

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI.



Scheme of Teaching and Examinations and Syllabus  
**M.Tech Water Resource Management (WRM)**  
(Effective from the Academic year 2020-21)

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI**  
**Scheme of Teaching and Examinations – 2020 - 21**  
**M.Tech Water Resource Management (WRM)**  
**Choice Based Credit System (CBCS) and Outcome Based Education(OBE)**

<b>I SEMESTER</b>											
Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Examination			Credits	
				Theory	Practical	Skill Development Activities	Duration in hours	CIE Marks	SEE Marks		Total Marks
				L	P	SDA					
1	PCC	20WRM11	Advanced Fluid Mechanics	03	--	02	03	40	60	100	4
2	PCC	20WRM12	Engineering Hydrology	03	--	02	03	40	60	100	4
3	PCC	20WRM13	Water Resource System Planning & Management	03	--	02	03	40	60	100	4
4	PCC	20WRM14	Open Channel Hydraulics	03	--	02	03	40	60	100	4
5	PCC	20WRM15	Optimization Techniques in Water Resources	03	--	02	03	40	60	100	4
6	PCC	20WRML16	Advanced Water Resource Engineering Laboratory -I	--	04	--	03	40	60	100	2
7	PCC	20RM117	Research Methodology and IPR	02	--	02	03	40	60	100	2
<b>TOTAL</b>				<b>17</b>	<b>04</b>	<b>12</b>	<b>21</b>	<b>280</b>	<b>420</b>	<b>700</b>	<b>24</b>

**Note: PCC: Professional core.**

**Skill development activities:**

Students and course instructor/s to involve either individually or in groups to interact together to enhance the learning and application skills.

The students should interact with industry (small, medium and large), understand their problems or foresee what can be undertaken for study in the form of research/ testing / projects, and for creative and innovative methods to solve the identified problem.

The students shall

- (1) Gain confidence in modelling of systems and algorithms.
- (2) Work on different software/s (tools) to Simulate, analyse and authenticate the output to interpret and conclude. Operate the simulated system under changed parameter conditions to study the system with respect to thermal study, transient and steady state operations, etc.
- (3) Handle advanced instruments to enhance technical talent.
- (4) Involve in case studies and field visits/ field work.
- (5) Accustom with the use of standards/codes etc., to narrow the gap between academia and industry.

All activities should enhance student's abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise, etc.

**Internship:** All the students have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed internship credit shall be counted for the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as fail in internship course and have to complete the same during the subsequent University examination after satisfying the internship requirements.

**Note:** (i) Four credit courses are designed for 50 hours Teaching – Learning process.  
(ii) Three credit courses are designed for 40 hours Teaching – Learning process.  
(iii) Two credit courses are designed for 25 hours Teaching – Learning process.

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**II SEMESTER**

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination			Credits	
				Theory	Practical/ Seminar	Skill Development Activities	Duration in hours	CIE Marks	SEE MARKS		Total Marks
				L	P	SDA					
1	PCC	20WRM21	Project Planning & Evaluation	03	--	02	03	40	60	100	4
2	PCC	20WRM22	Ground Water Hydrology	03	--	02	03	40	60	100	4
3	PCC	20WRM23	Water Conservation Management	03	--	02	03	40	60	100	4
4	PEC	20WRM24X	Professional elective 1	04	--	--	03	40	60	100	4
5	PEC	20WRM25X	Professional elective 2	04	--	--	03	40	60	100	4
6	PCC	20WRML26	Advanced water Resource Engineering	--	04	--	03	40	60	100	2
7	PCC	20WRM27	Technical Seminar	--	02	--	--	100	--	100	2
<b>TOTAL</b>				<b>17</b>	<b>06</b>	<b>06</b>	<b>18</b>	<b>340</b>	<b>360</b>	<b>700</b>	<b>24</b>

**Note: PCC: Professional core, PEC: Professional Elective.**

Professional Elective 1		Professional Elective 2	
Course Code under 20XXX24X	Course title	Course Code under 20XXX25X	Course title
20WRM241	Hydraulic Structures	20WRM251	River Engineering
20WRM242	Environmental Impact Assessment of Water Resource	20WRM252	Climate Change & Adaptation
20WRM243	Urban Hydrology	20WRM253	Techno Economic Analysis of Water Development
20XXX244	-----	20XXX254	-----

**Note:**

**1. Technical Seminar:** CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a senior faculty of the department. Participation in the seminar by all postgraduate students of the programme shall be mandatory.

The CIE marks awarded for Technical Seminar, shall be based on the evaluation of Seminar Report, Presentation skill and performance in Question and Answer session in the ratio 50:25:25.

**2. Internship:** All the students shall have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed internship credit shall be counted in the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as fail in internship course and have to complete the same during the subsequent University examination after satisfying the internship requirements.

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**III SEMESTER**

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination			Credits	
				Theory	Practical/ Mini-Project/ Internship	Skill Development activities	Duration in hours	CIE Marks	SEE Marks		Total Marks
				L	P	SDA					
1	PCC	20WRM31	Sediment Transport	03	--	02	03	40	60	100	4
2	PEC	20WRM32X	Professional elective 3	03	--	--	03	40	60	100	3
3	PEC	20WRM33X	Professional elective 4	03	--	--	03	40	60	100	3
4	Project	20WRM34	Project Work phase -1	--	02	--	--	100	--	100	2
6	Project	20WRM35	Mini Project	--	02	---	---	100	---	100	2
5	INT	20WRMI35	Internship	(Completed during the intervening vacation of I and II semesters and /or II and III semesters.)			03	40	60	100	6
<b>TOTAL</b>				<b>09</b>	<b>04</b>	<b>02</b>	<b>12</b>	<b>360</b>	<b>240</b>	<b>600</b>	<b>20</b>

**Note: PCC: Professional core, PEC: Professional Elective.**

Professional elective 3		Professional elective 4	
Course Code under	Course title	Course Code under	Course title
20WRM321	Theory of Seepage & earthen dams	20WRM331	Watershed Conservation & Management
20XXX322	Water power and dam engineering	20WRM332	Integrated Watershed Management

**Note:**

**1. Project Work Phase-1:** Students in consultation with the guide/co-guide if any, shall pursue literature survey and complete the preliminary requirements of selected Project work. Each student shall prepare relevant

introductory project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill and performance in Question and Answer session in the ratio 50:25:25. SEE (University examination) shall be as per the University norms.

**2. Internship:** Those, who have not pursued /completed the internship, shall be declared as fail in internship course and have to complete the same during subsequent University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.

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**IV SEMESTER**

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work	Duration in hours	CIE Marks	SEE Marks Viva voce	Total Marks	
				L	P					
1	Project	20WRM41	Project work phase -2	--	04	03	40	60	100	20
<b>TOTAL</b>				--	<b>04</b>	<b>03</b>	<b>40</b>	<b>60</b>	<b>100</b>	<b>20</b>

**Note:**

**1. Project Work Phase-2:**

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a Senior faculty of the department. The CIE marks awarded for project work phase -2, shall be based on the evaluation of Project Report subjected to plagiarism check, Project Presentation skill and performance in Question and Answer session in the ratio 50:25:25.

SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.



