REVISED SCHEME

For

POST GRADUATE PROGRAMME

(Master of Technology)

IN

WATER RESOURCES ENGINEERING

(EFFECTIVE FROM: 2025 BATCH)

DEPARTMENT OF CIVIL ENGINEERING NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR HAZRATBAL, SRINAGAR, KASHMIR, J&K, INDIA-190006

DEPARTMENT OF CIVIL ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR, J&K-190006

COURSE STRUCTURE AND SYLLABUS
FOR
M.TECH. IN WATER RESOURCES ENGINEERING
Applicable for Batch-2025 and Onwards

SEMESTER –I: AUTUMN SESSION

S.NO.	Course No.	Subject	L	T	P	Credits
1	MTH-101	Applied Statistics	2	1	0	3
2	CWE-101	Hydrologic Elements and Analysis	2	1	0	3
3	CWE-102	Advanced Fluid Mechanics	2	1	0	3
4	CWE-103	Advanced Fluid Mechanics Lab	0	0	2	1
5	**Elective-I**		2	1	0	3
	CWE-111	Programming for Civil Engineers				
	CWE-112	Water Management				
	CWE-113	Rural Water Supply and Sanitation				
	CWE-114	Hydrometeorology and Climate Change				
6	**Elective-II**		2	1	0	3
	CWE-121	Embankment Dams				
	CWE-122	Urban Hydrology				
	MTH-105	Numerical Methods in Civil Engineering				
Total Credits						**16**

L–Lecture– Tutorial/Seminar, P – Practical/Studio work

SEMESTER –II: SPRINGSESSION

S.NO.	Course No.	Subject	L	T	P	Credits
1	CWE-201	Water Resources Systems	2	1	0	3
2	CWE-202	Open Channel Flow	2	1	0	3
3	CWE-203	Ground Water Hydrology	2	1	0	3
4	CWE-204	Advanced Hydrology Lab	0	0	2	1
5	CWE-205	Seminar	0	0	2	1
6	**Elective-III**		2	1	0	3
	CWE-212	Contaminant Transport in Natural Systems				
	CWE-213	GIS & Remote Sensing Applications in Civil Engineering				
	CWE-214	Flood Forecasting				
	CSE-203	Advanced Concrete Technology				
7	**Elective-IV**		2	1	0	3
	CWE-221	Computational Fluid Dynamics				
	CWE-222	Environmental Impact Assessment				
	CWE- 223	Applications of AI/ML in Civil Engineering				
Total Credits						**17**

L–Lecture– Tutorial/Seminar, P – Practical/Studio work

SEMESTER –III: AUTUMN SESSION

S.NO.	Course No.	Subject	L	T	P	Credits
1	CWE-301	Water Quality and Environment	2	1	0	3
2	CWE-302	Hydraulic Structures	2	1	0	3
3	CWE-303	Dissertation (Stage I)	0	0	12	6
4	**Elective-V**		2	1	0	3
	CWE-311	Circular Water Economy				
	CWE-312	Stochastic Hydrology				
	CWE-313	River Engineering				
Total Credits						**15**

L–Lecture– Tutorial/Seminar, P – Practical/Studio work

SEMESTER –IV: SPRING SESSION

S.NO.	Course No.	Subject	L	T	P	Credits
1	CWE-401	Dissertation (Stage II)	0	0	24	12
Total Credits						**12**

Grand Total of Credits = 60

Evaluation:

Attendance & Class performance : 24%

Midterm Examination : 26%

End term Examination : 50%

DISSERTATION

The dissertation involves a detailed study of a Water resources-related problem (actual field/Research) which the student has to carry out under the supervision of faculty member(s) of the Department.

Part-time students will be eligible to take up courses of the 3rd semester in their 5th semester, only when they have completed the 1st and 2nd semester courses.

NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR
SYLLABUS FOR M.TECH IN WATER RESOURCES ENGINEERING

1ST SEMESTER

1. Subject Area : **Civil Engineering**

2. Subject Title : **Applied Statistics**

3. Subject Code : MTH-101

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **1ST** (Autumn Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: To understand the various statistical and probabilistic techniques required in water resources applications

11. Course Details -as in tabular form below:

S. No.	Contents	Contact Hours
1.	Basic Concepts of Probability and Statistics: Graphical exploration of hydrologic data; Descriptive Statistics, Measures of central tendency, Measures of variability Definition of probability and its interpretation, Probability axioms, Conditional probability and independence.	6
2.	Random variables: Definition, Discrete random variables, Continuous random variables, Expected value Probability mass function, Probability density function, Cumulative distribution function, Multiple random variables and joint probability	6
3.	Discrete Probability distributions: Bernoulli, Binomial, Hypergeometric, Poisson Continuous Probability distributions: Uniform, Exponential, Gamma, Normal, etc.	6
4.	Estimation of parameters: Method of Moments and Maximum likelihood Estimation, Uncertainty of estimators, Confidence intervals.	4
5.	Hypothesis testing: Tests for mean, Proportion, P-values, Difference of population means, Two-sample T-test, Tests for population variances, Analysis of variance (ANOVA).	6
6	Frequency analysis of extreme events: Order Statistics, Extreme Value Distributions: Gumbel, Weibull, GEV, Log-Pearson. Analysis of hydrologic data:	4

	floods, droughts, rainfall, winds, etc.	
7	Linear regression: Correlation, Simple linear regression, Estimation and uncertainty of parameter estimators, Residuals and Model adequacy, Multiple regression, Polynomial regression	4
8	Multivariate analysis: Principal components analysis, Clusters analysis, Factor analysis, etc. Examples with spatial hydrologic data.	6
Total		**42**

Suggested Books

S.No.	**Name of Books/Authors/Publishers**	**Year of Publication**
1.	Jay L. Devore, Probability and Statistics for Engineers and Scientists. 9th Edition, Cengage Learning	2020
2.	Nathabandu T. Kottegoda and Renzo Rosso, Applied Statistics for Civil and Environmental Engineers, 2nd Edition, Blackwell Publishing	2008
3.	Douglas C. Montgomnery, Elizabeth A. Peck, G. Geoffrey Vining, Introduction to Linear Regression Analysis, 6th Edition, A John Wiley & Sons, Inc., Publication	2021
4.	Timothy M. Delsole, Michael K. Tippett, Statistical Methods for Climate Scientists, Cambridge University Press	2022
5.	Daniel S. Wilks, Statistical Methods in the Atmospheric Sciences, 4th edition, Elsevier.	2019

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NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area **: Civil Engineering**

2. Subject Title : **Hydrological Elements and Analysis**

3. Subject Code : CWE-101

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **1ST** (Autumn Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : Nil

10. Objective: To impart skills in fundamentals of hydrology, analysis and correlation of hydrological data and hence impart understanding of various principles and their applications in solving the real engineering problems encountered by water recourses planners and managers.

