Bharati Vidyapeeth

(Deemed to be University)

Pune, India

College of Engineering, Pune

Program Curriculum

M.Tech-2019

(Civil - Water Resources Engineering)

(w.e.f. from 2019-20)

BHARATI VIDYAPEETH
(DEEMED TO BE UNIVERSITY)
COLLEGE OF ENGINEERING, PUNE

VISION OF UNIVERSITY:

Social Transformation through Dynamic Education

MISSION OF UNIVERSITY:

- To make available quality education in different areas of knowledge to the students as per their choice and inclination
- To offer education to the students in a conducive ambience created by enriched infrastructure! and academic facilities in its campuses.
- To bring education within the reach of rural, tribal and girl students by providing them substantive fee concessions and subsidized hostel and mess facilities
- To make available quality education to the students of rural, tribal and other deprived sections of the population

VISION OF THE INSTITUTE

To be World Class Institute for Social Transformation through Dynamic Education.

MISSION OF THE INSTITUTE

- To provide quality technical education with advanced equipment, qualified faculty members, infrastructure to meet needs of profession and society.
- To provide an environment conducive to innovation, creativity, research and entrepreneurial leadership.
- To practice and promote professional ethics, transparency and accountability for social community, economic and environmental conditions.

DEPARTMENT OF CIVIL ENGINEERING

VISION OF DEPARTMENT

To create Civil Engineers who will transform Civil Engineering Industry for sustainable development of society.

MISSION OF DEPARTMENT

- To create Civil Engineers enriched with quality technical education.
- To inculcate innovation, creativity and research approach among the graduants.
- To create entrepreneurs practicing professional ethics.

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COLLEGE OF ENGINEERING, PUNE

PROGRAMME: M.TECH (CIVIL – WATER RESOURCES ENGINEERING)

Programme Educational Objectives (PEOs):

PEO1: To Prepare students for career in Water Resources Engineering.

PEO2: To Inculcate, innovation ,creativity and research approach among the grandaunts

Programme Outcomes (PO): An Engineering Graduates will be able to:

PO1: An ability to independently carry out research /investigation and development work to solve practical problems

PO2: An ability to write and present a substantial technical report/document

PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

PO4: Manage the project efficiently with management principles considering economical & financial factors.

PO5: Contribute to the society for sustainable development with acquired professional skills, ethics, and social responsibility

Bharati Vidyapeeth University
College of Engineering
Department of Civil Engineering

Structure of M. Tech. – (Civil WRE)-2019

STRUCTURE & EXAMINATION PATTERN

Semester I									**Total Duration: 20 hrs/week** **Total Marks :500** **Total Credits: 18**		
Subjects	**Teaching Scheme (Hrs) Hrs./Week**		**Examination Scheme (Marks)**						**Examination Scheme (Credits)**		**Total Credits**
	L	**P**	**Theory**	**Unit Test**	**Attendance**	**Tutorial/assignments**	**TW**	**Pract/ Oral**	**TH**	**TW/PR /OR**	
Advanced Fluid Mechanics	04	02	60	20	10	10	25	25	04	01	05
Irrigation Water Management	04	02	60	20	10	10	25	25	04	01	05
Computational Methods in Hydraulic Engineering	04	--	60	20	10	10	-	-	04	-	04
Hydrology	04	--	60	20	10	10	-	-	04	-	04
Total	**16**	**04**	**240**	**80**	**40**	**40**	**50**	**50**	**16**	**02**	**18**

Semester II											**Total Duration: 20 hrs/week** **Total Marks :500** **Total Credits: 18**	
Subjects	**Teaching Scheme (Hrs/Week)**		**Examination Scheme (Marks)**							**Examination Scheme (Credits)**		
	L	**P**	**Theory**	**Unit Test**	**Attendance**	**Tutorial/ assignments**	**TW**	**Oral**	**Total Marks**	**TH**	**TW &OR**	**Total Credits**
Sediment Transport & River Engineering	04	02	60	20	10	10	25	25	150	04	01	05
Hydraulic Structures	04	--	60	20	10	10	--	--	100	04	-	04
Open Channel Flow	04	--	60	20	10	10	--	--	100	04	-	04
Optimization Techniques in Hydraulics	04	02	60	20	10	10	25	25	150	04	01	05
Total	**16**	**04**	**240**	**80**	**40**	**40**	**50**	**50**	**500**	**16**	**02**	**18**

Semester III									**Total Duration: 28 hrs/week** **Total Marks : 475** **Total Credits: 40**			
Subject	**Teaching Scheme (Hrs/Week)**		**Examination Scheme (Marks)**							**Examination Scheme (Credits)**		
	L	**P**	**Theory**	**Unit Test**	**Attendance**	**Tutorial/ assignments**	**TW**	**Oral**	**Total Marks**	**TH**	**TW & OR**	**Total Credits**
Elective –I	04	02	60	20	10	10	25	25	150	04	01	05
Elective –II	04	02	60	20	10	10	25	25	150	04	01	05
**Self-Study Paper-I	* 04	--	60	20	10	10	-	-	100	04	-	04
Seminar	-	05	-	-	--	--	25	25	50	-	05	05
Dissertation Stage –I	-	07	-	-	---	--	25	--	25		21	21
Total	**12**	**16**	**180**	**60**	**30**	**30**	**100**	**75**	**475**	**12**	**28**	**40**