<b>20WRM11- ADVANCED FLUID MECHANICS</b>			
Course Code	<b>20WRM11</b>	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
<b>Module-1</b>			
Introduction: Survey of Fluid Mechanics, Structure of Fluid Mechanics Based on Rheological, Temporal Variation, Fluid Type, Motion Characteristic and spatial Dimensionality Consideration, Approaches in Solving Fluid Flow Problems, Fundamental idealizations and Descriptions of Fluids.			
<b>Module-2</b>			
Motion, Quantitative Definition of Fluid and Flow, Reynolds Transport Theorem, Mass, Momentum and Energy Conservation Principles for Fluid Flow. Potential Flow: Frictionless Irrotational Motions, 2 - Dimensional Stream Function and Velocity Potential Function in Cartesian and Cylindrical Polar Coordinate Systems, Standard Patterns of Flow, Source, Sink, Uniform Flow and irrotational vortex, Combinations of Flow Patterns, method of Images in Solving Groundwater Flow problems, Method of Conformal transformations.			
<b>Module-3</b>			
Viscous Flow and Boundary Layer Theory: Study of Local Behavior, Differential Approaches in Analysis of Viscous Flows, Equations of Motion of a Viscous Flow, Navier – Stokes Equations, Exact and Approximate Solution of N – S Equations, Hele – Shaw Flow, Creeping Flow past a Sphere, Boundary Layer Concept, Prandtl's Boundary Layer Equations, Laminar Boundary Layer Along a Flat Plate, Integral Momentum Equation, Blassius Solution			
<b>Module-4</b>			
Turbulence in Fluid Flow: Origin of turbulence, Statistical Analysis of Turbulence, Reynolds Equations for Turbulent Flow obtained from N – S Equations, Models 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			
<b>Module-5</b>			
Design and Testing of Models: Design of and Experiment, Dimensional Analysis, Complete Set of Dimensionless Parameters, Dimensional Analysis, Scale effect, Distorted Models, Practical Significance of Key Modeling Parameters, Design of Models and Model Tests. Diffusion: Equations of Fluid Dynamics for a Mixture of Fluids, Dispersion of Pollutant in a Fluid Medium, Coefficient of Mass Transfer.			
<b>Course outcomes:</b>			
At the end of the course the student will be able to:			

**Question paper pattern:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.☐

**Textbook/ Textbooks**

(1) Wand D.J., and Harleman D.R. (1964) "Fluid Dynamics", Addison Wesley.

(2) Schlichting: (1976) "Boundary Layer theory", International Text – Butterworth

**Reference Books**

(1) Lamb, H. (1945) "Hydrodynamics", International Text – Butterworth

(2) Rouse, H. (1957), "Advanced Fluid Mechanics", John Wiley & Sons, N York

(3) Mohanty A.K. (1994), "Fluid Mechanics", Prentice Hall of India, N

**20WRM12-ENGINEERING HYDROLOGY**

Course Code	<b>20WRM12</b>	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

**Module-1**

Introduction: Hydrologic Cycle, Systems Concept, Hydrologic model classification. Hydrologic Processes: Reynolds Transport Theorem. Atmospheric circulation: Water Vapour, Precipitable water, Thunderstorm cell model. Evaporation: Energy balance method and Aerodynamic method. Evapotranspiration. Subsurface water: unsaturated flow, Richard"s equation. Infiltration: Horton"s and Phillip"s equations. Green-Ampt Method, Ponding time. Surface Water: Hydrograph Analysis, SCS method, Effective Rainfall, Runoff, Runoff Components, Direct Runoff Hydrograph.

**Module-2**

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 Hydrotherapy.

**Module-3**

Rainfall – Runoff Analysis: Review of Rational Methods, Conceptual Models, Parametric Unit Hydrograph, Clarke, Nash and Dooge Models, Hydrologic Simulation Models, Stanford Watershed Model, Derivation of Unit Hydrograph for Ungagged Catchments, Synthetic Unit Hydrograph

**Module-4**

Hydrologic Time Series Analysis: Independent and Autocorrelated Data, Structure of a Hydrologic Time Series, Trend, Jump and Seasonality, Stationarity and Ergodicity, Autocovariance and Auto Correlation Function, Correlogram Analysis, Spectral Analysis, Analysis of Multivariate Hydrologic Series. Modelling of Hydrologic Time Series: Data Generation Techniques, Linear Stochastic Models, Autoregressive, Moving Average, ARMA Models, Modelling of Nonstationary and seasonal Series, Thomas – Feiring Model, ARIMA Models.

<b>Module-5</b>
Hydrologic Flood Routing: Reservoir Routing, Channel Routing, Estimation of Parameters of Flood Routing Models, Flood estimation and flood frequency studies, Real Time Flood Forecasting.
<b>Course outcomes:</b> At the end of the course the student will be able to:
<b>Question paper pattern:</b> The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. <ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question is for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub questions) from each module.</li> <li>• Each full question will have sub question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module. ☐</li> </ul>
<b>Textbook/ Textbooks</b>
(1) Chow, V.T., Maidment, D.R. and Mays, L.W. (1988), "applied Hydrology", McGraw Hill Inc. N York
(2) Singh, V.P. (1986), "Hydrologic Systems," , Prentice Hall Inc., N York
<b>Reference Books</b>
(1) Viessman, W., Lewis, G.L. and Knapp, J.W. (1989), "Introduction to Hydrology", Harper & Row Publications Inc., Singapore.
(2) McCueen R.H. and Snyder, W.M. (1985), Hydrologic Modelling – Statistical Methods and
(3) Hydrology and Water resources Engineering, by K.C. Patra, Narosa publishing house, New Delhi.



<b>20WRM13- WATER RESOURCES SYSTEMS PLANNING &amp; MANAGEMENT</b>			
Course Code	<b>20WRM13</b>	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
<b>Module-1</b>			
Introduction: General Principles of Systems Analysis to Problems in Water Resources Engineering, Objectives of Water Resources Planning and Development, Nature of Water Resources Systems, Socio Economic Characteristics.			
<b>Module-2</b>			
Economic Analysis of Water Resources System: Principles of Engineering Economy, Capital, Interest and Interest Rates. Time Value of Money, Depreciation, Benefit Cost Evaluation, Discounting Techniques, Economic and Financial Evaluation, Socio-Economic Analysis			
<b>Module-3</b>			
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.			
<b>Module-4</b>			
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.			
<b>Module-5</b>			
Water Quality Management: Water Quality Objectives and Standards, Water Quality Control Models, Flow Augmentation, Wastewater Transport Systems, River Water Quality Models and Lake Quality models. 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.			
<b>Course outcomes:</b> At the end of the course the student will be able to:			
<b>Question paper pattern:</b> The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. <ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question is for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub questions) from each module.</li> <li>• Each full question will have sub question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module. ☐</li> </ul>			
<b>Textbook/ Textbooks</b>			

(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

**Reference Books**

(1) Hall. W.A. and Dracup, J.A. (1975), "Water Resources Systems", Tata McGraw Hill Pub. N Delhi

(2) James, L.D. and Lee (1975), "Economics of Water Resources Planning", McGraw Hill Inc. N York

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

<b>20WRM14- OPEN CHANNEL HYDRAULICS</b>			
Course Code	20WRM14	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
<b>Module-1</b>			
Basic Concepts of Free Surface Flow, classification of flow, velocity & pressure distribution. Conservation laws, continuity equation, momentum equation, Specific energy, Application of momentum & energy equation, Channel transition, Hydraulic jump. Critical flow.			
<b>Module-2</b>			
Uniform flow: flow resistance, equation of flow resistance, compound channel, Computation of normal flow depth.			
<b>Module-3</b>			
Gradually varied flow, Governing equation, classification of water surface profiles, and computation of GVF. Unsteady Rapidly Varied Flow. Application of conservation laws. Positive and Negative Surges. Moving hydraulic Jump, Spillways, Energy dissipaters. Critical slope and limit slope.			
<b>Module-4</b>			
Hydraulics of Mobile bed channel, Initiation of Motion of sediment, Critical analysis of Shield"s diagram, Bed forms, and Predication of bed form. Sediment load: Suspended load, Bed load, total bed material load, measurement and estimation of sediment load. Design of Stable Channels: Regime and Tractive force Methods.			
<b>Module-5</b>			
Introduction to Bridge Hydraulics: Water ways, Afflux, Scour: Local scour, abutment scour, Indian practice of design for scour			
<b>Course outcomes:</b> At the end of the course the student will be able to:			
<b>Question paper pattern:</b> The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. <ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question is for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub questions) from each module.</li> <li>• Each full question will have sub question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module.☐</li> </ul>			
<b>Textbook/ Textbooks</b>			
(1) Chow, V.T. (1979) "Open Channel Hydraulics", McGraw Hill. N York.			
(2) Henderson. (1966): "Open Channel Flow", McMillan Pub. London			
(3) Grade and Ranga Raju, K.G. (1980): "Mechanics of Sediment Transportation and Alluvial Stream Problems", Wiley Eastern, N Delhi.			