11. Course Details -as in tabular form below:

S.No	Contents	Contact Hours
1.	INTRODUCTION: Historical background, hydrological cycle, hydrologic problems, water balance.	2
2.	Precipitation: Definition, types, forms, measurement – network design, Non-recording and recording (automatic) precipitation gauges. Analysis of data , Supplementing missing data, consistency of record, hyetograph, mass curve analysis, depth areas duration analysis. Rainfall frequency analysis, Station year method.	7
3.	Evapotranspiration: Evaporation, transpiration, evapotranspiration, Factors affecting, measurement, network design, estimation of evaporation and -evapotranspiration, Evaporation retardation.	3
4.	Infiltration: Infiltration capacity, rates and indices, factors affecting, measurement of infiltration, estimation of infiltration capacity from hydrograph analysis.	5

	Infiltration models.	
5.	Hydrometry: Measurement of discharge, selection of site for stage and discharge measuring station non-recording and recording gauges, Accuracy and frequency of observed data, discharge measurement by area Velocity method and slope area method , Chemical methods.	3
6.	Runoff: Runoff, runoff cycle, components of runoff, factors affecting runoff, storage effects of runoff from snowmelt, Estimation of average monthly and annual runoff, rainfall - runoff relationships.	3
7.	Hydrograph and its components: Master recession curve, Base flow and its separation , Unit hydrograph theory and its application for isolated and complex storms , Synthetic unit hydrograph, S- curve, Unit hydrograph of varied durations, Instantaneous unit hydrograph, conceptual models.	10
8.	Computation of peak flow: Rational and Empirical relationships, Flood frequency analysis, Recurrence interval design flood.	3
9.	Flood routing: Routing through reservoirs.	6
Total		**42**

3. Suggested Books:

S.No.	**Name of Books/Authors/Publishers**	**Year of Publication**
1.	Chow, Ven Te, Maidment, David, R., Mays Lary W. "Applied Hydrology", McGraw Hill Publications.	1988
2	Viessmann, Warren Jr., Lewis Gary L." Introduction to Hydrology" Prentice Hall of India, New Delhi.	2009
3	Wilson, E.M. "Engineering Hydrology" ELBS, English Language book Society/ Macmillam Education Ltd., London.	1999
4	Linsely,K.,Kohler, A. and Paulhus L.H. "Hydrology for Engineers" McGraw Hill Book Company Inc. New York.	1975
5	Linsely,K.,Kohler, A. and Paulhus L.H. "Applied Hydrology" McGraw Hill Book Company Inc. New York.	1949
6	Chow Ven Te," Handbook of Applied Hydrology", McGraw Hill Book Company, New York.	1964
7	Singh, V.P."Elementary Hydrology", Prentice Hall of India, Pvt. Ltd., New Delhi.	1994
8	Patra K.C. "Hydrology and water resources engineering" second edition Narosa Publishing House New Delhi	2008.

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NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area **: Civil Engineering**

2. Subject Title : **Advanced Fluid Mechanics**

3. Subject Code : CWE-102

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **1ST** (Autumn Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: To impart the advanced knowledge of fluid mechanics

11. Course Details -as in tabular form below:

S. No.	**Contents**	**Contact Hours**
1	Equations of motion in general orthogonal coordinate systems: Derivation of Navier- Stoke's equations.	6

2	Dimensional analysis	6
3	Laminar Flow : Laminar flow between parallel plates- Plain-Poiseulle and Couette flow, Laminar flow through closed conduits, Lubrication mechanics.	6
4	Boundary layer theory – Laminar boundary layer, turbulent boundary layer; stability analysis of the boundary layer	6
5	Turbulence: Introduction, description by statistical methods, Phenomenological method, Measurement of Turbulence, scale and spectrum, Turbulence intensity RMS value, Laser-Doppler principle.	6
6	Diffusion	6
7	Fluid Machinery:	6
Total		**42**

10. Suggested Books:

S.No.	Name of Books/Authors/Publishers	Year of Publication
1.	White, F.M. Fluid Mechanics. Mc Graw Hill	
2	Daiy and Harleman ; Fluid Dynamics , Edison Wesely , New York.	1973
3	R.A. Granger; Fluid Mechanics, Dover Publications, New York.	1995
4	Kundu, P.K.; Cohen I.M. Fluid Mechanics. ELSEVIER	2008
5	Graebel, W.P. Advanced Fluid Mechanics. ELSEVIER	2007
6	Fox R.W. and McDonald A.T. Introduction to Fluid Mechanics, John Wiley & Sons Inc.	2004

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NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area **: Civil Engineering**

2. Subject Title : **Advanced Fluid Mechanics Lab**

3. Subject Code : CWE-103

4. Contact Hours : L-T-P: 0-0-3 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 1

6. Semester/Session : **1ST** (Autumn Session)

7. Examination Duration (Hrs) : Mid-Term Exam End-Term Exam

8. Pre-requisite : Nil

9. Objective: To impart understanding of measurement of various fluid flow and weather parameters.

11. Course Details -as in tabular form below:

S. No.	Contents	Contact Hours
1	To study fluid properties and hydrostatic bench	3
2	To study of pipe surge and water hammer	3
3	To study the phenomenon of cavitation in pipe flow	3
4	Free vortex experiment.	1.5
5	Forced vortex experiment.	1.5
6	Reynold's Experiment.	1.5
7	Flow visualization experiment.	1.5
8	To study the variation of discharge with brink depth in a laboratory flume	3
9	To study the formation of hydraulic jump in a laboratory channel	3
10	To study gradually varied flow water surface profiles in a laboratory flume	3
11	To study the velocity distribution in an open channel and to determine the energy and momentum correction factors	3
Total		**18**

1. Subject Area **: Civil Engineering**

2. Subject Title : **Programming for Civil Engineers [Elective]**

3. Subject Code : CWE-111

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **1ST** (Autumn Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: Data analysis is among the most growing tools desired in many engineering fields, including Civil Engineering. The course aims to develop programming skills in Civil Engineering students using two open-access data analysis-oriented languages R and Python.

11. Course Details -as in tabular form below:

S. No.	Content	Contact Hours
1	**R (Use R!):** Introduction to RStudio: Installing RStudio, overview, packages, getting Help	2
2	Data Types: R Objects and attributes, vectors and lists, matrices; factors; data frames, dates and times; reading tabular data; Sub-setting and Operations. Some practical applications	7
3	Control Structures - Introduction; choices and loops, Loop functions: lapply; mapply; tapply; Some examples	6
4	Functional Programming: Introduction, scoping Rules; coding standards; piping; Practical applications; Some packages for Civil Engineers	8
5	Debugging: Introduction; general techniques, locating errors, interactive and non-interactive debugging	3
6	**Python:** Introduction: installation Anaconda and overview, libraries, and getting help.	2
7	Data types and structures: strings, scalers, vectors, matrices, lists, reading tabular data, Numpy and Pandas	4
8	Control structures: Introduction, choices and loops; Some examples	3
9	Functional Programming: functions, scoping, and classes; Some libraries for Civil Engineers; Debugging rules and ideas	5

10	Introduction to Matlab	2
	Total	**42**

10. Suggested Books:

S. No.	Name of Book/Authors/Publishers/Edition	Year of Publication
1.	R for Data Science: Import, Tidy, Transform, Visualize, and Model Data/ Hadley Wickham, Garret Grolemund/O'Reilly Media/1st Edition	2017
2.	Advanced R/Hadley Wickham/ Chapman & Hall/CRC/ Second Edition,	2019
3.	Introduction to Computation and Programming Using Python/ John V. Guttag/ MIT Press/Second Edition	2016

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NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area **: Civil Engineering**

2. Subject Title : **Water Management [Elective]**

3. Subject Code : CWE-112

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **1ST** (Autumn Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: To impart understanding of various aspects related to supply and management of water for irrigating agricultural lands..