Elective – I	**Elective – II**
• Coastal Engineering • Hydraulic Modeling Techniques	• Water Power Engineering • Environmental Fluid Mechanics • Numerical Methods in Hydraulic Engineering

Semester IV									Total Duration: 14hrs/week Total Marks : 325 Total Credits: 34			
Subject	**Teaching Scheme (Hrs/Week)**		**Examination Scheme (Marks)**							**Examination Scheme (Credits)**		
	L	**P**	**Theory**	**Unit Test**	**Attendance**	**Tutorial /assignments**	**TW**	**Oral**	**Total Marks**	**TH**	**TW & OR**	**Total Credits**
**Self-Study Paper-II	* 04	--	60	20	10	10	-	-	100	04	-	04
Dissertation Stage –II	-	10	-	-	--	-	150	75	225		30	30
Total	**04**	**10**	**60**	**20**	**10**	**10**	**150**	**75**	**325**	**04**	**30**	**34**

List of Self Study Papers

Sr.No	SELF STUDY PAPER- I (SEM-III)	SELF STUDY PAPER- II (SEM-IV)
1	Water Resources Planning and Management	Offshore Structures
2	Ground Water Hydrology	Urban Water Management
3	Instrumentation in Hydraulics	River Engineering
4	Disaster Management	Planning of Ports
5	Operation and Maintenance of Hydraulic Structures	Soil conservation and Watershed Management
6	Application of Remote Sensing To Water Resources	Reservoir Sedimentation
7	Floods and Flood management	Tides and Tidal Hydraulics
8	Environmental Impact assessment for Water Resources Projects	Dam break analysis

SEMESTER I

1: ADVANCED FLUID MECHANICS

TEACHING SCHEME
Lectures : 04 Hrs/Week
Practical : 02 Hrs/Week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Term Work : 25 Marks
Oral. : 25 Marks
Credits : 5

Unit-I (08 Hours)
Kinematics of Flow: Flow visualization, stream lines, streak lines, path lines, continuity equation in cartesian and cylindrical polar coordinates system, accelerations, rotation, vorticity.

Unit-II (08 Hours)
Velocity potential and stream function, flow-net, Laplace equation and its solution by graphical and relaxation methods, simple flow patterns.

Unit-III (08 Hours)
Dynamics of Flow: Integration of Euler's equation along streamline and in cartesian coordinate system. Bernoulli's equation, momentum equation, applications of energy and momentum equations to different problems.

Unit-IV (08 Hours)
Navier-Strokes equations for incompressible fluids, Strokes law, creeping flow, Helle-shaw motion, flow between parallel plates, flow near suddenly accelerated plate, flow in a circular pipe. Review of dimensional analysis, drag on immersed bodies.

Unit-V (08 Hours)
Boundary layer on flat plate, b. L. equations, Blasius solution, Karman's momentum and Integral equation, laminar and turbulent boundary layers, transition mechanisms, b.L.separation

Unit-VI (08 Hours)

Turbulent Flow: Nature of turbulence, scales of turbulence, different averages, Reynolds rules of averaging, Reynolds equations, statistical approach, isotropic and homogeneous turbulence, spectrum of turbulence.

Text Books / References

Shames, “Mechanics of Fluids”, McGraw Hill
Rouse H. Ed, “Advanced Fluid Mechanics”, John Wiley, 1959
Schlichting H., “Boundary Layer Theory”, McGraw Hill series in Mechanical Engineering
Garde R. J., “Turbulent Flow”,New Age Publisher, New Delhi, 1994
Garde R. J., Mirajgaoker A. G., “Engineering Fluid Mechanics”,SciTech Publisher, Chennai, 2004

Syllabus for Unit Test

Unit Test 1	Units I , II & III
Unit Test 2	Units IV, V & VI

2: IRRIGATION WATER MANAGEMENT

TEACHING SCHEME
Lectures : 04 Hrs/Week
Practical : 02 Hrs/Week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
T. W. : 25 Marks
Or. : 25 Marks
Credits : 5

Unit – I (08 Hours)

Soil Plant water relationship-Water relation of soils, Soil moisture and plant growth,estimating water requirement of crops, evapotranspiration and consumptive use , soil water availability to plants..