<b>Reference Books</b>
(1) Chaudhry M.H. (1994), "Open - Channel Flow", Prentice Hall of India, N Delhi.
(2) French, R.H. (1986), "Open Channel Hydraulics", McGraw Hill Pub Co., N York.
(3) Hamill L. (1999), Bridge Hydraulics, E & FN Spon, London.

<b>20WRM15- OPTIMIZATION TECHNIQUES IN WATER RESOURCES</b>			
Course Code	<b>20WRM15</b>	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
<b>Module-1</b>			
<b>Module-2</b>			
Linear programming III: Concept of duality, formulation of dual linear problems, primal dual relationship, duality theorem, shadow prices in linear programming, dual simplex method, advantages of duality, revised simplex method.			
<b>Module-3</b>			
Transportation problem: Transportation problem, mathematical formulation of problem, steps in transportation method, methods for finding initial basic feasible solution, generacy in transportation problem.			
<b>Module-4</b>			
Assignment problems: mathematical formulation, assignment algorithm methods for solving assignment problems. Integer Programming: Nature of the problem, graphical method Gomory's all integer cutting plane method, mixed integer programming problem.			
<b>Module-5</b>			
Goal Programming: Application and solution of the problem. Dynamic Programming: Dynamic programming, characteristics of DP problems, D.P. algorithm, Bellman's optimality principle, recursive relations, backward & forward recursions, solutions to various problems, dimensionality in D.P.			
<b>Course outcomes:</b> At the end of the course the student will be able to:			
<b>Question paper pattern:</b> The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. <ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question is for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub questions) from each module.</li> <li>• Each full question will have sub question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module. ☐</li> </ul>			
<b>Textbook/ Textbooks</b>			
(1) H.A. Taha: "Operations Research" Macmilan publishing Co.			

(2) S.D. Sharma: "Operations Research" Kedar Nath Ram Nath & Co. Meerut.
<b>Reference Books</b>
(1) S. Ravidran, D.T. Phillips & J.J. Solberg "Operation Research".
(2) Kanti Swarup, P.K. Gupta & Manmohan "Operations Research" Sultan Chand & Sons.

<b>20WRML-16 Advanced Water Resources Engineering-Laboratory-I</b>			
Course Code	20WRML16	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	0:4:0	SEE Marks	60
Credits	02	Exam Hours	03
<b>Sl. NO</b>	<b>Experiments</b>		
1	Measurement of velocity profile in straight and meandering open channel;		
2	Experiments on velocity distribution and Boundary shear in rough and smooth channels,		
3	Discharge measurement by weir;		
4	Measurement of Shear stress from velocity distribution obtained from Acoustics Doppler Velocity-meter (ADV).		
5	Measurement of rainfall, evaporation, infiltration, laboratory and field tests.		
6	Characteristics of Hydraulic Jump in horizontal and Sloping Channels		
7	Determination of Manning's N for Composite Sections		
8	Velocity Distribution in Open Channels		
9	Performance Characteristics of Centrifugal pumps		
10	Measurement of Soil Water Tension and Determination of Soil moisture Potential		
11	Rainfall - Runoff Studies		
12	Determination of Infiltration Characteristics		
<b>Course outcomes:</b>			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> <li>•</li> </ul>			

<b>RESEARCH METHODOLOGY AND IPR</b>			
Course Code	20RMI17	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	1:0:2	SEE Marks	60
Credits	02	Exam Hours	03
<b>Module-1</b>			
<p><b>Research Methodology:</b> Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.</p> <p><b>Defining the Research Problem:</b> Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration. ☒</p>			
<b>Module-2</b>			
<p><b>Reviewing the literature:</b> Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.</p> <p><b>Research Design:</b> Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of</p>			
<b>Module-3</b>			
<p><b>Design of Sampling:</b> Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.</p> <p><b>Measurement and Scaling:</b> Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale.</p> <p><b>Data Collection:</b> Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method. ☒</p>			
<b>Module-4</b>			
<p><b>Testing of Hypotheses:</b> Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis.</p> <p><b>Chi-square Test:</b> Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests. ☒</p>			
<b>Module-5</b>			
<p><b>Interpretation and Report Writing:</b> Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.</p> <p><b>Intellectual Property:</b> The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999, The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act 1999, Copyright Act, 1957, The Protection of Plant Varieties and Farmers' Rights Act, 2001, The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO), WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights (TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO. ☒</p>			

<p><b>Course outcomes:</b></p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> <li>• Discuss research methodology and the technique of defining a research problem</li> <li>• Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.</li> <li>• Explain various research designs, sampling designs, measurement and scaling techniques and also different methods of data collections.</li> <li>• Explain several parametric tests of hypotheses, Chi-square test, art of interpretation and writing research reports</li> <li>• Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR.☐</li> </ul>
<p><b>Question paper pattern:</b></p> <ul style="list-style-type: none"> <li>• The question paper will have ten questions.</li> <li>• Each full question is for 20 marks.</li> <li>• There will be 2full questions (with a maximum of four sub questions in one full question) from each module.</li> <li>• Each full question with sub questions will cover the contents under a module.</li> <li>• Students will have to answer 5 full questions, selecting one full question from each module. ☐</li> </ul>
<p><b>Textbooks</b></p> <p>(1) Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International, 4<sup>th</sup> Edition, 2018.</p> <p>(2) Research Methodology a step-by-step guide for beginners. (For the topic Reviewing the literature under module 2), RanjitKumar, SAGE Publications, 3<sup>rd</sup> Edition, 2011.</p> <p>(3) Study Material (For the topic Intellectual Property under module 5), Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013.</p>
<p><b>Reference Books</b></p> <p>(1) Research Methods: the concise knowledge base, Trochim, Atomic Dog Publishing, 2005.</p>



(2) Conducting Research Literature Reviews: From the Internet to Paper, Fink A, Sage Publications, 2009.

\*\*\* END OF I SEMESTER \*\*\*

<b>20WRM21-PROJECT PLANNING EVALUATION &amp; RESOURCE ENGINEERING</b>			
Course Code	20WRM21	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
<b>Module-1</b>			
Introduction: Water Resource Projects- Over all planning- Water resources planning – water resource of India – development policy – and programs and planning approach – Data requirement- string and rational method.			
<b>Module-2</b>			
Project planning: Bar chart method, critical path method, PERT method, Float time. Compression and decompression of network scheduling. Resource leveling. Operating cost and fixed costs. Optimum costs. Objective and policies. Project control – Human aspects of project management.			
<b>Module-3</b>			
Inventories: Management and operating cost of stores, Economic levels of ordering stocks. Machinery requirements for concrete dams, earth dams, etc. estimation of costs and benefits from machinery. Irrigation projects, power projects and multipurpose projects – Lift irrigation projects			
<b>Module-4</b>			
Spatial Planning and Regional analysis: Introduction, problems, potentials, trends, physical characteristics, basic and non basic concepts, analysis of spatial linkages. Social aspects of economic development.			
<b>Module-5</b>			
International Project Planning and Management: Introduction, institutes of technical, financial and scientific cooperation.			
<b>Course outcomes:</b> At the end of the course the student will be able to:			

**Question paper pattern:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.☐

**Textbook/ Textbooks**

(1) Design of water resource systems- Mass et al.