11. Course Details -as in tabular form below:

S.No	Contents	Contact Hours
1.	Moisture –crop relationship	6
2.	Irrigation requirements, Irrigation efficiencies (Conveyance losses lined/unlined channels).	6
3.	Trickle, sprinkler and furrow irrigation. of arid lands. Drainage of irrigation land, Design aspects of these irrigation systems.	6
4.	Salinity of soil. Salinity control. Quality of irrigation water ; contaminants and their effect on various crop types.	8
5.	Operation of reservoirs	8
6.	Water management Policy during droughts. Predicting effect of water shortages on crops. Planning of water resources projects, Application of Nano-technology in Irrigation Engineering.	8
	Total	**42**

Suggested Books

S.No.	Name of Books/Authors/Publishers	Year of Publication
1.	Hansen, V.E. et al.; Irrigation Principles and Practice, John Willey and Sons, inc. New York.	1980
2	Michael A.M. Irrigation-Theory and Practice, Vikas Publishing House, New Delhi.	1990
3	Richard H. Cuenca; Irrigation System Design – An Engineering Approach, prentice hall Inc. New Jersy,.	1986
4	Zimmerman J.D.; Irrigation, John Wiley and Sons Inc. New York	1986
5	Asawa, G.L. ; Irrigation and Water Resources Engineering, New Age International (P) Ltd. Publishers.	2005

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NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area : **Civil Engineering**

2. Subject Title : **Rural Water Supply and Sanitation [Elective]**

3. Subject Code : CWE-113

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **1ST** (Autumn Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: The objective of this course is to provide training on planning to water supply and sanitation programs in the rural sector.

11. Course Details -as in tabular form below:

S. No.	Contents	Contact Hours
1.	Village environment, Sources of water: quantity, quality and accessibility; Assessment of demands, planning and construction of direct and community water supply schemes; Source protection measures; Cost effective water treatment technologies	8
2.	Type and source of wastes; Management of solid and liquid waste; Low cost sanitation planning and construction including household toilets, community toilets; Innovative and adaptable initiatives like compost pits, vermin composting, common and individual bio gas plants, and low cost drainage apart from collection, segregation, and disposal of household waste at the village level, Disposal and Reuse issues	8
3.	Public health concepts, review of key health determinants, public health priorities in emergency and development settings, sustainable community health/hygiene: mechanisms for delivery and management	6
4.	Social, cultural, political and economic aspects linked to water and sanitation practices, Initiatives of National and International agencies in empowerment of communities by promoting pro-community policies, programs and financial support and skill upgradation in developing countries	7
	Assesment of current conditions and trends in water and sanitation services in low and middle-income countries; Strategies to improve water	5

5.	and sanitation conditions; lessons learned; key interventions	
6.	Soft Skills for Water and Sanitation Professionals	4
7.	Case studies and projects	4
	Total	**42**

Suggested Books

S. No	Name of Author/ Books/ Publishers	Year of Publication/Reprint
1.	Ministry of Drinking Water and Sanitation, Operation and Maintenance Manual for Rural Water Suppliers	2013
2.	Ministry of Drinking Water and Sanitation, Manual for preparation of detailed Project Report for Rural Piped Water Supply Schemes	2013
3.	Ministry of Drinking Water and Sanitation, Handbook on Technical Option for On-Site Sanitation	2013
4.	Community Led Total Sanitation (CLTS) TrainingManual for Natural Leaders	2010
5.	Sustainable Water Supply and Sanitation (SWSS) Project	2010
6.	Manual on The Right to Water and Sanitation	2007
7.	The CPHEEO manuals on Water Supply	2002

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NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area **: Civil Engineering**

2. Subject Title : **Hydrometeorology and Climate Change [Elective]**

3. Subject Code : CWE-114

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **1ST** (Autumn Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: To introduce the principles of atmospheric science for understanding impact of climate change.

11. Course Details -as in tabular form below:

S. No.	Contents	Contact Hours
1.	Atmosphere: General circulation, composition and structure of atmosphere, role of meteorology in hydrology	4
2.	Precipitation Process: Adiabatic process, stability and instability of atmosphere	2
3.	Atmospheric Thermodynamics: Equation of state, Dalton's law of partial pressure, Poisson's law, equivalent potential temperature, concept of air parcel, virtual temperature, dry adiabatic lapse rate and saturated adiabatic lapse rate, hydrostatic equilibrium equation, dispersion of air pollutants	6
4.	Clouds: Classification, formation and characteristics,Monsoon circulation, monsoon troughs, monsoon depression and tropical cyclones	4

5.	Climate and Climate Change: Components, Phenomena, radiative forces, Energy budget and transport, atmospheric circulation, ocean circulation, land-surface process, carbon cycle	6
6.	Physical processes: Conservation of momentum, equation of state, temperature equation, continuity equation, conservation of mass	2
7.	Climate Models: Introduction to GCM and RCM simulations, SRES, downscaling GCM outputs	6
8.	ENSO: El Niño basic, Tropical pacific climatology, El Niño mechanism, ENSO indices, predictions and teleconnections	3
9.	Greenhouse effects and climate feedbacks:Global energy model, greenhouse effect and global warming, climate feedback	3
10.	Climate Model scenarios for global warming: Greenhouse gases, aerosols forcing, global-average response to GhG warming scenarios on temperature, rainfall, sea, ice/snow, extreme events	6
	Total	**42**

4. Suggested Books:

S. No.	Name of Authors/ Books / Publisher	Year of Publication/ Reprint
1.	Assessment Report 5, IPCC, WMO	2014
2.	David, J., "Climate change and Climate modelling", Cambridge University Press.	2011
3.	Shelton, ML, "Hydroclimatology", Cambridge University Press.	2009
4.	Singh, V.P. and Rakhecha, P. Book, Applied Hydrometeorology	2009
5.	Cotton R and Pielke RA, Human Impacts on Weather and Climate, Cambridge University Press.	2007
6.	Wallace, J.M. and Hubbs, P.V., "Atmospheric science – An Introductory Survey", Academic Press	1977
7.	Donn , W.,"Meteorology",Mc Graw Hill	1975
8.	Berry I.A., "Handbook of Meteorology", Mc Graw Hill	1973

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NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area : **Civil Engineering**

2. Subject Title : **Advance Concrete Technology [Elective]**

3. Subject Code : CSE-302

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **1ST** (Autumn Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: To impart the understanding of various aspects of concrete as used in Civil Engineering works.