Unit – II (08 Hours)

Water Application methods- Surface and sub surface irrigation methods ,Border Irrigation, Check basin, Furrow, Sprinkler and drip irrigation.Prospective new methods of irrigation

Unit – III (08 Hours)

Design of drip and sprinkler irrigation systems-Hydraulic design of various Components of Drip and sprinkler Irrigation

Unit – IV (08 Hours)

Measurement of Irrigation Water-Various methods, Weirs, Parshall flumes, orifices, meter gates, tracer method. Irrigation efficiency, components of project irrigation efficiency, efficiency of irrigation practices, water use and operation of irrigation system..

Unit – V (08 Hours)

Scheduling of irrigation , time of irrigation ,frequency and interval of irrigation ,Water conveyance and control-Surface water distribution system, under ground Pipe line Irrigation distribution system.

Unit VI (08 Hours)

Study Salt problems in Irrigated Agriculture-Salt balance, Quality of irrigation water, Plant response to saline and alkali soils, Reclamation and management of salt affected soils, Case studies.

Text Books / References

Irrigation Theory and Practice –A.M.Michael, Vikas Publishing House.
Irrigation Engineering- G.L. Asawa, Wiley Eastern Ltd.
Irrigation water management- D.K.Majumdar. PHI Pvt. Ltd, 2013

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

3: COMPUTATIONAL METHODS IN HYDRAULIC ENGINEERING

TEACHING SCHEME
Lectures : 04 Hrs/Week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Credits : 4

Unit-I (08 Hours)
Complex Variables: Function of complex variables, Analytic function, Cauchy-Riemann equations (Cartesian and polar form), Harmonic functions, Construction of Analytic function, Milne-Thompson method.

Unit-II (08 Hours)
Complex Variables:Transformations or Mapping, Conformal mapping, Bilinear transformations, The Scharwz-Christoffel transformation, Complex Integration, Cauchy's Integral theorem, Cauchy's Integral formula, Residue theorem, Taylor's and Laurent's series. Applications to boundary value problems.

Unit-III (08 Hours)
Numerical Solution of Partial Differential Equations: Classification of second order partial differential equations, Solution of Laplace's, Poisson's, heat and wave equations by finite difference methods, Use of method of characteristics for solution of initial and boundary value problems. System of Linear equations- Jacobi, Gauss Seidel, Relaxation methods.

Unit-IV (08 Hours)
Numerical Methods: Curve fitting : Method of least squares, Straight line, Second degree parabola, Exponential curve. Numerical Integration-General Quadrature formula, Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8th rule, 12 Weddle's rule, Newton-Cotes Integration formulae, Gauss-Quadrature two point and three points formulae.

Unit-V (08 Hours)
Statistics: Measure of central tendency, measures of dispersion, Moments, Skewness and Kurtosis. Coefficient of Correlation and Regression, Multiple and Partial Correlation coefficient, Reliability of regression estimates (standard error of estimates).

Unit-VI (08 Hours)
Probability : Classical definition of probability, Addition and multiplication theorem of probability, Conditional Probability, Random variable, discrete and continuous random variables, Binominal, Poisson, Normal, Geometric, Exponential Beta, Gamma Distributions, Sampling distributions, Testing of Hypothesis, Large sample tests for means and proportions, small sample tests based on Chi-square test of goodness of fit and independence of attributes.

Text Books / References

Erwin Kreyszig, “Advanced Engineering Mathematics”, Wiley Eastern Ltd.Mumbai
Wylie C. R., Barret L. C., “Advanced Engineering Mathematics”, McGraw-Hill
B.S.Grewal, “Engineering Mathematics” (Khanna Publications, Delhi)
P.N.Vertikar & J. N. Vertikar, “Applied Mathematics”(Volume I & II) , P.V.G.Publications, Pune.

Murray R. Spiegel, “Schaum's Outline of theory and problems of “Complex Variables”, McGraw Hill Book Company
S. C. Gupta & V. K. Kapoor, “Fundamentals of Mathematical Statistics”, S. Chand & Sons , Delhi
S.S. Sastry, “Introductory Methods of Numerical Analysis”,Prentice Hall of India Pvt. Ltd., New Delhi
Irwin Miller & John E. Freund, “Probability & Statistics For Engineers”, Prentice Hall of India Pvt. Ltd., New Delhi

Syllabus for Unit Test

Unit Test 1	Units I , II & III
Unit Test 2	Units IV, V & VI

4: HYDROLOGY

TEACHING SCHEME
Lectures : 04 Hrs/Week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Credits : 4

Unit-I (08 Hours)
Forms of precipitation, hydrologic cycle, climate and seasons in India. Water availability in India and world. Methods of measuring precipitation, location of rain gauge, rainfall mass curve and rainfall hyetograph, intensity-duration-frequency analysis, depth-area-duration analysis, PMP,

Unit-II
Evaporation , Evaporimeters, empirical evaporation equations, empirical method of evaporation estimation, Evapotranspiration , Measurement of evapotranspiration, evapotranspiration equations , Infiltration , Infiltration capacity, measurement of infiltration, modeling infiltration capacity , infiltration indices.