(2) Water resources systems planning – M.C Chaturvedi and Peter Rogards.

**Reference Books**

(1) Construction planning and Management- P.S Gahlot, B.M. Ahir

(2) Water resource of India and their utilization in agriculture – Dhakshina Murthy et al

(3)Irrigation commission reports 1972 Ministry of Irrigation and Power- Volume I,II,&III.

## 20WRM22 –GROUNDWATER HYDROLOGY

Course Code	20WRM22	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
<b>Module-1</b>			
Introduction: Scope, historical background, utilization of groundwater, groundwater in the hydrologic cycle, origin and age of groundwater. Rock properties affecting groundwater: Geologic formations as aquifers, types of aquifers, porosity, soil classification, specific surface, vertical distribution of groundwater, zone of aeration, zone of saturation, specific retention, specific yield, storage coefficient, springs			
<b>Module-2</b>			
Groundwater movement: Darcy's law and its validity, intrinsic permeability, hydraulic conductivity, transmissivity, techniques for determination of hydraulic conductivity, groundwater flow rates, flow nets, flow in relations to ground water contours, flow across a water table, flow across a hydraulic conductivity boundary, dispersion, general flow equations in rectangular and radial co-ordinations.			
<b>Module-3</b>			
Groundwater well hydraulics: Steady unidirectional flow steady radial flow to a well, unsteady radial flow in a confined aquifer, unsteady radial flow in an unconfined aquifer, unsteady radial flow in a leaky aquifer, well flow near aquifer boundaries, multiple well systems, partially penetrating wells, characteristic well losses, specific capacity and well efficiency			
<b>Module-4</b>			
Water wells: surface geophysical methods - electrical resistivity method - seismic method - subsurface investigation - test drilling - resistivity logging - application of remote sensing method. Test holes and well log; methods for constructing shallow wells and deep wells, well completion, pumping equipment for wells, protection of wells, well rehabilitation, infiltration galleries, horizontal pipes, collector wells.			
<b>Module-5</b>			

Groundwater Levels and Environmental Influences: Time variations of levels, stream flow and groundwater levels, fluctuations due to evapotranspiration, meteorological phenomena urbanization, earthquakes, external loads and land subsidence.
<b>Course outcomes:</b> At the end of the course the student will be able to:
<b>Question paper pattern:</b> The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. <ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question is for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub questions) from each module.</li> <li>• Each full question will have sub question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module.☐</li> </ul>
<b>Textbook/ Textbooks</b>
(1) Groundwater Manual", "A water resources Technical Publication", U.S. Department of the interior - Edition. 1985.
(2) Karanth, K. R. A text book "Ground Water Assessment: Development and Management" Tata McGraw-
<b>Reference Books</b>
(1) Raghunath H.M, "A text book on Groundwater", IIIrd Edition, New age4. Publications, 2007.
(2) Todd, D.K., "Groundwater Hydrology", John Wiley & Sons edition, 1980.

<b>20WRM23- WATERSHED CONSERVATION AND MANAGEMENT</b>			
Course Code	<b>20WRM23</b>	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
<b>Module-1</b>			
Introduction: Watershed – Definition and Classification – Components- Basic factors influencing watershed development – Codification - Watershed delineation – Characteristics of watershed: size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology – Socio - economic characteristics			
<b>Module-2</b>			
Soil conservation measures: Types of Erosion – Water and Wind Erosion: Causes, Factors, Effects and Control – Estimation of Soil Erosion- Soil Loss Models- Sedimentation - Soil Conservation Practices: Vegetative and Mechanical.			
<b>Module-3</b>			
Water harvesting and conservation: Types of storage Structures-Water yield from Catchments-Losses of stored water- Water Conservations Methods-Water harvesting methods and Techniques-Rainwater Harvesting-Catchment, Harvesting structures, Roof water harvesting- Soil Moisture Conservation-Check Dams-Artificial Recharge-Farm Ponds- Percolation tanks			
<b>Module-4</b>			
Watershed management: Project Proposal Formulation - Watershed Development Plan Entry Point Activities – Estimation – Watershed Economics - Agroforestry – Grassland Management – Wasteland Management – Watershed Approach in Government Programmes–Developing Collaborative know how – People"s Participation – Evaluation of Watershed Management			
<b>Module-5</b>			
Watershed management plan: Methodology of planning a watershed management, identification of watershed problems, socio-economic issues - application of Remote Sensing and GIS in watershed management.			
<b>Course outcomes:</b> At the end of the course the student will be able to:			
<b>Question paper pattern:</b> The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.			
<ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question is for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub questions) from each module.</li> <li>• Each full question will have sub question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module. ☐</li> </ul>			
<b>Textbook/ Textbooks</b>			
(1) Dhuruvanarayana.V.V, Sastry.G and Patnaik.U.S, "Watershed Management",			

(2) Geln O. Schwab, "Soil and Water Conservation Engineering", John Wiley and Sons, New York, 1981.

**Reference Books**

(1) Ghanashyam Das, "Hydrology and Soil Conservation Engineering", Prentice Hall of India Private Limited, New Delhi, 2000.

(2) Suresh, R., "Soil and Water Conservation Engineering", Standard Publishers

(3) Tideman E.M., "Watershed Management", Omega Scientific Publishers, New Delhi

<b>20WRM241- HYDRAULIC STRUCTURES</b>			
Course Code	20WRM241	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
<b>Module-1</b>			
Reservoir Planning: Classification of reservoirs, storage zones of a reservoir, fixing capacity of reservoirs, life of a reservoir.			
Dams: Investigation surveys, selection of dam site, selection of types of dam, classification of dams.			
Gravity Dams Forces acting on dam, combination of forces for design, design parameters, design of gravity dam, profiles of a dam, stability analysis, foundation treatment, galleries in gravity dams.			
<b>Module-2</b>			
Earth and Rock fill Dams: Types, design criteria for earth dams, design consideration in seismic region, phreatic line, flow net, stability analysis, methods of analysis, slope protection, seepage, dam section to suit available materials and foundation, causes of failure of earth dams, safety measures			
<b>Module-3</b>			
Spillways: Components factors affecting type and design of spillway, types, energy dissipation below spillways, hydraulic jump type stilling basins spillway gates, types.			
<b>Module-4</b>			
Weirs and Barrages: Design of impervious floor on pervious foundation. Bligh's Lane's creep theories, potential theory cut offs, weir design, Khosla's method.			
<b>Module-5</b>			
Unlined irrigation channels: Design parameters, transmission losses, determination of water losses, design formulae, Kennedy's and Lacey's theories, channels on non- alluvial soils			
<b>Course outcomes:</b> At the end of the course the student will be able to:			
<b>Question paper pattern:</b> The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.			
<ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question is for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub questions) from each module.</li> <li>• Each full question will have sub question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module.</li> </ul>			
<b>Textbook/ Textbooks</b>			
(1) Creager, W.P, Justin, J and Daud Hinds, "Engineering for Dams", Vol. I-III, Wiley,N.Y, USA.			
(2) Satyanarayana Murthy, C, "Design of Minor Irrigation and Canal Structure",Wiley Eastern, 1990.			
<b>Reference Books</b>			