11. Course Details -as in tabular form below:

S. No.	Contents	Contact Hours
1	Concrete Making Materials: Aggregates – Classification, IS specifications, Properties, Grading, Methods of combining aggregates, specified gradings, Testing of aggregates.	7
2	Chemical compoisition, Hydration of cement, structure of hydrated cement, special cements, water chemical admixtures.	5
3	Concrete: Properties of fresh concrete, Hardened concrete, Strength, Elastic properties, Creep and Shrinkage, Variability of concrete strength.	7
4	Mix Design: Principles of concrete mix design, Methods of concrete mix design, Testing of concrete.	6
5	Special Concretes: Light weight concrete, Fibre reinforced concrete, Polymer concrete, Super plasticized concrete, Properties and applicatons.	8
	Concreting Methods: Process of manufacturing of concrete, Methods of	

6	Transportation, placing and curing. Extreme weather concreting, Special concreting methods.	9
Total		**42**

4. Suggested Books:

S.No.	Name of Books/Authors/Publishers	Year of Publication
1.	Neville, A.M., Properties of Concrete, Pitman Publishing Ltd. London.	1978
2	Shetty, M.S., Concrete Technology, S. Chand and Company Ltd. Delhi.	1991
3	Rudhani,G., Light Weight Concrete, Academic Kiado Publishing Home of Hungarian Academy of Sciences.	1963

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NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area **: Civil Engineering**

2. Subject Title : **Numerical Methods in Civil Engineering [Elective]**

3. Subject Code : MTH-105

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **1ST** (Autumn Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: To impart the understanding of various numerical techniques used in solving mathematical problems

11. Course Details -as in tabular form below:

S. No.	Contents	Contact Hours
1	Numerical analysis, finite differences, interpolation, numerical solution of algebraic and transcendental equations, iterative algorithms, convergence, Newton-Rapson procedure	9
2	Solution of polynomial and simultaneous linear equations	6
3	Numerical integration, Euler-Maclaurin formula, Newton-Cotes formula, error estimates	7
4	Numerical solutions of ordinary differential equations: method of Euler, Taylor, Adams Runge-Kutta and predictor-corrector procedures, stability of solution, solution of boundary value problems, finite differences techniques, stability and convergence of solution, finite element method.	10
5	Special functions. Legendre's special function, Rodrigue's formula, generating functions for Legendre's polynomials and recurrence formulae, Bessel's function, recurrence formulae, Bessel's function of integral order.	10
Total		**42**

1. Suggested Books:

S.No.	Name of Books/Authors/Publishers	Year of Publication
1.	Numerical methods for Scientists and Engineers by M.K. Jain, S.R. Iyengar & R.K. Jain, Wiley Eastern Ltd.	
2	Mathematical Numerical Analyis By S.C. Scarborough, Oxford and IBH Publishing Company.	
3	Introductory methods in Numerical Analysis by S.S. Sastry, Prentice Hall of India.	
4	Theory and problems in Numerical Methods by T. Veeranjan and T. Ramachandran, Tata McGraw-Hill Publishing Company, New Delhi.	2004.
5	Numerical Methods for Mathematics Sciences and Engineering 2nd ed. By John H. Mathews, Prentice Hall of India, New Delhi.	2003
6	Advanced Engineering Mathematics by R.K. Jain & S.R.K. Iyengar, Narosa-.	2001

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NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area **: Civil Engineering**

2. Subject Title : **Urban Hydrology [Elective]**

3. Subject Code : CWE-123

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **1ST** (Autumn Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: To study the process of urbanization and its influence on urban hydrological processes and urban water supply system including, storm water modeling.

11. Course Details -as in tabular form below:

S.No.	Contents	Contact Hours
1.	Urbanization process, urban planning, landuse/landcover changes, hydrological impacts of urbanization	5
2.	Urban hydrologic cycle and processes, rainfall analysis, IDF Curves and design storm computation,	8
3.	Urban runoff computations; Abstractions, Rational Method, Computation of overland flow at design point, empirical methods, SCS method, time-area and unit hydrograph approaches, Stream flow routing	8
4.	Guidelines for the design of Urban drain and other structure	6
5.	Storages inside urban areas, storm run-off, piped and open channel drainage, mixed transport of storm and waste water	3
6.	Urban water supply; Estimate of demand, sources of surface and ground water, potable water quality	4
7.	Urban flood modelling using urban hydrologic models namely SWMM and MOUSE	6
8.	Rain water harvesting	2
	Total	42

6. Suggested Books:

S.No.	Name of Authors/ Books / Publisher	Year of Publication/ Reprint
1.	Iyyer, M.J., "Urban Water Supply and Sanitation A Management Perspective", ICFAI University Press	2008
2.	Shamsi, U.M., "GIS Applications for Water, Wastewater, and Stormwater Systems", CRC Press	2005
3.	Debo,T.N and Reese, A., "Municipal Stormwater Management", 2nd Edition, CRC Press	2002
4.	Twort, A.C. and Ratnayaka, D.D., "Water Supply", 5th Edition, Butterworth-Heinemann	2001
5.	James, W., "Advances in Modeling the Management of Stormwater Impacts", CRC Press	1997
6.	Akan, O.S., "Urban Stormwater Hydrology", CRC Press	1993
7.	Chow, V.T., "Applied Hydrology", Mc Graw Hill	1988
8.	Lazaro, T.R. "Urban Hydrology: A Multidisciplinary Perspective", Ann Arbor Science Publishers Inc.	1979

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SEMESTER – II

NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area : **Civil Engineering**

2. Subject Title : **Water Resources Systems**

3. Subject Code : CWE-201

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **2nd** (Spring Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: To impart know how regarding the planning and management aspects of water Resources projects.

S.No	Contents	Contact Hours
1.	Objective of water resources development	2
2.	economic analysis and discounting techniques, conditions of project optimality	5
3.	Graphic optimization techniques for multipurpose projects, analytical optimization techniques for water resources projects by linear Programming. Nonlinear programming and dynamic programming, Optimization by simulation	14
4.	mathematical models for large scale Multipurpose projects, different case studies	6
5.	stochastic optimization Techniques, water quality subsystems	5
6.	optimum operation model for Reservoir systems by incremental dynamic programming	5
7.	sequencing of Multipurpose project	5
Total		**42**

5. Suggested Books:

S.No.	Name of Books/Authors/Publishers	Year of Publication
1.	Arthur Mass et el., Design of Water Resources Systems, MacMillan.	1962
2	L.D. James and R.R.Lee, Economics of Water Resources Planning, McGraw-Hill New York.	1971
3	Loucks, D.P., J.R. Stedinger D.A., Haith: Water Resources ystems, Planning and Analysis, Prentice Hall.	1981
4	Biswas A.K. Systems Approach to Water Management , McGraw Hill, Kogakusha Ltd.	1976
5	Votruba L. Analysis of Water Resources Systems Elsevier.	1988

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NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area : **Civil Engineering**

2. Subject Title : **Open Channel Flow**

3. Subject Code : CWE-202

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **2nd** (Spring Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: To develop skills in solution of highly varied problems in gravity type natural and artificial water courses and hence impart understanding of several aspects related to development and management of surface water resources.

S.No	Contents	Contact Hours
1.	Basic Fluid Flow Concepts, Classification of channels basic equation; Uniform flow in rigid boundary channels, Shear stress and its	6

	distribution, conveyance of a channel, relation with depth	
2	Mobile boundary channels, regimes, resistance to flow, design of rigid and alluvial channels,	8
3.	Specific energy, Specific forces and Critical depth; Applications of Specific energy	7
4.	Gradually varied flow-types and governing equation, non-Prismatic channels; Hydraulic exponents, Gradually flow computations	6
5.	Hydraulic Jumps, Forced hydraulic Jump, Jump in rectangular and non-rectangular channels;	6
6.	Channel Controls and transition, Subcritical and Supercritical flow transition; Unsteady flow, Waves, Celerity of a wave, Surge, Method of characteristics, Flood Routing through channels etc.	9
	Total	**42**

1. Suggested Books:

S.No	Name of Books/authors/Publishers	Year of Publication
1.	V.T.Chow ; Open Channel Hydraulics, McGraw Hill Publishing Co., Inc.,	1973
2	K.Subramanaya "Open channel Flow"3rd.Tata McGraw Hill Pub.Co.New Delhi	1999
3.	Ranga Raju, K.G., "Flow Through Open Channels", 2nd.Tata McGraw Hill Publishing Company Ltd., New Delhi,1986	1999
4.	Henderson F.M; Open Channel Flow, Mac Millan Publishing Co., New York	1986
5.	Richard H.H. French; Open Channel Hydraulics, Mac Millan Publishing Co. New York, 1986	1986
6	Asawa G.L. , Flow of Fluids in Pipes and Channels, CBS Publishers and Distributors	2009

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NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area **: Civil Engineering**

2. Subject Title : **Ground Water Hydrology**

3. Subject Code : CWE-203

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **2nd** (Spring Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: To impart understanding of different aspects of groundwater movement, exploitation, management and quality issues.