Unit-III (08 Hours)
Runoff: runoff components, factors affecting runoff, basin yield, runoff-rainfall relations.
Data Analysis: Correlation, regression analysis, transformations, stochastic process, and time series analysis ,auto correlation analysis and synthetic flow generation models using random variates.

Unit-IV (08 Hours)
Unit Hydro graph, S-curve and IUH, Cleark's method of IUH. Synthetic Unit-hydrograph. Floods: Frequency analysis, normal, log-normal and Gumbel's distributions, envelope curves, empirical formulae and regional flood frequency analysis.

Unit-V (08 Hours)
.Flood Routing- Introduction , basic equations, Hydrologic/ storage routing in reservoir and channels, Hydraulic methods of flood routing, Simple cases.

Unit-VI (08 Hours)
Ground Water Hydraulics: Types of aquifers, distribution of surface and sub surface water in global and Indian context, Darcy's law, Dupuits assumptions, application of Darcy's law to simple flow systems, differential equation for confined and unconfined aquifers, wells fully and partially penetrating, multiple wells, interference of wells, pumping test with steady and unsteady flow. Ground Water Development: Ground water exploration, types of wells, construction and design of wells, screens, pumping equipment, ground water quality, ground water pollution

Text Books / References
P. Jayarami Reddy, "Textbook of Hydrology", Laxmi Publication, New Delhi
P. Jayarami Reddy, "Stochastic Hydrology", Laxmi Publication, New Delhi
R. H. Mccuen and W. M. Snyder, "Hydrologic Modelin Statistical Methods and Applications" Prentice Hall, New Jersey, U. S. A
K. N. Mutreja, "Applied Hydrology",Tata McGraw Hill Publication
V.T.Chow, "Applied Hydrology", Tata McGraw Hill Publication

Raghunath H. M., “Ground water”, New Age International Publication
Linsely ,Kohler ,Pauhlas, Applied Hydrology, Mcgraw hill Publishers.

Syllabus for Unit Test

Unit Test 1	Units I , II & III
Unit Test 2	Units IV, V & VI

SEMESTER II

5 : SEDIMENT TRANSPORT AND RIVER ENGINEERING

TEACHING SCHEME
Lectures : 04 Hrs/week
Practical : 02 Hrs/week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
T.W. : 25 Marks
Oral : 25 Marks
Credits : 5

Unit-I (08 Hours)
Introduction:Sediment prob lems, significant sediment properties, beginning of sediment movement – Shields analysis, critical tractive stress of non uniform materials.

Unit-II (08 Hours)
Bed Forms and Resistance: Description of bed forms, flow regimes, their significance, resistance analysis, different resistance laws.

Unit-III (08 Hours)
Modes of sediment transport, bed load transport, Dubuoy's equation. Einstein's approach, Meyer Peter and Muller's equation, suspended load transport, total load transport microscopic and macroscopic methods.

Unit-IV (08 Hours)
Design of stable channels:Regime method, Kennedy's method, Lacey's method, Blench and Simons-Albertson method and tractive forceapproach.

Unit-V (08 Hours)
Sediment Measurement: Bed load measurement, suspended load measurement, erosion from catchments, aggradation, degradation, silting of reservoirs, scour around bridge piers in uniform and non-uniform sediments.

Unit-VI (08 Hours)
Planforms and their prediction, river channel dimensions and their analysis, river training: objectives of river training, methods of river training by guide banks, spurs, levees, cut offs, pitched island and vanes, methods of bank protection.

Text Books / References

Garde R. J., Ranga Raju K. G., “Mechanics of Sediment Transportation and Alluvial Stream Problems” , New Age International (P) Limited, New Delhi, 2004
Garde R. J., “River Morphology”, New Age International (P) Limited, New Delhi, 2006

Syllabus for Unit Test

Unit Test 1	Units I , II & III
Unit Test 2	Units IV, V & VI

6: HYDRAULIC STRUCTURES

TEACHING SCHEME
Lectures : 04 Hrs/week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Credits : 4

Unit-I (08 Hours)
Gravity Dams-Concrete, masonry , Forces acting on a gravity dam, earthquake force-pseudo static and dynamic response approach, load classification, stability analysis, distribution of shear and normal stresses, principal stresses .

Unit-II (08 Hours)
Stress concentration around opening, foundation treatment, use of colgrout masonry in gravity dams, Roller Compacted Concrete Dams: Materials for R.C.C mixture, design concepts, construction methods, advantages.

Unit-III (08 Hours)
Earth Dam: Cross section of earth dam, Seepage through dam and its foundation, stability analysis for sudden draw down condition and steady seepage condition, during construction stages.

Unit-IV (08 Hours)
Seismic effects, pore pressure, protection of upstream and down stream slopes, design of filters. Rock fill Dams: Relevant rock fill characteristic, general design principles, method of construction and compaction.

