuzzy Systems", Prentice Hall of India Pvt. Ltd., New Delhi.

4. Klir, George J., T.A. Forger, (1995), "Fuzzy Sets, Uncertainty and Information", Prentice Hall of India, Pvt. Ltd., New Delhi.

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester II)	
Course Code: MWR 692 **Course: Program Elective –II** **Environmental Evaluation of Water Resource Development** **Teaching Scheme:** **Theory: 03 Hrs/week** **Tutorial: 01 Hr/week.**	**Credits: 3-1-0** **Mid Semester Examination -I :- 15 Marks** **Mid Semester Examination -II :- 15 Marks** **Teacher Assessment:- 10 Marks** **End Semester Examination:- 60 Marks** **End Semester Examination. (Duration):-3 Hrs**

Prerequisite: Basic understanding aboutEnvironmental Evaluation of Water Resource Development

Course Objectives:

- **To Understand Basic concepts of Environment and its interaction with human activities**
- **To introduce the importance of Environmental issues in water resource development**
- **To Understand Fundamental concepts of Principles of Environmental engineering**
- **To explain the details of Water Quality Impact Assessment**
- **To give and overview of Guidelines and legal aspects for environmental protection**
- **To develop an understanding of the Methodologies for Carrying Environmental Impact Assessment**

Course Outcome:

Upon completion of this course student will be able to

CO1	Introduce the importance of Environment and its interaction with human activities.
CO2	Understand Basic concepts of Environmental issues in water resource development.
CO3	Analyze concepts of Principles of Environmental engineering.
CO4	Explain the details of Water Quality Impact Assessment.
CO5	Develop an understanding of Guidelines and legal aspects for environmentalprotection.
CO6	Give and overview of the Methodologies for Carrying Environmental.

Unit content Hours:

UNIT 1	**A. Introduction** Environment and its interaction with human activities, Environmental imbalances Attributes, Impacts, Indicators and Measurements, Concepts of Environmental Impact. Assessment (EIA), Environmental Impact Statement, Objectives of EIA, Advantages and Limitations of EIA.**(6Hrs)**
	B.Environmental issues in water resource development Environmental issues in water resource development - Land Use - Soil erosion and their sort and long term effect - Eco system studies - Flora -Fauna -Aquatic and terrestrial ecosystem balance - Disturbance and long term impacts - changes in quantity and quality of flow - sedimentation Environmental impact - assessment of water resources development structures - Case Studies.**(8Hrs)**
UNIT 2	**A. Principles of Environmental engineering** Principles of Environmental engineering, Ecological diversity, its importance and conservation, Ecosystem evaluation, landscape-main ecological elements, Diversity, matrices, patches, corridors, Interrelations of ecological elements in a cultural landscape, Reclamation and environmental engineering, water resources and ecology, saving endangered species, International and regional convention on environmental protection.**(8Hrs)**
	B. Water Quality Impact Assessment Water Quality Impact Assessment: Attributes to be Considered, Water Quality Impact Assessment of Water Resources Projects, Data Requirement of water quality impact Assessment for Dams, Impacts of Dams on Environment, Case Studies.**(6Hrs)**
UNIT 3	**A. Guidelines and legal aspects for environmental protection** Guidelines and legal aspects for environmental protection, role of Ministry of environment and forests, Role of pollution control board, Environmental protection acts, measures of effectiveness of pollution control activity.**(6Hrs)**
	B. Methodologies for Carrying Environmental Impact Assessment Methodologies for Carrying Environmental Impact Assessment: Overview of Methodologies Ad hoc, Checklist, Matrix, Network, Overlays, Benefit Cost Analysis, Choosing a Methodology, Review Criteria.**(6Hrs)**

ReferenceBooks:-

1. Jain, R.K., Urban, L.V., Stracy, G.S., (1991), "Environmental Impact Analysis", Van Nostrand Reinhold Co., New York.

2. Rau, J.G. and Wooten, D.C. (1995), "Environmental Impact Assessment MacGraw Hill Publication Co., New York. "

3. Canter, L.W., (1997), "Environmental Impact Assessment", McGraw Hill Pub. Co., New York.

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester II)	
Course Code: MWR 693 **Course: Open Elective** **Water Power Engineering** **Teaching Scheme:** **Theory: 03 Hrs/week** **Tutorial: 01 Hr/week.**	**Credits: 3-0-0** **Mid Semester Examination I : 15 Marks** **Mid Semester Examination II : 15 Marks** **Teacher Assessment: 10 Marks** **End Semester Examination: 60 Marks** **End Semester Examination. (Duration): 3 Hrs**