S.No	Contents	Contact Hours
1.	Occurrence of ground water types of aquifers, ground water in different formations, aquifer properties.	5
2	Ground water movement: Basic equations of steady and unsteady groundwater flow in confined and unconfined aquifers	6
3.	Well Hydraulics: mechanics of well flow into fully and partially penetrating wells in confined aquifers, leaky aquifers, unconfined aquifers, approximate solutions, multiple well systems , aquifer tests, well design criteria, ground water control.	10
4.	Techniques of artificial recharge	3
5.	solution to transit problems of ground water mounds	4
6.	theory of subsurface drainage	3
7.	stream aquifer systems	4
8.	ground water quality, Sea water intrusion into coastal aquifers	3
9.	digital and analogue models for evaluation of aquifer response	4
Total		**42**

3. Suggested Books:

S.No	Name of Books/authors/Publishers	Year of Publication
1.	El-Kadi A.; Ground water Models for Resource Analysis and Management, Lewis Publications, Boca Raton.	1995
2	S. Ne-Zheng; Inverse Problems in Ground water Modelling, Kluwer Academic Dordrecht.	1994
3.	USEPA; Handbook of Groundwater, Vols. I & II, Scientific Publications, Jodhpur Reprint.	1994
4.	E. Custodio(Editor); Study and Modelling of Salt water Intrusion into Aquifers, CIMNE publications, Barcelona, Spain.	1993
5.	Walton W.c.; Groundwater Modellling Utilities, Lewis Publications, Boca-Raton.	1992
6	Karanth K.R.; Groundwater Assessment Development and Management, Tata McGraw Hill New Delhi.	1990

7	R. Willis and W.W.G. Yeh; Groundwater Systems Planning and Management, Prentice Hall New Jersey.	1987
8	Todd D.K. , Groundwater Hydrology, John Wiley & Sons.	2005

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NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area **: Civil Engineering**

2. Subject Title : **Advanced Hydrology Lab**

3. Subject Code : CWE-204

4. Contact Hours : L-T-P: 0-0-3 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 1

6. Semester/Session : **2nd** (Spring Session)

7. Examination Duration (Hrs) : Mid-Term Exam; End-Term Exam

8. Pre-requisite : **Nil**

9. Objective: To impart understanding of various fluid flow measurement in open channels

S. No.	Contents	Contact Hours
1	To determine the infiltration rate of a particular plot of land using double ring infiltrometer, and construct infiltration capacity curves.	3
2	To study the variation of meteorological parameters, such as, air temperature relative humidity, wind speed and wind direction using thermohygrometer and anemometer	3
3	To study the permeability of a soil sample using constant/ varying head permeameter.	3
4	To study the variation of hydrological parameters, such as, water level and water temperature/ conductivity in a bore well., using water level recorder	3
5	To demonstrate and simulate the formation of river features, including flow and bed load motion. a. Experimental investigation on erosion and deposition. b. Characteristics of meandering water courses. c. Sediment transport and bedload motion capabilities. d. Channel morphology studies	6
Total		**18**

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NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area : **Civil Engineering**

2. Subject Title : **Embankment Dams [Elective]**

3. Subject Code : CWE-211

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **2nd** (Spring Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: To impart skills in solution of typical problems in embankments and hence impart understanding of several aspects related to safety criteria for embankments.

11. Details of course:

S.No	Contents	Contact Hours
1.	Introduction, Types and advantages of Embankment dams,	5
2.	Factors affecting the design of Embankment dams, safety criteria,	8
3.	Theoretical analysis of seepage through embankment and its applications, Control of seepage through embankment dams,	9
4.	Stability analysis including seismic stability	6
5.	Construction methods, Instrumentation, quality control	6
6.	Typical problems and their solutions in Embankment dams.	8
Total		42

4. Suggested Books:

S.No	Name of Books/authors/Publishers	Year of Publication
1.	Anderson, M.G. and Richards, K.S.; Slope Stability, John Wiley.	1987
	Sherard, J.L.;Woodward, R.J. Gizienski; and Clevenger, W.A.; Earth and Earth Rock Dams, John Wiley.	1963
3.	McCarthy, R.N.; Essentials of Soil Mechanics and Foundations, Prentice Hall.	1988
4.	Chowdhury, D.F.; Slope Analysis, Prentice Hall.	1988
	Bramhead, E.N; The Stability of Slopes, Blackey Academic and	

5.	Professionals Publications, Glasgow.	1986

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NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area **: Civil Engineering**

2. Subject Title : **Contaminant Transport in Natural Systems [Elective]**

3. Subject Code : CWE-212

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **2nd** (Spring Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: To impart understanding of fate and transport of chemical contaminants in surface water and ground water with emphasis on principles and mathematical description of mass transport

11. Details of course:

S.No	Contents	Contact Hours
1.	Overview of contaminants of concern in aquatic systems Conventional chemical and emerging contaminants, Biological contaminants.	5
2	Chemical Equilibria/Partitioning, volatilization, sorption/desorption, chemical transformations,	7
3	Photochemical transformations, biological transformations and biodegradation.	5
4	Mass, momentum and energy balance, advection, molecular diffusion, dispersion.	7
5	Subsurface flow and transport. Pollutants in groundwater, Groundwater Pollution Hydraulics and Transport, Groundwater Reactions and Sorption, Biodegradation and Bioremediation in Groundwater	9
6	System/Reactor Modeling with chemical reaction. Physical and hydrologic characteristics of lakes. Finite difference steady state lake models.	9

Total	42

4. Suggested Books:

S.No	Name of Books/authors/Publishers	Year of Publication
1.	Jerald L. Schnoor, Environmental Modeling: Fate and Transport of Pollutants in Water, Air, and Soil, John Wiley&Sons, Inc.: New York.	1996
2.	Harold F. Hemond and Elizabeth J. Fechner-Levy, Chemical Fate and Transport in the Environment, 2nd Edition, Academic Press: San Diego	2000
3.	Mark M. Clark, Transport Modeling for Environmental Engineers and Scientists, 2nd edition, Wiley-Interscience: New York.	2009

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NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area : Civil Engineering

2. Subject Title : **GIS and Remote Sensing Application in Civil Engineering [Elective]**

3. Subject Code : CWE-213

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **2nd** (Spring Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: To impart understanding of basic principles of remote sensing, image processing and applications.