Unit-V (08 Hours)
Spill ways: Determination of capacity, types of spillways, ogee, siphon, chute, side, shaft, orifice spillway and stepped spillway, their hydraulic design, crest profile, energy dissipaters and divide walls.

Unit-VI (08 Hours)
Spillway gates: Vibration, types of gates, radial, drum, vertical lift and automatic gates. Instrumentation in Dams: necessity, measurements and their purpose, planning of installation of instruments. Weirs and Barrages, water bridges and culverts ,design concepts .

Text Books / References

Bharat Singh,Varshney R.S."Engineering of Embankment Dams", Oxford & IBH Publishing Co.,1995.
Thomas, "The Engineering of Large Dams", John Wiley & Sons
Varshney R. S., "Concrete Dams", Oxford and IBH Publishing Co.
Vishcher D. L. and Hager W. H.,"Dam Hydraulics",John Wiley & Sons
"Design of Small Dams", USBR Oxford IBH Publishers
USBR Monogram -25, Stilling basins.

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

7: OPEN CHANNEL FLOW

TEACHING SCHEME
Lectures : 04 Hrs/week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Credits : 4

Unit-I (08Hours)

Basic Concepts of Fluid Flow: Classification of flow, differential form of continuity and momentum equations, energy equation, energy and momentum correction coefficients, pressure variation in vertical.

Unit-II (08 Hours)

Steady Uniform Flow in Rigid Boundary Channels: Shear stress on the boundary, velocity distribution in the vertical, resistance laws and their limitations, Stickler's equation, conveyance and section factor.

Unit-III (08 Hours)

Specific energy, specific force and critical depth, control section, applications of specific energy and critical depth concepts.

Unit-IV (08 Hours)

Gradually varied flow, governing equations, classification of surface curves, computation of gradually varied flow in prismatic and non-prismatic channels, graphical, direct and numerical integration methods

Unit-V (08 Hours)

Rapidly varied flow and application of momentum equation, hydraulic jump in horizontal and sloping rectangular channels, location and length of jump.

Unit-VI (08 Hours)

Unsteady flows : Waves and classification, celerity of waves, surges , equations of motion, and method of characteristics.

Text Books / References

K .G. Ranga Raju, “Flow Through Open Channels”, Tata McGraw Hill Publication 1993
Chaudhry M.H., ‘Open channel flow’, Spinger, New York, 2007.
F. M. Henderson, “Open Channel Flow”, The McMillan Company, N. Y., 1966
K. Subramanya, “Flow in Open Channels”, Tata McGraw Hill Publication, 1990
V. T. Chow, “Open Channel Flow”,McGraw Hill Publication, 1990
Garde R. J. & Mirajgaokar, “Engineering Fluid Mechanics”,SciTech Publishers, Chennai , 2004

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

8: OPTIMIZATION IN HYDRAULICS

TEACHING SCHEME
Lectures : 04 Hrs/week
Practicals : 02 Hrs/week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Marks : 40 Marks
Term Work : 25 Marks
Oral. : 25 Marks

Unit-I (08 Hours)
Concept and need of Optimization; Linear Programming: Formulation of problem, graphical solutions, simplex method, Big M method, Two-phase method, duality.

Unit-II (08 Hours)
Transportation problems-BFS-Optimality test, maximization problems. Assignment Problems - minimization, maximization.

Unit-III (08 Hours)
Nonlinear Programming: Unconstrained one dimensional search methods - Dichotomous search, Fibonacci, golden section; Multivariable unconstrained methods-gradient techniques, steepest ascent, descent methods, Newton's method .

Unit-IV (08 Hours)
Nonlinear Programming :Constrained method : Lagrangian multiplier techniques, Khun- Tuckers conditions, Dynamic Programming: Principle of optimality, recursive equation.

Unit-V (08 Hours)
Introduction to genetic algorithms, simulated annealing, neural networks and fuzzy systems for solving optimization problems.

Unit-VI (08 Hours)
Model formulation and case studies : Conjunctive use of ground water and surface water, hydropower optimization, crop yield optimization, multi-basin and multi-reservoir systems.

Text Books / References

Rao S.S., 'Engineering Optimization -Theory and Practice', New Age International(P) Ltd., 1914.
Taha H.A., "Operation Research - An Introduction", Prentice - Hall, 2009.
Wagner, H. M., 'Principles of Operations Research', Prentice - Hall, 1975.
Vedula S. and Mujumdar P. P.'Water resources engineering',Tata McGraw Hill Education, 2005.
Deb Kalyanmoy. 'Optimization for Engineering Design - Algorithms and Examples' PHI Learning (P) Ltd, 2012.
Louks D. P, Stedinger J. R. and Haith D. A., Water Resources Systems Planning and Analysis, Prentice Hall, Inc. Engelwood Cliffs, 1981.