(1)Sharma, R.K, "Text Book of Irrigation Engineering and Hydraulic Structures ", Oxford & IBH, 1984			
(2)Varshney, R, S, "Theory and Design of Irrigation Structures", Nem Chand & Bros, 2009.			
(3)Sharma, S.K, "Design of Irrigation Structures", S. Chand & Co, 1988.			
<b>20WRM242 -ENVIRONMENTAL IMPACT ASSESSMENT OF WATER RESOURCES DEVELOPMENT</b>			
Course Code	20WRM242	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
<b>Module-1</b>			
Environmental Issues: Water resources development issues – Environment in water resources project planning – Environmental regulations and requirements – EIA (Environmental Impact Assessment) Notification, 2006 – MoEF & CC Guidance document an major Hydroelectric and Irrigation Projects – ESA (Ecologically Sensitive Area) Notification			
<b>Module-2</b>			
Environmental Issues: Water resources development issues – Environment in water resources project planning – Environmental regulations and requirements – EIA (Environmental Impact Assessment) Notification, 2006 – MoEF & CC Guidance document an major Hydroelectric and Irrigation Projects – ESA (Ecologically Sensitive Area) Notification			
<b>Module-3</b>			
Environmental Impacts: Hydrological and water quality impacts – Ecological and biological impacts – Social and cultural impacts – Soil and landscape changes – Agro economic issues Human health impacts – Ecosystem changes.			
<b>Module-4</b>			
Methods of EIA: EIA team formation – Development of scope, mandate and study design – Base line theory – Check lists – Network and matrix methods – Semi-quantitative methods – ICID check list – Economic approaches – Environmental Impact Statement (EIS) preparation			
<b>Module-5</b>			
Environmental Management: In-stream ecological water requirements – Public participation in environmental decision making – Sustainable water resources development – Eco restoration – Hydrology and global climate change – Afforestation – R & R (Resettlement & Rehabilitation) Programmes - Environmental monitoring programs.			
<b>Course outcomes:</b> At the end of the course the student will be able to:			
<b>Question paper pattern:</b> The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.			
<ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question is for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub questions) from each module.</li> <li>• Each full question will have sub question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each</li> </ul>			
<b>Textbook/ Textbooks</b>			
(1) Biswas, A.K and Aggarwal, S.B.C, "Environmental Impact Assessment for developing Countries", Oxford Butterworth – Heinemann, 1992.			



(2) Canter, L.W, "Environmental Impact Assessment", McGraw Hill International Edition, New York,2008.

### Reference Books

(1) Lawrence, D.P, "Environmental Impact", Wiley-Interscience, New delhi, 2003.

(2)Petts, J, "Handbook of Environmental Impact Assessment", Blackwell Science London, 1999.

## 20WRM243 -URBAN HYDROLOGY

Course Code	20WRM243	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

### Module-1

Urban hydrologic cycle: Water in the urban eco-system - Urban water resources - Major problems - Urban hydrological cycle - Storm water management objectives and limitations - Storm water policies - Feasibility consideration.

### Module-2

Urban Water Resources Management Models: Types of models - Physically based - conceptual or unit hydrograph based -Urban surface runoff models - Management models for flow rate and volume control rate - Quality models.

### Module-3

Urban Storm Water Management: Storm water management practices (Structural and Non-structural Management measures) - Detention and retention concepts - Modelling concept - Types of storage - Magnitude of storage - Hydraulic analysis and design guidelines - Flow and storage capacity of urban components - Temple tanks.

### Module-4

Master plans: Planning and organizational aspects - Inter dependency of planning and implementation of goals and measures - Socio - economics financial aspects - Potential costs and benefit measures - Measures of urban drainage and flood control benefits - Effective urban water user organizations

### Module-5

Operation and Maintenance: General approaches to operations and maintenance - Complexity of operations and need for diagnostic analysis - Operation and maintenance in urban water system - Maintenance Management System - Inventories and conditions assessment - Social awareness and involvement

### Course outcomes:

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

**Question paper pattern:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ☒

**Textbook/ Textbooks**

(1) Geiger.W.F., Marsalek.F., Rawls.W.J., and Zuidena.F.C., (Ed), manual on drainage in urbanized areas - Vol.I and Vol.II, UNESCO, 1987.

(2) Hengeveld H. and C.DeVocht.t (Ed), "Role of Water in Urban Ecology", 1982.

**Reference Books**

(1) Martin P.Wanelista and Yousef A.Yousef., "Storm Water Management", John Wileyand sons, 1993

(2) Neil S.Grigg., "Urban Water Infrastructure planning, management and Operations", John Wiley and Sons, 1986.

(3) Overtens D.E. and Meadows M.E., "Storm Water Modelling", Academic Press, New York, 1976.

<b>20WRM251- RIVER ENGINEERING</b>			
Course Code	<b>20WRM251</b>	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
<b>Module-1</b>			
River functions: Primary function of a river – River uses and measures – Water and Sediment loads of river – Rivers in India, Himalaya and Peninsular.			
<b>Module-2</b>			
River hydraulics: Physical Properties and Equations – Steady flow in rivers – uniform and non-uniform – Turbulence and velocity profiles – resistance coefficients – Boundary conditions and back waters – Transitions – Rating Curve – Unsteady flow in rivers : Propagative of surface waves – Characteristics, flood waves – kinematic and diffusion analogy – velocity of propagation of flood waves – Flood wave –Maximum.			
<b>Module-3</b>			
River mechanics: River Equilibrium: Stability of Channel – regime relations – river bend equilibrium – hydraulic geometry of downstream - Bars and meandering - River dynamics – degradation and aggradations of river bed – Confluences and branches – River Data base			
<b>Module-4</b>			
River surveys and Model: Mapping – Stage and Discharge Measurements –Sediments – Bed and suspended load Physical hydraulic Similitude – Rigid and mobile bed –Mathematical – Finite one dimensional – multi – dimensional – Water Quality and ecological Model.			
<b>Module-5</b>			
River management: River training works and river regulation works – Flood plain management – waves and tides in Estuaries - Interlinking of rivers – River Stabilization			
<b>Course outcomes:</b> At the end of the course the student will be able to:			
<b>Question paper pattern:</b> The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. <ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question is for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub questions) from each module.</li> <li>• Each full question will have sub question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module. ☐</li> </ul>			
<b>Textbook/ Textbooks</b>			
(1)Janson PL.Ph., Lvan BendegamJvanden Berg, Mdevries A. Zanen ( Editors),			
(2)Principles of River Engineering – The non tidal alluvial rivers – Pitman, 1979.			
<b>Reference Books</b>			
(1)K.L Rao , INDIA"s WATER WEALTH – Orient Longman Ltd., 1979.			

(2)R. J. Garde River Morphology New Age International (P) Limited, Publishers New Delhi 2011.

(3) R.J.Garde and K.G.Ranga Raju Mechanics of Sediment Transportation and Alluvial

## 20WRM 252- CLIMATE CHANGE AND ADAPTATION

Course Code	20WRM252	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

### Module-1

Earth's Climate System: Introduction – Climate in the spotlight - The Earth's Climate Machine – Climate Classification – Global wind systems – Trade Wind Systems– Trade Winds and the Hadley Cell – The Westerlies – Cloud formation and Monsoon Rains – Storms and Hurricanes – The Hydrological Cycle – Global Ocean Circulation – El Nino and its Effect – Solar Radiation – The Earth's Natural Green House Effect – Green House Gases and Global Warming – Carbon Cycle.

### Module-2

Observed Changes and Its Causes: Observation of Climate Change – Changes in pattern of temperature, precipitation and sea level rise – Observed effects of Climate Changes – Patterns of Large Scale Variability – Drivers of Climate Change – Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India – Climate Change modeling.

### Module-3

Impacts Of Climate Change: Impacts of Climate Change on various sectors – Agriculture, Forestry and ECOSystem – Water resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for different regions Uncertainties in the Projected Impacts of Climate Change – Risk of irreversible changes.