11. Details of course:

S.No	Contents	Contact Hours
1.	Principles of Remote Sensing: Introduction to remote sensing, Remote sensing system, electromagnetic spectrum, Black body, Atmospheric windows, spectral characteristics of earth's surface, range of sensing system.	6
2	Platforms, Sensors and Data Products: Ground aircraft, Spacecraft platforms, photographic sensors, scanners, radiometers, radar and mission planning, data types and format, scale and legend.	6
3.	Interpretation and Analysis Techniques: Multispectral, multitemporal, multisensoral, multistage concepts, photo interpretation techniques for aerial photo and satellite imagery, interpretation elements, false colour composition, etc.	12
4.	Photogrammetry: Photogrammetry- Basic application, applications of aerial photo interpretation to water resources engineering.	5
5.	Digital Analysis: Preprocessing and processing, image restoration/enhancement procedures, pattern recognition concepts, classification algorithms, post processing procedures.	6
6.	Application in Water Resources Engineering: River drainage and flood flow, watershed delineation and characteristic studies, command area mapping, drought assessment, groundwater inventory, soil moisture study, water quality assessment and monitoring, disaster management.	7
Total		**42**

S.No	Name of Books/authors/Publishers	Year of Publication
1.	Thomas, M. Lillisandand R.W.Kiefer; Remote Sensing and Image Interpretation, John Wiley.	1987
	Sabins and Floyd, F.J.R; Remote Sensing Principles and	

2	Interpretation, W.H. Freeman, Sanfrancisco.	1978
3.	C. Elachi; Introduction to Physics and Techniques of Remote Sensing, New York Wiley.	1987
4.	Phillip, H. Swain and Shirley, M. Davis; Remote Sensing- The Quantitative Approach, McGraw Hill Publications.	1978
5.	Johnson, R. Jenson; Introductory Digital Image Processing, Prentice hall.	1986

3. Suggested Books:

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1. Subject Area : **Civil Engineering**

2. Subject Title : **Flood Forecasting [Elective]**

3. Subject Code : CWE-214

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **2nd** (Spring Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: To introduce the details of various methods of flood estimation, forecasting and control.

11. Details of course:

S.No.	Contents	Contact Hours
1.	Definitions, objectives and importance of flood estimation and real time forecasting; Classification of hydrological forecasts	3
2.	Flood estimation and forecasting methods, statistical and deterministic approaches, basic concepts and formulations	4
3.	Monitoring networks;Site selection and installation of instruments, river monitoring and raingauge networks design, automatic weather stations and G and D station; Data transmission	4
4.	Meteorological forecasting and quantitative precipitation forecasting	5
5.	Graphical and statistical models for flood forecasting adopted by CWC and other operational models; Case studies	6
6.	Unit hydrograph and Soil conservation service – curve number based deterministic models for flood forecasting; Autoregrenive (AR), Moving Average (MA), Autoregrenive moving average (ARMA) models: basic concepts, formulations and updating of parameters using adaptive filter models	6
7.	Physically based models for flood forecasting;Fundamentals and overview of operational models, Choice of appropriate methods or models for flood forecasting	6
8.	Calibration and validation of forecasts, dissemination of forecast, Early warning system	4
9.	Potential applications from emerging technologies	4
	Total	**42**

7. Suggested Books:

Sl. No.	Name of Authors/Books/Publisher	Year of Publication/Reprint
1.	Manual on flood forecasting and warning- WMO publication no. 1072	2011
2.	Montgomery, D.C., Jennings, C.L. and Kulahci M., "Introduction to Time Series Analysis and Forecasting", John Wiley & Sons	2008
3.	Abraham, B. and Ledolter, J., "Statistical Methods for Forecasting", John Wiley & Sons	2005
4.	Maidment, D.R., "Handbook of Hydrology", McGraw Hill	1993
5.	"Manual on Flood Forecasting, River Management Wing", Central Water Commission, India	1989
6.	"Manual on Flood Forecasting, Central Flood Forecasting Organisation", Central Water Commission, India	1980
7.	Kottegoda N.T., "Stochastic Water Resources Technology", John Wiley & Sons	1980
8.	"Hydrological Forecasting Practices, Operational Hydrology", World Meteorological Organization, Report No. 6	1975

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1. Subject Area : **Civil Engineering**

2. Subject Title : **Computational Fluid Dynamics [Elective]**

3. Subject Code : CWE-221

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **2nd** (Spring Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Fluid Mechanics and Numerical Methods**

10. Objective: The aim of this course is to offer a programme of study which will enhance the skills of the graduate student providing a detailed introduction to the fundamentals of Computational Fluid Dynamics (CFD) together with an insight into the applications of CFD across the breadth of the subject.

11. Details of course:

S.No	Contents	Contact Hours
1.	Introduction: Conservation equation; mass; momentum and energy equations; convective forms of the equations and general description.	3
2.	Classification and Overview of Numerical Methods: Classification into various types of equation; parabolic elliptic and hyperbolic; boundary and initial conditions; over view of numerical methods.	4
3.	Finite Difference Technique: Finite difference methods; different means for formulating finite difference equation; Taylor series expansion, integration over element, local function method; treatment of boundary	3
	conditions; boundary layer treatment; variable property; interface and free surface treatment; accuracy of f.d. method.	
4.	Finite Volume Technique: Finite volume methods; different types of finite volume grids; approximation of surface and volume integrals; interpolation methods; central, upwind and hybrid formulations and comparison for convection-diffusion problem.	5
5.	Finite Element Methods: Finite element methods; Rayleigh-Ritz, Galerkin and Least square methods; interpolation functions; one and two dimensional elements; applications.	5
6.	Methods of Solution: Solution of finite difference equations; iterative methods; matrix inversion methods; ADI method; operator splitting; fast Fourier transform.	5

7.	Time integration Methods: Single and multilevel methods; predictorcorrector methods; stability analysis; Applications to transient conduction and advection-diffusion problems.	5
8.	Numerical Grid Generation: Numerical grid generation; basic ideas; transformation and mapping.	4
9.	Navier-Stokes Equations: Explicit and implicit methods; SIMPLE type methods; fractional step methods.	4
10.	Turbulence modeling: Reynolds averaged Navier-Stokes equations, RANS modeling, DNS and LES.	4
	Total	**42**

5. Suggested Books:

S.No	Name of Books/authors/Publishers	Year of Publication
1.	Ferziger, J. H. and Peric, M.. Computational Methods for Fluid Dynamics. Third Edition, Springer-Verlag, Berlin.	2003
2	Versteeg, H. K. and Malalasekara, W.. Introduction to Computational Fluid Dynamics: The Finite Volume Method. Second Edition (Indian Reprint) Pearson Education.	2008
3.	Anderson, D.A., Tannehill, J.C. and Pletcher, R.H. Computational Fluid Mechanics and Heat Transfer. Taylor & Francis.	1997

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NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area **: Civil Engineering**

2. Subject Title : **Environmental Impact Assessment [Elective]**

3. Subject Code : CWE-222

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **2nd** (Spring Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: To impart knowledge related to socio-economic aspects of water resources projects and their environmental impact assessment.