Syllabus for Unit Test

Unit Test 1 Units I , II, III
Unit Test 2 Units IV, V, VI

SEMESTER III

9 : ELECTIVE I: COASTAL ENGINEERING

TEACHING SCHEME
Lectures : 04 Hrs/week
Practical : 02 Hrs/week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Termwork : 25 Marks
Oral : 25 Marks
Credits : 5

Unit-I (08 Hours)

Basic understanding of wave mechanics including wave generation, propagation, form and assessment in the surf zone. Statistical and spectral analysis of recorded wave data and prediction in coastal zone.

Unit-II (08 Hours)

Global tidal cycle, tidal análysis. Types of tides, effect of tides, significance in coastal engineering, Coastal process-erosion/accretion due to waves, estimation of littoral drift, Effect of construction of coastal structures on stability of shoreline / beaches, shoreline configuration

Unit-III (08 Hours)

Introduction to Coastal structures:, Design criteria and functional aspects of coastal structures: sea wall, revetment, bulk-head, quay- wall, jetties, breakwater types : rubble-mound, composite, floating and pneumatic types, design of RBW , offshore structures: oil platform, design criteria for sub marine pipelines, cables, response of oil platform members , floating structure to wave load –vibration and spacing of piles, forces on piles.

Unit-IV (08 Hours)

Dredging technology: types of dredgers, Radio active tracers studies for feasibility of dumping ground for dredged materials- environmental aspects of dredging etc.

Unit-V (08 Hours)

Planning and management of port and Harbors, Modern trends and techniques in port engineering.- Roll on-Roll off/ Lift on –Lift off etc. Special purpose ports: Concepts of twin /mother port, SBM , outer to outer port etc. Significance of port cost analysis economics.

Unit-VI (08 Hours)

Pollution in Coastal zone, disposal of waste/dredged spoils, design criteria of coastal outfall inlets and system. Oil spills and contaminants, coastal zone management: activities in coastal zone, CRZ, Issues related to Integrated coastal zone management. Coastal regulation zone.

Text Books / References

Basic Coastal Engineering-R.M.Sorensen,2006.
Coastal Hydrodynamics-J.S.Mani ,I IT Madras
Shore Protection Manual-U.S.Waterways Experiment Station Corps of Engineer,
Coastal Protection Manual 2002.
Narasinhan and S. Kathiroli, " Harbour and Coastal Engineering", Vol I&II, Ocean
and Coastal Engineering Publication, NIOT, Chennai

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & VI

9 : ELECTIVE I : HYDRAULIC MODELLING TECHNIQUES

TEACHING SCHEME
Lectures : 04 Hrs/week
Practical : 02 Hrs/week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Term work : 25 Marks
Oral : 25 Marks
Credits : 5

Unit-I
Dimensional analysis: Units, dimensions of physical quantities, different methods of btaining dimension less parameters viz., Rayleigh's method, method of repeating variables, Buckingham π theorem ,Reynolds number, Froude number, Mach number, Euler Number and Weber number.

Unit-II (08 Hours)
Determination of scales for models , Necessity of distortion of scales, scale effects. Movable bed models. Construction and operation of hydraulic models. Wind tunnels, flumes-2D,comprehensive models3D .

Unit-III (08 Hours)
Measuring Equipments: Flumes ,Weirs, flow meters, pressure transducers, hot film anemometer, Current meter, Laser doppler , pointer gauges.

Unit-IV (08 Hours)
Application to coastal and tidal problems. Design of Regular & Random (3D and2D) wave modelling techniques , stability of coastal structures, Simulation of littoral drift , Design of sand trap , Distorted scale tidal modelling technique(rigid/movable) for Estuarine Ports,

Unit-V (08 Hours)
Rigid bed models and movable bed models ,bank protection works , barrages and weirs , canal offtakes ,power intakes, gates ,bridges and intakes. Applications for structures in hilly regions – Dams , spillways and energy dissipaters, combination of rigid and movable bed models,sedimentation and flushing of reservoirs.

Unit-VI (08 Hours)
Introduction to basic mathematical modelling techniques for hydraulic phenomena & processes related to various hydraulic structures, Advantages & limitations for interpretation of the results, need of validation with field /prototype data- Typical case studies using software.

Text Books / References
"Langhaar- Dimensional Analysis"
Hydraulic Modeling", IAHR Bulletin no 7
"Fluid Mechanics", Dr. R. J. Garde Scitech Publications Channai
River behaviour control and training-CBIP Publications (60) revised no (279)
Narasinhan and S. Kathiroli, " Harbour and Coastal Engineering", Vol I&II, Ocean and Coastal Engineering Publication, NIOT, Chennai

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

10 : ELECTIVE II WATER POWER ENGINEERING

TEACHING SCHEME
Lectures : 04 Hrs/week
Practical : 02 Hrs/week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Term work : 25 Marks
Oral : 25 Marks
Credits : 5

Unit -I (08 Hours)

Classification of Hydropower plants, low & high head plants. Run of river plants, High head diversion plants, pumped storage plants, Electrical load on turbines load facter, power factor, capacity factor, load duration curve, firm power ,secondary power.