Prerequisite: Basic understanding aboutWater Power Engineering

Course Objectives:

- **To Understand Sources of energy, types of power**
- **To introduce the importance of Hydraulic design of various elements**
- **To Understand Nature of demand**
- **To explain the details of air cushion chamber type**
- **To give and overview of Pumped storage plants**
- **To develop an understanding Economic comparison of underground power stations with the surface power stations.**

Course Outcome:

upon completion of this course student will be able to

CO1	Introduce the importance of Sources of energy, types of power.
CO2	Understand the Hydraulic design of various elements.
CO3	Analys Nature of demand.
CO4	Explain the details of air cushion chamber type.
CO5	Overview of Pumped storage plants.
CO6	Introduce Economic comparison of underground power stations with the surface power stations.

Unit content Hours:

UNIT 1	**A. Introduction** Introduction: Sources of energy, types of power, choice of type of generation. Components of a waterpower project, types of hydro power schemes and their general layouts. Concept of power transmission. Estimation of Hydropower available - Basic water power equation, estimation

	of discharge and hear available. Preliminary choice of the type of system.(**6Hrs**)
UNIT 1	**B. Hydraulic design of various elements** Intakes: Types, elements of an intake, hydraulic design of various elements. Conveyance System: Power channel, pressure conduits, tunnels. General concepts of design and the economics. Tail Race: Functions, types (Channel and tunnel). Draft tubes, function and principle types.(**8Hrs**)
UNIT 2	**A. Nature of demand** Nature of demand: Load curves, load duration curves, load factor, plant capacity factor, plant use factor, firm and secondary power.(**6Hrs**)
	B. Surge tank Surge tank: Function, location, types such as simple, restricted orifice, differential, air cushion chamber type. Basic design criteria. Fore bay.(**6Hrs**)
UNIT 3	**A. Pumped storage plants** Pumped storage plants: Concepts, general layout, types and economics. Other types of power plant : a) Depression power plant. (b) Micro Power Station Need for the development and the problems faced.(**6Hrs**)
	B. Power station Power station: Types, elements of a power station. General criterion for the design of main dimensional of the powerhouse. Economic comparison of underground power stations with the surface power stations. Turbines: Classification, characteristics of different types, choice of type. Turbine setting and cavitations. Tidal power stations: Concepts general layout, classification, types.(**8Hrs**)

ReferenceBooks:-

1. Mosonyi, E. - "Water Power Development" Vol. I & II.
2. Brown,G. Etal - "Hydro-electric engineering practice" Vol. I, II and III.
3. Dandekar M.M. - "Water Power Engineering Vikas Pub. House Pvt. Ltd .

Faculty of Science & Technology Syllabus of M.E (Water Resources Engineering) (Semester I)	
Course Code: MWR 694 **Course: Open Elective 2** **Computational and Statistical Methods** **Teaching Scheme:** **Theory: 03 Hrs/week** **Tutorial: 01 Hr/week.**	**Credits: 3-0** **Mid Semester Examination - I :- 15 Marks** **Mid Semester Examination - II :- 15 Marks** **Teacher Assessment:- 10 Marks** **End Semester Examination:- 60 Marks** **End Semester Examination. (Duration):- 3Hrs**

Prerequisite: Basic understanding about Computational and Statistical Methods

Course Objectives:

- **To explain the details of finite elements methods.**
- **To give and overview of computational and statistical methods.**
- **To explain the details of probability distribution.**
- **To give and overview of basic concept of probability.**
- **To explain the details of Fuzzy logic.**
- **To give and overview of regression analysis.**

Course Outcomes:

upon completion of this course student will be able to

CO1	Understand the details of finite elements methods.
CO2	overview of computational and statistical methods.
CO3	Analys the details of probability distribution.
CO4	Explain and overview of basic concept of probability.
CO5	Develop the details of Fuzzy logic.
CO6	Introduce and overview of regression analysis.

Unit content Hours:

UNIT 1	**A. Finite Elements Method** Finite Elements method: Basic Concepts, Solution of Discrete Problems, Steady State and Time Dependent Continuous Problems, Application of Finite method through illustrative examples. **(6 Hrs)**
	B. Numerical Solution of Ordinary Differential Equations Numerical Solution of Ordinary Differential Equations: Solution by Taylor's Series, Euler's Method, Runge Kutta Methods, Miles Methods, Solution of Algebraic and Transcendental equations, Newton Rapson, Bisection method. **(8Hrs)**