### Module-4

Climate Change Adaptation and Mitigation Measures: Adaptation Strategy/options in various sectors – Water – Agriculture – Infrastructure and Settlement including coastal zones. Human Health – Tourism – Transport – Energy – Key Mitigation Technologies and practices – Energy supply – Transport – Buildings – Industry – Agriculture – Forestry– Carbon sequestration – Carbon Capture and Storage (CCS) – Waste (MSW & Biowaste, Biomedical, Industrial waste – International and Regional co-operation

### Module-5

Clean Technology and Energy: Clean Development Mechanism – Carbon Trading – Examples of future Clean Technology – Biodiesel – Natural Compost – Eco-friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind –Hydroelectric Power – Mitigation Efforts in India and Adaptation funding.

### Course outcomes:

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

**Question paper pattern:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ☒

**Textbook/ Textbooks**

(1) Dash Sushil Kumar, "Climate Change – An Indian Perspective", CambridgeUniversity Press India Pvt. Ltd, 2007

(2) IPCC Fifth Assessment Report – [www.ipcc.ch](http://www.ipcc.ch)

**Reference Books**

(1) Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003

**20WRM 253 -TECHNO ECONOMIC ANALYSIS OF WATER DEVELOPMENT**

Course Code	<b>20WRM253</b>	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
<b>Module-1</b>			
Development Course Objectives: Need system, economic and social development, integrated development, multiple purpose of water resource development.			
<b>Module-2</b>			
Institutional Studies:Setup for evaluation implementation, operation water laws, regulation, organizations, and functions data requirement.			
<b>Module-3</b>			
Primary and secondary data, data related to development sectors, environment, and water resource related land and other natural resources.			
<b>Module-4</b>			
Elements of welfare economics, resources economics, environmental economics, definition of the project resources structure, elucidation of organization, managerial, social, technical, physical, institutional and economics dimensions.			
<b>Module-5</b>			
Definition of primary and secondary impact, long-term and short-term impacts, identifications of casts and benefits, evaluation research, Course Objective of post implementation, evolution, methodologies, elements of risk			

**Course outcomes:**

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

**Question paper pattern:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ☐

**Textbook/ Textbooks**

(1)James and Lae: Economics of water resource planning, McGraw Hills.

(2)Kuiper: Water resource development, planning engineering and economics.

**Reference Books**

(1)James and Lae: Economics of water resource planning, McGraw Hills.

(2)Kuiper: Water resource development, planning engineering and economics.

<b>20WRM 26-Advanced Water Resources Engineering-Laboratory II</b>			
Course Code	<b>20WRML26</b>	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	0:4:0	SEE Marks	60
Credits	02	Exam Hours	03
<b>SLNO</b>	<b>Experiments</b>		
1	Estimation of Crop Water Requirements and design of an Irrigation System		
2	Irrigation Scheduling		
3	Watershed Modelling: a. Unit Hydrograph Models b. Synthetic Unit Hydrograph Models		
4	Determination of Design Flood		
5	Analysis and Design of Hydraulic Structures		
6	Design and Analysis of water Distribution Network		
7	Digital Simulation of Regional Aquifers		
8	Parameter Estimation Through Regression		
9	Design and Operation of a Reservoir		
10	Design of Sewer Network		
11	Diagnostic Analysis of Irrigation Systems		
12	Stream Flow Analysis and Simulation		
13	Design of Urban Storm water System		
<b>Course outcomes:</b>			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> <li>•</li> </ul>			

<b>TECHNICAL SEMINAR</b>			
Course Code	<b>20WRM27</b>	CIE Marks	100
Number of contact Hours/week (L:P:SDA)	0:0:2	SEE Marks	--
Credits	02	Exam Hours	--
<p><b>Course objectives:</b>            The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas.            Each student, under the guidance of a Faculty, is required to</p> <ul style="list-style-type: none"> <li>• Choose, preferably through peer reviewed journals, a recent topic of his/her interest relevant to the Course of Specialization.</li> <li>• Carryout literature survey, organize the Course topics in a systematic order.</li> <li>• Prepare the report with own sentences.</li> <li>• Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.</li> <li>• Present the seminar topic orally and/or through power point slides.</li> <li>• Answer the queries and involve in debate/discussion.</li> <li>• Submit two copies of the typed report with a list of references.</li> </ul> <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.            The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculties from the</p>			
<p><b>Marks distribution for CIE of the course 20WRM27 seminar:</b>            Seminar Report: 30 marks            Presentation skill:50 marks            Question and Answer:20 marks</p>			

\*\*\* END OF II SEMESTER\*\*\*



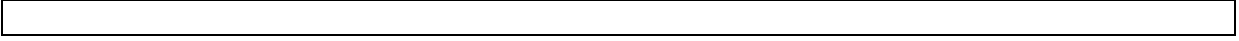
<b>20WRM31- SEDIMENT TRANSPORT</b>			
Course Code	<b>20WRM31</b>	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
<b>Module-1</b>			
Properties of sediment. Initiation of motion of sediment. Analysis of non-cohesive sediment movement. Shield's diagram. Critical shear stress, critical velocity, lift on particles, Hydraulic relations for alluvial streams			
<b>Module-2</b>			
Sediment Sources & sediment yield: Gross erosion, sediment yield, delivery ratio, estimation of sheet erosion, Universal soil loss equation (USLE), different factors affecting erosion process.			
<b>Module-3</b>			
Sediment delivery ratio from watershed, flow duration curve and sediment rating curve, reservoir sedimentation: empirical equations, trap efficiency, sediment control method			
<b>Module-4</b>			
Fundamentals of sediment transport: general relationships. Bed forms. Wash load, suspended load and Bed load, Rouse equation for suspended sediment load. Sediment discharge formulas by DuBoys, Mayer-Peter & Muller, Schoklitsch, Einstein-Brown and Engelund- Hansen. Sediment sampling.			
<b>Module-5</b>			
Introduction to Meandering of rivers and river engineering. Scour: local scour at a bridge & abutment, Indian Codal provision for design scour depth.			
<b>Course outcomes:</b> At the end of the course the student will be able to:			
<b>Question paper pattern:</b> The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. <ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question is for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub questions) from each module.</li> <li>• Each full question will have sub question covering all the topics under a module.</li> <li>• <del>The students will have to answer five full questions selecting one full question from each</del></li> </ul>			
<b>Textbook/ Textbooks</b>			
(1) Manuals and Reports on Engineering Practice No. 54, Sedimentation Engineering : Vito A. Vanoni			
(2) Sediment Transport (Theory and Practice): C.T. Yang			
<b>Reference Books</b>			
(1) Sediment and Ecohydraulics (INTERCOH 2005): T. Kusuda, H. Yamanishi, J. Spearman, and J.Z. Gailani			
(2) Mechanics of Sediment Transportation and Alluvial Stream Problems: R.J. Garde, K.G. RangaRaju			
(3) Fundamentals of Fluvial Geomorphology: Ro Charlton			