Unit -II (08 Hours

Assessment of available power, Essential stream flow data for water power studies flow duration curves, Intakes structures, location and intake type, shape of inlet, aeration in inlets, design of intake, sediment exclusion arrangement.

Unit -III (08 Hours

Penstocks and Accessories, classification of pen stocks, design criteria for penstocks, Economical diameter of penstocks, Anchor blocks, conduit values, Bends & manifolds.

Unit -IV (08 Hours

Water hammer and surges, channel surges, water hammer, resonance in penstocks. Function of surge tank, Types of surge tanks, Differential surge tanks.

Unit -V (08 Hours

Turbines- Type of turbines , Hydraulic features, Turbine size, lay out arrangements, Hydraulics of turbines, draft turbines, cavitation in turbines, characteristics of turbines.

Unit -V (08 Hours

Planning of power house – Power house structure, under ground power station, components of under ground power house, types of layouts, small scale Hydropower, Potential of small scale Hydropower.

Text Books / References

Dandekar M.M., K.N.Sharma “Water Power Engineering “ Vikas Publishing house.
Varshney R.S.”Hydro power Structures” Nemchand & Bros, Roorkey.

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

10 : ELECTIVE II: NUMERICAL METHODS IN HYDRAULIC ENGINEERING

TEACHING SCHEME
Lectures : 04 Hrs/week
Practical : 02 Hrs/week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Term work : 25 Marks
Oral : 25 Marks
Credits : 5

Unit-I (08 Hours)
Governing equations of 1-D and 2-D unsteady flow : St. Venant equations, Boussinesq equations, groundwater flow equations and boundary conditions.

Unit-2 (08 Hours)
Numerical method for one dimensional flow : Method of characteristics, characteristics, initial and boundary conditions, characteristic grid method, method of specified intervals, other numerical methods.

Unit-3 (08 Hours)
Numerical method for one dimensional flow : Finite difference method, explicit finite difference schemes, implicit finite difference schemes, stability.

Unit-4 (08 Hours)
Numerical method for two dimensional flow : Finite difference method, explicit finite difference schemes, implicit finite difference schemes, stability.

Unit-5 (08 Hours)
Numerical method for ground water flow : Explicit finite difference method, Implicit finite difference method, finite element method, application.

Unit-6 (08 Hours)
Applications of unsteady flows using commercial 1-D and 2-D software.

References
Chaudhry M. Hanif, Open Channel Flow, Spinger, 2007.
Abbott M. B.and Minns A. W., Computational Hydraulics, Gower Technical, 1998.
Vreugdenhil, C. B., Computational Hydraulics, 1989.
Fenton , J. , Computational Hydraulics, 2010
Popescu I., Computational Hydraulics, Numerical methods and modelling paperback, IWA Publishing, 2014.
Rastogi A. K., Numerical ground water hydrology, Penram, 2007.
Pinder G. F. and Gray W. G., Finite Element Simulation in Surface and Subsurface Hydrology, 1977.

Syllabus for Unit Test

Unit Test 1	Units I , II & III
Unit Test 2	Units IV, V & VI

10 ELECTIVE II: ENVIRONMENTAL FLUID MECHANICS

TEACHING SCHEME
Lectures : 04 Hrs/week
Practical : 02 Hrs/week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Term work : 25 Marks
Oral : 25 Marks
Credits : 5

Unit-I (08 Hours)
Global wind currents, atmospheric boundary layer, simulation of boundary layer in wind tunnel and applications to forces on structures, use of wind tunnel for studying dispersion, diffusion. Cyclones, anti cyclones, and tornadoes, Tsunami.

Unit-II (08 Hours)
Waves, deep and shallow water waves, braking of waves, littoral drift and sediment transport by waves, dispersion and diffusion in coastal waters, ocean out falls.

Unit-III (08 Hours)
Vortex formation at intakes, similarity criteria, hydraulic design of sumps, design of water intakes.

Unit-IV (08 Hours)
Heated water disposal in reservoirs and channels, mathematical considerations, solution techniques, physical modeling.

Unit-V (08 Hours)
Thermal plumes, dispersion and diffusion in atmosphere.

Unit-VI (08 Hours)
Problem and numerical solution.
Dam break

Text Books / References

Fisher H. B., List E. J., Imberger J. and Brooks N.H., “Mixing of Inland and Coastal Waters, Academic Press, NY, 1979
Bernard Le, Mehaute, “Introduction to Hydrodynamics and Water Waves, Springer– Verlag”, NY, 1996
Khauss J., “Swirling Flow Problems at Intakes, Hydraulic Structure Design Manual-I”, IAHR, Ed. 1987
Fredsoe J and Deigaard R., “Mechanics of Coastal Sediment Transport”

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

11 SELF STUDY PAPER I

12 SEMINAR

TEACHING SCHEME
Practical : 01 Hrs/week

EXAMINATION SCHEME
Term work : 25 Marks:
Oral : 25 Marks
Credits : 5

Each student will select a topic in the area of Hydraulic Engineering keeping track of the recent technological trends and developments. Students will make a seminar presentation using audio visual aids and submit the seminar report in the form of bound journal.