UNIT 2	**A. Regression Analysis** Regression Analysis: Sample Linear Regression, Evaluation of Regression-Confidence Intervals and Tests of Hypothesis -Multiple linear Regression - Correlation and Regression Analysis. **(6 Hrs)**
	B. Presentation of Data Classification and Presentation of data, Basic Concepts of Probability, Probability Axioms, Analysis and Treatment of Data, Population and Samples, Measures of Central Tendency Measures of Dispersions, Measures of Symmetry. **(6 Hrs)**
UNIT 3	**A. Fuzzy logic** Fuzzy logic, Neural Networks and Genetic Algorithms: Introduction, Concepts, Basic Fuzzy Mathematical Operations, Mathematical Model of Neuron, Learning Algorithm Architecture, Introduction to genetic algorithm, Operators, Applications. **(6 Hrs)**
	B. Probability Distributions Probability Distributions: Discrete and Continuous Probability Distribution Functions – Binomial, Poisson, Normal, Lognormal, Transformations to Normal Distributions Extreme Value Distributions, Parameter Estimation – Methods of Moments, Gama Distributions, Gamble Distributions, Skewness& Kurtosis Probability Weighted Moments and Least Square Methods. **(8Hrs)**

Reference Books:-

1. Gupta S.P. (1999) "Statistical Methods", S. Chand & Sons
2. Hann C.T., (1995), "Statistical Methods in Hydrology", East West Press, New Delhi.
3. Sastry. S.S. (1995), "Introductory Methods of Numerical Analysis", Prentice Hall of India (P) Ltd., New Delhi.
4. Rao V & H. Rao, (1995), "C++, Neural Networks and Fuzzy Logic, BPB Publications, New Delhi.
5. Goldberg, D.E. (200), "Genetic Algorithms in Search, Optimization & Machine Learning", Addison Wesley Longman (Singapore) Pvt. Ltd., Indian Branch, Delhi.
6. Higher Engineering Mathematics by B.5 Grewal (Konno publication, Delhi)
7. Numerical Method by Kristina Raju

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester II)	
Course Code: MWR 671 **Course: Lab I (Hydraulic Structure)** **Teaching Scheme:** **Practical: 02 Hrs/week**	**Credits: 0-0-1** **Term Work :- 25 Marks**

Course Objectives:

- **To gain additional insides of the courses.**
- **Assignment shall be based on five theory courses of semester II (two on each course) the marks shall be awarded by concerned course teach**

List of Practical:

1) **Compute the physical properties of given tap water and muddy water.**
2) **Compute the physical properties of given oil and Mercury.**
3) **Use the piezometer and measure the pressure at a given point.**
4) **Use the Reynolds apparatus to interpret types of flow.**
5) **Determine the efficiency of centrifugal pump.**

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester II)	
Course Code: MWR 672 **Course: Lab -II (Land & Water Management)** **Teaching Scheme:** **Practical: 02 Hrs/week**	**Credits: 0-0-1** **Practical Oral : 25 Marks**

The lab V work consists of the process analysis using relevant software through, product identification appropriate process selection process details Verification analysis the candidate will deliver the work in front of two examiners (one internal and other appointed by university)

Faculty of Science & Technology Syllabus of M.E (Water Resources Engineering) (Semester II)	
Course Code: MWR 674 **Course: Mini Project** **Teaching Scheme:** **Tutorial: 04 Hrs/week**	**Credits: 0-0-1** **PR/OR : 50 Marks**

Prerequisite: Not applicable.

Course Outcomes:

upon completion of this course student will be able to

CO1	To search literature from different sources to appraise the state-of-the-art.
CO2	To compile and prepare a technical report from the collected literature.
CO3	To present the literature in a comprehensive manner and identify the problem for the dissertation.

Detailed Syllabus:

Term Work:

The Mini Project with Seminar shall consist of collection of literature from a chosen field of Water Resources Engineering from various sources such as refereed journals, proceedings of national international conferences, PG/PhD theses etc. Based on the literature survey, case studies, data collection, surveys, pilot studies, mathematical/analytical modelling, etc., as necessary the candidate shall define the problem for the dissertation.

The candidate shall prepare a technical report in a prescribed format and present before a panel of examiners consisting of guide and at least one faculty member of the department.

Viva Voce Examination: It consists of two parts.

Part-I : Mid-Term Evaluation for 10 Marks: A mid-term evaluations for 10 marks out of 25 marks shall be done as per the schedule given in the institute academic calendar. Student should prepare a power point presentation and present before the panel of examiners and class students and should be able to answer questions asked by the panel of examiners and class students. Panel of examiner consists of guide as internal examiner and one faculty members appointed by the DCoE as external examiners. The panel of examiner will assess the contents and presentation and give the suggestions, if any and assigns the marks out of 10. In this phase student is expected to collect and present substantial literature.