11. Details of course:

S. No.	Contents	Contact Hours
1	Water Resources Projects: Need and importance of Water Resources Projects, Types of projects.	5
2	Environmental policy and laws	3
3	Environment: Eco systems, Habitat assessment, Environmental objectives, study of available resources, Environmental monitoring, Eco-friendly projects, public involvement	7
4	Environmental Impact Assessment (EIA): Introduction, historical background, Types of EIA, EIA process , components of EIA report, Environmental evaluation techniques.	11
5	Prediction and assessment of impacts	5
6	Project Evaluation: Evaluation and impact of projects like irrigation, Power Supply, Water Supply, Flood Control, Sewage, etc. Facilities generated, negative effects- inundation, migration, etc.	7
7	Case studies and evaluation of some important water Resources Projects in India and abroad.	4
Total		**42**

1. Suggested Books:

S.No	Name of Books/authors/Publishers	Year of Publication
1.	Canter L.W. . Environmental Impact Assessment. McGraw-Hill, Inc. Printed in the United States of America. 331pp.	1977
2	Eccleston, H.C. Environmental Impact Statements. John Wiley & Sons, Inc. Canada. 346 pp.	2000
3.	Lee, N. and C. George (editors). Environmental Assessment in Developing and Transitional Countries. John Wiley & Sons Ltd, England. 290 pp.	2000
	United Nations. Environmental Impact Assessment: A Management Tool for Development Projects. Proceedings of the Expert Group	

4.	Meeting on Environmental Impact Assessment of Development Projects Bangkok, Thailand. 155pp.	1988
5	Modi, P.A. Economic development and Environmental Issues	
6	Abbasi. S.A. Water Resources and their Environmental Impacts	

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NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area	**: Civil Engineering**
2. Subject Title	: **Application of AI/ML in Civil Engineering [Elective]**
3. Subject Code	: CSE-201
4. Contact Hours	: L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]
5. Credits	: 3
6. Semester/Session	: **2nd** (Spring Session)
7. Examination Duration (Hrs)	: Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs
8. Evaluation Weightage (Marks)	: C. P. =24; End-Term = 26 & End-Term = 50 [C. P. = Class performance, which includes attendance, Assignments and interaction in the class]
9. Pre-requisite	: **Nil**

10. Objective: To equip students with machine learning tools that help in learning from data and find solutions for complex civil engineering problems

11. Details of course:

S.No	Name of Books/authors/Publishers	Year of Publication
1.	Introduction to AI and Machine learning Review of statistics and linear algebra: Basic definitions; probability, conditional probability, expectation, normalization and standardization; parameter estimation and uncertainty; eigen value; eigen vectors; positive definite matrix, singular value decomposition	8
2	Regression: Simple linear regression, multiple regression, model adequacy tests, Overfitting and regularization; ridge regression, Feature selection, Lasso regression, Nearest neighbor and Kernal regression. Gradient decent for solution of linear regression; Examples and case studies	8
3	Classification and clustering: Linear and logistic classifiers, support vector machines; Hierarchical clustering	6
4	Decision trees: Ensemble learning: gradient boosting, and random forests; nearest neighbor; mixture models, expectation-maximization algorithm.	6
5	Neural networks: Perceptron, multi-layer perceptron, Feedforward network, back propagation; Computation; Coding; training; recurrent neural networks (RNN) and convolution neural networks (CNN); Case studies	10
6	Deep Reinforcement Learning: policy gradients and deep Qnetworks (DQNs), including a discussion of Markov decision processes (MDPs).	4
	Total	**42**

Suggested Books

S.No.	Name of Books/Authors/Publishers	Year of Publication
1.	Trevor Hastie, Robert Tibshirani, and Jerome Friedman, The Elements Of Statistical Learning: Data Mining, Inference, And Prediction, 2nd Edition, Springer	2019
2.	Gilbert Strang, Linear Algebra and Learning from Data, Wellesley, Cambridge Press,	2019
3.	Aurélien Géron, Hands-on Machine Learning with Scikit-Learn, Keras & TensorFlow, 2nd Edition; O'Reilly Media, Inc.,	2019
4.	Andriy Burkov, The hundred-page machine learning book, True Positive Inc	2025

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SEMESTER – III

NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area : **Civil Engineering**

2. Subject Title : **Water Quality and Environment**

3. Subject Code : CWE-301

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **3rd** (Autumn Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: To impart understanding of various aspects related to supply of pure and safe drinking water to communities and some environmental issues

11. Details of course:

S.No	Contents	Contact Hours
1.	Introduction: The composition and characteristics of natural waters. Effect of Temperature, Equilibria in water systems.	3
2.	Water Quality Characteristics :	9

	Physical, Chemical and Biological Characteristics of Water. Standard methods of determination of important physical and chemical parameters of water quality, eg. PH, turbidity, electrical conductivity, total Solids, alkalinity, hardness etc., Units of measurements and expression of results, Bacteriological Indicators, and determination of Coliforms	
3.	Instrumental Methods of Chemical Analysis: Concepts of Instrumental/ Analysis on Selective Electordes, Atomic Absorption spectrophotometric methods, potentiometry including O_2 electrodes, Gas chromatography.	4
4.	Concepts in Organic and Biochemical Methods: Biochemical cycles of C, N, P and S, Trace Organics, Detergents, Pesticides, Fertilisers , etc.	4
5.	Water Quality Representation and Standards: Water Quality Criteria, Guidelines, and Standards for Various uses.	3
6.	Water Pollution Natural factors affecting water quality and pollution from various wastes , mechanisms of surface water pollution, point and Non-point sources , Effect of Geological formations on Water quality.	5
7.	Water Quality in Receiving Water Bodies: Lakes and Impoundments , Stratification and Eutrophication , Water Quality in Rivers , self purification and Reaeration , Dissolved Oxygen Balance in Rivers , Thermal Pollutions.	4
8.	Ground Water Quality: Sources and Mechanisms of Groundwater Pollution. Groundwater Pollution from Lnadfills and Waste Dumps.	6
9.	Case Studies: Case Studies on Environmental Impact of Dam and Irrigation Schemes , and Land Reclamation Projects.	4
	Total	**42**

6. Suggested Books:

S.No.	**Name of Books/Authors/Publishers**	**Year of Publication**
1.	Metcalf And Edduy, Inc.; Waste Water Engineering, Treatment, Disposal, Reuse, Tata McGraw Hill.	2002
2	Masters G.M.; Introduction to Environmental Engineering and Science, Pretice hall of India.	1994
3	Garg S.K. Water supply Engineering Vol.I, Khanna Publishers, New Delhi.	2003

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NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area : **Civil Engineering**

2. Subject Title : **Hydraulic Structures**

3. Subject Code : CWE-302

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **3rd** (Autumn Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: To provide the knowledge about various Hydraulic Structures constructed for the purpose of harnessing and using Water Resources and also for preventing the negative and destructive actions of water on the surrounding environment.

11. Details of course:

S. No.	Contents	Contact Hours
1	**Storage Structures**: Types, Selection of Type Earthen Dams- Causes of failure, Elements of Earth Dam, Seepage, Stability Gravity Dams-Site Selection, Forces on Gravity Dam, Stability Analysis, Elementary and Practical profile, Design	10
2	**Flow Control Structures**: Spillways, Outlets Types and Design Features	6
3	**Reservoirs** Investigations for Reservoir Planning, Reservoir Sedimentation, Operation of Reservoir, Reservoir Flood Routing	6
4	**Head Works** Types of Head Works, Components of Diversion Head Works, Types of Weirs, Design of Weirs, Canal Head Regulator. Theory Of Seepage Bligh's Creep Theory, Method of Independent Variable of Khosla,	10
6.	**Cross Drainage Works** Types of Cross-Drainage Works, Design of Cross-Drainage Works , causeways, culverts, bridges, estimation of design	10

	discharge, fixation of waterway, foundation depth and spans	
	Total	**42**

4. Suggested Books:

S.No.	Names of Books/Authors/Publishers
1.	Hydraulic Structures; P. Novak, AIB Moffat, C. Nalluri, and R. Narayanan: Taylor & Francis, New York
2	Engineering for Dams, Vol I & Vol II; Creager, Justin and Hinds; John Wiley
3	Water Resources Engineering; JB Franzini, DL Freyberg, G Tchobanoglous; McGraw Hill
4	Design Textbooks in Civil Engineering – Irrigation Engineering – Vol VI – Dams; L Leliavsky; Chapman & Hall
5	Design of Small Dams; USBR; Oxford & IBH
6	Fundamentals of Irrigation Engineering; Bharat Singh; Nem Chand
7	Irrigation and Water Power Engineering; BC Punmia, BBL Pande; Laxmi Pub.
8	Irrigation, Water Power and Water Resources Engineering; KR Arora; Standard Pub.
9	Theory and Design of Irrigation Structures; Varshney, Gupta, Gupta; Nem Chand.
10	Irrigation Engineering and Hydraulic Structures; SK Garg; Khanna Pub.