<b>20WRM321 -THEORY OF SEEPAGE &amp; EARTHEN DAMS</b>			
Course Code	20WRM321	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
<b>Module-1</b>			
Seepage analysis and treatment: Seepage analysis, pore pressure, hydraulic heads, flow net in confined and unconfined condition.			
<b>Module-2</b>			
Flow net of earthen dam in different condition – steady seepage and drawdown, graphical method, determination of quantity of seepage, piping phenomenon.			
<b>Module-3</b>			
Application of finite difference and finite element method, conformal mapping, method of foundation treatment to control seepage			
<b>Module-4</b>			
Earth dam: Factors influencing design of earth dam, type of dams, design criteria for various components of earth dams, filters for earth dam, filter design, requirement for the safety of earth dams, stability of earth dam slope -factor of safety, safety against overtopping.			
<b>Module-5</b>			
Quality control and failure measures in earthen dam: Embankment construction procedures, quality control, Performances studies of earth dam, instrumentation, causes of failures of earth dams and corrective measures.			
<b>Course outcomes:</b> At the end of the course the student will be able to:			
<b>Question paper pattern:</b> The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.			
<ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question is for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub questions) from each module.</li> <li>• Each full question will have sub question covering all the topics under a module.</li> <li>• <del>The students will have to answer five full questions selecting one full question from each</del></li> </ul>			
<b>Textbook/ Textbooks</b>			
(1) Justin J. D., Hinds J. and Creager, P. W. "Engineering for Dams" Volume III, John Wiley & Sons Inc, Chapman & Hall,Ltd, London, 5th Reprint, 1955.			
(2) George F. Sowers, Hari Lal Sally, "Earth and Rockfill dam engineering", Asia Pub. House, 1962.			
<b>Reference Books</b>			
(1) Harr, M.E. "Ground water and seepage" McGraw Hill Book Co., New York, 1962.			
(2) Alam Singh "Soil engineering in theory and practice", Volume 2, Asia Publishing House, 1981			

<b>20WRM322 -WATER POWER AND DAM ENGINEERING</b>			
Course Code	<b>20WRM322</b>	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
<b>Module-1</b>			
Introduction, sources of energy, role of hydropower in a power system, development of water power potential in India and the world, Features and characteristics of water power generation. Data requirement for assessment of water power potential-flow duration and mass curves, energy flow diagram, demand and prediction, Types of Hydropower generation plants- site selection and Planning – Environmental Considerations and its layouts,			
<b>Module-2</b>			
Components of a hydropower structure- regulatory structures-intake structures –types, location, losses, air entrainment, anti-vortex device, air vent, fore bay, trash racks, power canals, tunnels, surge tanks, settling basins, anchor blanks, penstocks- classification, resonance in penstocks, design criteria, losses, anchor blocks, valves, bends and manifolds			
<b>Module-3</b>			
Tunnels- geometric and hydraulic design, water hammer and surges, surge tank- functions, type, design of surge tank, methods of surge analysis, channel surges Types of water power house- structural and geotechnical aspects of power house design, location, site and general arrangements, draft tubes, tail trace and their hydraulic design, draught and cooling towers, turbines - characteristics, hydraulics of turbines,			
<b>Module-4</b>			
cavitations, transients caused by turbine and foundations, pumps-efficiency and characteristics, generators, exciters, switchboard, transformers and other accessories Water retaining structures-Dams-Classifications, types, planning and investigation of reservoir and dam sites, reservoir capacity and regulation, reservoir silting, dam optimization, analysis and design of earthen and rockfill dams, internal seepage, stability and stress, settlement and deformation, foundation treatment, analysis for failure and safety			
<b>Module-5</b>			
Gravity dam - forces acting and criteria, elementary and practical profile, stability analysis, modes of failures, joints, seals, keys and galleries in gravity dams, spillways-types, location and design, energy dissipaters, dam break analysis, dam safety and hazard mitigation			
<b>Course outcomes:</b> At the end of the course the student will be able to:			
<b>Question paper pattern:</b> The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. <ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question is for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub questions) from each module.</li> <li>• Each full question will have sub question covering all the topics under a module.</li> <li>• <del>The students will have to answer five full questions selecting one full question from each</del></li> </ul>			
<b>Textbook/ Textbooks</b>			

(1) Barrows, H. K, "Water Power Engineering", Tata McGraw Hill Publishing Company Ltd, New Delhi,
(2) Creager, W.P, Justin, J. D and Hinds J, "Engineering for dams", Nem Chand and Brothers, Roorkee
<b>Reference Books</b>
(1)Dandekar, M.M., and Sharma, K.N, "Water Power Engineering", Vikas Publishing House, New Delhi
(2) Garg S. K, "Irrigation Engineering and Hydraulic Structures" Khanna Publishers, New Delhi, 1998.
(3) Khatsuria, R. M, "Hydraulics of spillways and energy dissipaters", CRC Press, New Delhi, 2005.

<b>20WRM331- WATERSHED CONSERVATION AND MANAGEMENT</b>			
Course Code	<b>20WRM331</b>	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
<b>Module-1</b>			
Watershed Concepts: Introduction – Significance – Geology – Soil – Morphological Characteristics – Elements – Land Capability Classification – Delineation – Codification – Factors Influencing Watershed Development.			
<b>Module-2</b>			
Soil Conservation Practice: Types of Erosion – Wind Erosion: Causes, Factors, Effects and Control – Water Erosion: Types, Factors, Effects – Engineering Measures for Erosion Control in Agricultural and Non-Agricultural Lands – Estimation of Soil Loss.			
<b>Module-3</b>			
Water Harvesting and Conservation: Water Harvesting Techniques – Design of Small Water Harvesting Structures – Types of Storage Structures – Yield from a Catchment – Losses of Stored Water.			
<b>Module-4</b>			
Watershed Management: Strategies – Identification of Problems – Watershed Development Plan – Entry Point Activities -- Concept of Priority Watersheds – Agroforestry – Grassland Management – Wasteland Management – Watershed Approach in Government Programmes – Developing Collaborative know how – People's Participation – Evaluation of Watershed Management.			
<b>Module-5</b>			
Watershed Assessment Models: Regulation and Restoration – A Brief Description and Significance of Watershed Models: SWAT, TMDL, AGNPS, BASINS, CREAMS – Case Studies.			
<b>Course outcomes:</b> At the end of the course the student will be able to:			
<b>Question paper pattern:</b> The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. The question paper will have ten full questions carrying equal marks. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub questions) from each module. Each full question will have sub question covering all the topics under a module. The students will have to answer five full questions, selecting one full question from each module. ☐			
<b>Textbook/ Textbooks</b>			
(1) Debarry A. Paul, Watersheds, Wiley and Sons, 2004. Devanport E. Thomas, Watershed Project Management Guide, Lewis Publishers, London, 2003.			
(2) Ghanashyam Das, Hydrology and Soil Conservation engineering, Prentice Hall of India Private Limited,			
<b>Reference Books</b>			
(1) Glenn O. Schwab, Soil and Water Conservation Engineering, John Wiley and Sons, 1981.			



<b>20WRM332 -INTEGRATED WATERSHED MANAGEMENT</b>			
Course Code	<b>20WRM332</b>	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
<b>Module-1</b>			
Introduction: Definition & importance, delineation of watershed, watershed characteristics, causes consequences of watershed deterioration, objectives, principle of watershed operations & management, different approaches in watershed management, watershed management plan identification of problems, objectives & priorities. Steps in developing watershed. Issues in watershed management- Land degradation. Socio economic survey- collection of data, analysis of problems, watershed maps.			
<b>Module-2</b>			
Map preparation: Introduction, different approaches, thematic maps- base map, drainage, land use/land cover, hydro geomorphology, soil, slope, lineament etc. Map updation, change detection & analysis. Drainage analysis: Definition, drainage pattern- different types, Horton"s & Strahler"s Method of stream ordering. Analysis – linear aspects, relief aspects and the influences.			
<b>Module-3</b>			
Runoff and Soil loss estimation: Introduction, necessity, runoff- different methods, factors affecting runoff, SCS curve number, Soil loss- introduction, importance, types of erosion, resources mapping, urbanization effect on hydrological cycle. Runoff estimation, soil loss estimation (USLE), erosion control measures and land reclamation. Management control, sediment control & flood control.			
<b>Module-4</b>			
Water conservation and harvesting: Introduction, conservation, methods for crop land, treatment for catchments, small storage structures, design data. Small earthen dams- planning, construction sequence, computation of storage capacity, small weirs, drought from pond, nala bonding. Ground water recharge- ground water recharge, extraction, water harvesting methods and techniques			
<b>Module-5</b>			
Water resources management for sustainability: principles, integrated urban water management, water law surface and ground water management aspects, sustainable water supply methodologies for arid and semi-arid regions, life cycle assessment (LCA)			
<b>Course outcomes:</b>			
At the end of the course the student will be able to:			

**Question paper pattern:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ☒

**Textbook/ Textbooks**

(1) Tideman, EM "watershed management"- guidelines for Indian conditions, omega pub. New Delhi.