Part-II : End Semester Evaluation for 15 Marks: Student should prepare technical report in prescribed format duly incorporating suggestions of Part-I and present power point presentation before the panel of examiners and class students. The student should be able to answer the questions asked. The panel of examiner will assess the seminar contents and seminar presentation and assigns the marks out of 15. In this phase the students is expected to define the problem for dissertation through further literature survey, case studies, data collection, surveys, pilot studies, mathematical/analytical modelling, etc., as necessary.

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester II)	
Course Code: MWR 675 **Course: In-plant Training / OJT**	**Credits: 2-0** **TW : 50 Marks** **End Semester Examination. (Duration): 4 Hrs**

Course objectives:

The learning objective of the In plant training course are -

- **To learn and Recognize Industrial environment**
- **Understand various career paths**
- **Communicate effectively**
- **Understand and learn employability skills required**

Course outcome:

Upon completion of this course student will be able to

CO1	Understand and learn industrial Environment
CO2	Understand and learn industrial Environment
CO3	Identify career path taking into account their individual career path
CO4	Communicate effectively through technical presentation
CO5	Enhance employability skills

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester III)	
Course Code: MWR 720 **Course: MOOC Course** **Teaching Scheme:** **Theory: 03 Hrs/week** **Tutorial: 00 Hr/week.**	**Credits: 3-0-0** **End Semester Examination: 100 Marks** **End Semester Examination. (Duration): 3 Hrs**

It is mandatory for the students to complete one MOOC course related to the program of study. The student will have to complete the MOOC course which will be available on the SWAYAM portal (Free online education portal). Registered MOOC course should not have similar or overlapping content to that of the regular course in the curriculum of the program. The credit can be given to the students after successful completion of the MOOC course of 12 weeks or more. The credits will be transferred by the evaluation in terms of assignments or examinations of viva-voce.

In case the student is unable to clear MOOC course examination, the student will have to appear for an institute-level examination for the respective MOOC course.

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester III)	
Course Code: MWR 721 **Course: Dissertation part I** **Teaching Scheme:** **Practical: 18 Hours/week**	**Credits: 0-0-9** **Term Work: 100 Marks** **Practical oral: 100 Marks**

Course objective:- This course is focused to facilitate student to carry out extensive research and development project or technical project at place of work through problem and gap identification, development of methodology for problem solving, interpretation of findings, presentation of result and discussion of findings in context of national and international research. The overall goal of the dissertation is for the student to display the knowledge and capability required for independent work.

The dissertation shall consist of a report on any research work done by the candidate or a comprehensive and critical review of any recent development in the subject or detailed report of the project work consisting of a design and / or development work that the candidate has executed. The report must include comprehensive literature work on the topic selected for dissertation.

Term work:

The dissertation part I will be in the form of seminar report on the project work being carried out by the candidate and will be assessed by two examiners appointed by the university, one of whom will be the guide and other will be a senior faculty member from the department.

Viva-voce:

Student should prepare a power point presentation and present before the panel of examiners and class students. Panel of examiner consists of guide as internal examiner and at last one faculty member appointed by the head of the Department as external examiner.

Faculty of Science& Technology Syllabus of M.E (Water Resources Engineering) (Semester IV)	
Course Code: MWR 771 **Course: Dissertation part II** **Teaching Scheme:** **Practical: 24 Hours/week**	**Credits: 0-0-12** **Term Work: 150 Marks** **Practical oral: 150 Marks**

Course objective:

This course is focused to facilitate student to carry out extensive research and development project or technical project at place of work through problem and gap identification, development of methodology for problem solving, interpretation of findings, presentation of result and discussion of findings in context of national and international research. The overall goal of the dissertation is for the student to display the knowledge and capability required for independent work.

The dissertation part II will be in continuation of dissertation part I and shall consist of a report on the research work done by the candidate or a comprehensive and critical review of any recent development in the subject or detailed report of the project work consisting of a design and/ or development work that the candidate has executed. The examiner shall submit the dissertation in triplicate to the head of the institution duly certified by the guide and the concerned head of department and the principal that the work has been satisfactorily completed.

Term Work:

The dissertation will be assessed by two internal examiners appointed by the institute, one of whom will be the guide and other will be a senior faculty member from the department.

Viva-voce:

Student should prepare a power point presentation and present it before the panel of examiners consisting of guide and the external examiners appointed by the controller of examination. The candidate should be able to defend his work in front of the panel of examiners and peers. The panel of examiners will assess the dissertation content and presentation and assigns the mark out of 150