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NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR, J&K

1. Subject Area **: Civil Engineering**

2. Subject Title : **Circular Water Economy**

3. Subject Code : CWE- 311

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **3rd** (Autumn Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective To impart knowledge on planning, design, and operation of water infrastructure towards a circular and resilient approach considering paradigm shift in the water sector

11. Details of course:

S. No.	Contents	Contact Hours
1	**Introduction:** Circular economy; Linear economy; Resource scarcity; Climatic and Non-climatic challenges to cater the linear economy; Techno-economic feasibility; Social acceptance of a circular economy	10
2	**Circular economy and resilience**: Application of circular economy principles in the water sector; Resilient and inclusiveness of water systems in the circular economy; The 6 R's in the circular water economy	06
3	**Circular Economy in water Conservation**: Water efficiency; Reducing water wastage; Water utility-led water conservation	06
4	**Developing the Circular Water Economy**: Reuse and Recycle-Industrial water reuse and recycling; Agricultural reuse; Urban reuse; Sustainable water management and circular economy in water-energy-food nexus	04

5	**Circular Water Economy in Energy sector**: Recover-Renewable energy generation technologies at wastewater treatment facilities; Traditional renewable energy at water and wastewater treatment facilities; Resource recovery from wastewater	08
6	**Circular Economy in water resources management**: Restore and Reclaim Restoration of the water sources like groundwater, river water, water in lakes, artificial recharge; Managed Aquifer Recharge; Rejuvenation of water sources; Constructed Wetland (CW) technology; Repurposing the wastewater from residential buildings, industries or agriculture	08
	Total	**42**

10. Suggested Books

S.No.	**Name of Authors/Book/Publisher**	**Year of Publication / Reprint**
1.	Delgado, A., Rodriguez, D. J., Amadei, C. A., & Makino, M., "Water in Circular Economy and Resilience (WICER)." World Bank, Washington, DC.	2021
2.	Brears, R. C., "Developing the circular water economy" Springer International Publishing.	2020
3.	WBCSD (World Business Council for Sustainable Development)., "Business Guide to Circular Water Management: Spotlight on Reduce, Reuse and Recycle", World Business Council for Sustainable Development.	2017
4.	UNIDO (United Nations Industrial Development Organization). "Circular Economy"	2017
5.	IWA. "Water Utility Pathways in a Circular Economy." IWA, London.	2016

6.	Veolia., "Water at the Heart of the Circular Economy.	2014
7.	McKinsey Global Institute. Resource Revolution: Meeting the World's Energy, Materials, Food, and Water Needs. McKinsey Global Institute.	2011

1. Subject Area **: Civil Engineering**

2. Subject Title : **Stochastic Hydrology**

3. Subject Code : CWE- 312

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **3rd** (Autumn Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective: The objective is to provide an understanding of the theory and application of various probability and stochastic models for the modelling of hydrologic processes. The basic tools required for forecasting, simulation and frequency prediction of hydrological processes are presented.

11. Details of course:

S.No	Contents	Contact Hours
1.	Characteristics of Hydrological Data: Population and sample, mean, median, mode, range, standard deviation, skewness, hypothesis testing, goodness of fit tests. Introduction to hydrological statistics.	5
2.	Probability Distributions: Discrete Distributions: Binomial and Poisson Continuous Distributions: Normal, log-normal, Gamma distribution, Pearson type-III, Gumbel's extreme distribution.	9
3.	Frequency Analysis: Introduction to frequency analysis, analytical frequency analysis	9
4.	Multiple Regression and Correlation : Correlation and regression , partial correlation, SLR, MLR, regression diagnostics.	6
	Introduction to Time Series: Stationarity and ergodicity, Purely Stochastic Models: Markov processes, Auto Correlation and Partial Auto Correlation. Auto Regressive Moving Average Models (Box- Jenkins	

5.	models) - model identification;Parameter estimation ; calibration and validation; Simulation of hydrologic time series ;Applications to Hydrologic Forecasting – case studies.	13
Total		42

Suggested Books:

S.No.	Name of Books/Authors/Publishers	Year of Publication
1.	Ross, S.M., 'Introduction to Probability Models',Academic Press, Elsevier.	2007
2	Hipel, K. and McLeod, A. 'Time-series Modellingof Water Resources and EnvironmentalSystems', Elsevier,.	1993
3	Kottegoda, N.T. 'Stochastic Water ResourcesTechnology', Macmillan, London	1980
4	Haan, C.T. Statistical methods in Hydrology, First East-West Press Edition, New Delhi,.	1995
5	Warren, Viessman, etal. Introduction to Hydrology, Prentice Hall	2003
6	Clarke, R.T., "Statistical Models in Hydrology", John Wiley, Chinchester.	1994

1. Subject Area : **Civil Engineering**

2. Subject Title : **River Engineering**

3. Subject Code : CWE- 313

4. Contact Hours : L-T-P: 2-1-0 [L: Lecture, T: Tutorial & P: Practical]

5. Credits : 3

6. Semester/Session : **3rd** (Autumn Session)

7. Examination Duration (Hrs) : Mid-Term Exam = 1hr 15 minutes; End-Term Exam = 2.5 hrs

8. Evaluation Weightage (Marks) : C. P. =24; End-Term = 26 & End-Term = 50

[C. P. = Class performance, which includes attendance, Assignments and interaction in the class]

9. Pre-requisite : **Nil**

10. Objective To impart understanding of various aspects related to flow of water and sediments through natural and artificial channels and design aspects thereof.

11. Details of course:

S.No	Contents	Contact

		Hours
1.	Introduction to sediment and Fluvial hydraulics, nature of problems	3
2.	Origin and properties of sediments	4
3.	Incipient motion of sediment particles	4
4.	Regimes of flow	4
5.	Resistance equations	4
6.	Bed load computations	4
7.	Suspended load and total load transport- computations of	6
8.	sediment samplers	2
9.	Design of Stable alluvial channels	3
10	Alluvial streams and their hydraulic geometry	2
11	Variation in plan form of streams	2
12	Alluvial river models	4
	Total	42

Suggested Books

S.No.	Name of Books/Authors/Publishers	Year of Publication
1.	Garde, R.J. and RangaRaju, K.G.; Mechanics of Sediment Transport and Alluvial Stream Problems, New Age International Publications Pvt. (Ltd.)	2000
2	C.T Yang; Sediment Transport Theory and Practice, McGraw Hill Companies Inc.	1996
3	F.M.Henderson, Open Channel Flow, MacMillan, New York,	1996
4	H.H.Chang; Fluvial Processes in River Engineering, John Wiley.	1988

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