(2) Thomas M Lillisand& RW kiefer. "remote sensing & interpretation ", WH Freeman, San Francisco.

**Reference Books**

(1) Water resources engineering by larry W Mays wiley students edition.



<b>PROJECT WORK PHASE – 1</b>			
Course Code	20WRM34	CIE Marks	100
Number of contact Hours/Week	2	SEE Marks	--
Credits	02	Exam Hours	--
<p><b>Course objectives:</b></p> <ul style="list-style-type: none"> <li>• Support independent learning.</li> <li>• Guide to select and utilize adequate information from varied resources maintaining ethics.</li> <li>• Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.</li> <li>• Develop interactive, communication, organisation, time management, and presentation skills.</li> <li>• Impart flexibility and adaptability.</li> <li>• Inspire independent and team working.</li> <li>• Expand intellectual capacity, credibility, judgement, intuition.</li> <li>• Adhere to punctuality, setting and meeting deadlines.</li> <li>• Instil responsibilities to oneself and others.</li> <li>• Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.</li> </ul>			
<p><b>Project Phase-1</b> Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work.</p> <p><b>Seminar:</b> Each student, under the guidance of a Faculty, is required to</p> <ul style="list-style-type: none"> <li>• Present the seminar on the selected project orally and/or through power point slides.</li> <li>• Answer the queries and involve in debate/discussion.</li> <li>• Submit two copies of the typed report with a list of references.</li> </ul> <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.</p>			
<p><b>Course outcomes:</b></p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> <li>• Demonstrate a sound technical knowledge of their selected project topic.</li> <li>• Undertake problem identification, formulation, and solution.</li> <li>• Design engineering solutions to complex problems utilising a systems approach.</li> <li>• Communicate with engineers and the community at large in written and oral forms.</li> <li>• Demonstrate the knowledge, skills and attitudes of a professional engineer.</li> </ul>			
<p><b>Continuous Internal Evaluation</b></p> <p>CIE marks for the project report (50 marks), seminar (30 marks) and question and answer (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most</p>			

<b>MINI PROJECT</b>			
Course Code	20XXX35	CIE Marks	100
Number of contact Hours/Week	02	SEE Marks	--
Credits	02	Exam Hours/Batch	03
<b>Course objectives:</b>			
<ul style="list-style-type: none"> <li>• To support independent learning and innovative attitude.</li> <li>• To guide to select and utilize adequate information from varied resources upholding ethics.</li> <li>• To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.</li> <li>• To develop interactive, communication, organisation, time management, and presentation skills.</li> <li>• To impart flexibility and adaptability.</li> <li>• To inspire independent and team working.</li> <li>• To expand intellectual capacity, credibility, judgement, intuition.</li> <li>• To adhere to punctuality, setting and meeting deadlines.</li> <li>• To instil responsibilities to oneself and others.</li> <li>• To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.</li> </ul>			
<b>Mini-Project:</b> Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.			
<b>Course outcomes:</b>			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> <li>• Present the mini-project and be able to defend it.</li> <li>• Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.</li> <li>• Habituated to critical thinking and use problem solving skills.</li> <li>• Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.</li> <li>• Work in a team to achieve common goal.</li> <li>• Learn on their own, reflect on their learning and take appropriate actions to improve it.</li> </ul>			
<b>CIE procedure for Mini - Project:</b>			
The CIE marks awarded for Mini - Project, shall be based on the evaluation of Mini - Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25. The marks awarded for Mini - Project report shall be the same for all the batch mates.			

<b>INTERNSHIP / PROFESSIONAL PRACTICE</b>			
Course Code	20WRMI36	CIE Marks	40
Number of contact Hours/Week	2	SEE Marks	60
Credits	06	Exam Hours	03
<p><b>Course objectives:</b>            Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,            To put theory into practice.            To expand thinking and broaden the knowledge and skills acquired through course work in the field.            To relate to, interact with, and learn from current professionals in the field.            To gain a greater understanding of the duties and responsibilities of a professional.            To understand and adhere to professional standards in the field.            To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality.            To identify personal strengths and weaknesses.            To develop the initiative and motivation to be a self-starter and work independently. ☒</p>			
<p><b>Internship/Professional practice:</b> Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.  <b>Seminar:</b> Each student, is required to</p> <ul style="list-style-type: none"> <li>• Present the seminar on the internship orally and/or through power point slides.</li> <li>• Answer the queries and involve in debate/discussion.</li> <li>• Submit the report duly certified by the external guide.</li> <li>• The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. ☒</li> </ul>			
<p><b>Course outcomes:</b>            At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> <li>• Gain practical experience within industry in which the internship is done.</li> <li>• Acquire knowledge of the industry in which the internship is done.</li> <li>• Apply knowledge and skills learned to classroom work.</li> <li>• Develop a greater understanding about career options while more clearly defining personal career goals.</li> <li>• Experience the activities and functions of professionals.</li> <li>• Develop and refine oral and written communication skills.</li> <li>• Identify areas for future knowledge and skill development.</li> <li>• Expand intellectual capacity, credibility, judgment, intuition.</li> <li>• Acquire the knowledge of administration, marketing, finance and economics. ☒</li> </ul>			
<p><b>Continuous Internal Evaluation</b>            CIE marks for the Internship/Professional practice report (20 marks), seminar (10 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson. ☒</p>			
<p><b>Semester End Examination</b>            SEE marks for the internship report (30 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University. ☒</p>			

<b>PROJECT WORK PHASE -2</b>			
Course Code	<b>20WRM41</b>	CIE Marks	40
Number of contact Hours/Week	4	SEE Marks	60
Credits	20	Exam Hours	03
<p><b>Course objectives:</b></p> <ul style="list-style-type: none"> <li>• To support independent learning.</li> <li>• To guide to select and utilize adequate information from varied resources maintaining ethics.</li> <li>• To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.</li> <li>• To develop interactive, communication, organisation, time management, and presentation skills.</li> <li>• To impart flexibility and adaptability.</li> <li>• To inspire independent and team working.</li> <li>• To expand intellectual capacity, credibility, judgement, intuition.</li> <li>• To adhere to punctuality, setting and meeting deadlines.</li> <li>• To instil responsibilities to oneself and others.</li> <li>• To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. ☐</li> </ul>			
<p><b>Project Work Phase - II:</b> Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism. ☐</p>			
<p><b>Course outcomes:</b></p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> <li>• Present the project and be able to defend it.</li> <li>• Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.</li> <li>• Habituated to critical thinking and use problem solving skills</li> <li>• Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.</li> <li>• Work in a team to achieve common goal.</li> <li>• Learn on their own, reflect on their learning and take appropriate actions to improve it. ☐</li> </ul>			
<p><b>Continuous Internal Evaluation:</b></p> <p><b>Project Report:</b> 20 marks. The basis for awarding the marks shall be the involvement of the student in the project and in the preparation of project report. To be awarded by the internal guide in consultation with external guide if any.</p> <p><b>Project Presentation:</b> 10 marks. The Project Presentation marks of the Project Work Phase -II shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.</p> <p><b>Question and Answer:</b> 10 marks. The student shall be evaluated based on the ability in the Question and Answer session for 10 marks.</p> <p><b>Semester End Examination</b> SEE marks for the project report (30 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University. ☐</p>			