13 DISSERTATION STAGE I

TEACHING SCHEME
Practical : 02 Hrs/week

EXAMINATION SCHEME
Term work : 25 Marks
Credits : 21

Dissertation stage-I will include identification of problem, preparation of synopsis literature survey and formulation of problem.

SEMESTER IV

14 : SELF STUDY PAPER II

15 : DISSERTATION STAGE II

TEACHING SCHEME
Practical : 04 Hrs/week

EXAMINATION SCHEME

Term work : 150 Marks
Oral : 75 Marks
Credits : 30

Dissertation stage-II will include experimentation, data analysis and submission of final report.

11 : SELF STUDY PAPER I: WATER RESOURCES PLANNING AND MANAGEMENT

TEACHING SCHEME
Lectures : 04 Hrs/Week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Credits : 4

Unit-I (08 Hours)
Water Resources of India: Land resources of India, water sources per capita water availability, Irrigation potential, methods of assessment of water resources.

Unit-II (08 Hours)
Water Resources Development: Objectives, planning for water resources development, water resources system design, economics of water resources development, micro and macro economics, discounting factors, discounting techniques – present worth, rate of return, benefit cost analysis, annual cost methods, profitability analysis.

Unit-III (08 Hours)
Integrated and conjunctive use of water, allocating water for various uses.Irrigation water management, constraints in irrigation development. National water policy.

Unit-IV (08 Hours)
Augmentation of water resources: Conservation of water, augmentation of water resources, method of artificial recharge.

Unit-V
(08 Hours)
Water quality: Quality of water for irrigation and municipal use, water pollution and it s co ntrol. Development of water resources and environment. Environmental impacts of water storage reservoirs.

Unit-VI (08 Hours)
Water logging and land reclamation: Causes of water logging, anti logging measures, factors responsible for formation of saline and alkali soils, ill effects of salinity and alkalinity, land reclamation methods.

Text Books / References
Ray K. Linsley, Joseph B. Franzini, “Water Resources Engineering”, McGraw Hill Publication
R. K. Sharma, T. K. Sharma, “Hydrology and Water Resources Engineering”, Dhanpat Rai Publication
P. P. Mujumdar, Vedula, “Water Resources Engineering”, Tata McGraw Hill Publications.

Syllabus for Unit Test

Unit Test 1	Units I , II & III
Unit Test 2	Units IV, V & VI

11 : SELF STUDY PAPER I: GROUND WATER HYDROLOGY

TEACHING SCHEME
Lectures : 04 Hrs/Week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Credits : 4

Unit – I **(**08 Hours)
Hydrological cycle, role of ground water in hydrological cycle, aquifers, classification and characteristics.

Unit – II **(**08 Hours)
Ground water hydraulics- Darcy's law and application, flow nets-application.

Unit – III
(08 Hours)
Ground water hydraulics- mass conservation, aquifer flow equation, heterogeneity, anisotropy, unsaturated flow, recharge, stream-aquifer interaction, well hydraulics.

Unit – IV (08 Hours)
Application of ground water hydraulics for estimation of yield- case study.

Unit – V
(08 Hours)
Model (Numerical) in ground water hydraulics

Unit – VI **(**08 Hours)
Working organization: Global and Indian data collection, water quality and control.

Text Books/References

Groundwater Hydrology, David Keith Todd and Larry W. Mays

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

11: SELF STUDY PAPER I: INSTRUMENTAION IN HYDRAULICS

TEACHING SCHEME
Lectures : 04 Hrs/Week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Credits : 4

Unit – I (08 Hours)

Definition of instruments, purpose of instrumentation, system of application of instrumentation, different classifications of instruments, main hydraulic and other civil engineering parameters involved.

Unit – II (08 Hours)

Qualifications and characteristic of instruments, calibration and errors – definitions, utility and dependability, transducers - their purpose, characteristics and usage, decision on the requirements for selection of instruments, need of system analysis before the selection of instruments.

Unit – III (08 Hours)

Specific instruments : measurement of velocity and discharge, requirements for field and laboratory, methods of measurement and different structures used, supporting structure requirements, designs parameters.

Unit – IV (08 Hours)

Methodologies adopted for observations, requirements for good instruments and Instrumentation, application of above requirements to instrument systems.

Unit – V (08 Hours)

Specific instruments : measurement of pressure and strain, requirements for field and laboratory methods of measurement and different structures used, supporting structure requirements, designs parameters.

Unit – IV (08 Hours)

Modern electronic and high precision instruments. hot film anemometer, 3D observations for velocities, eddies, etc.

Text Books/References

Handbook for Flow measurement and documentation – South Florida Management District, USA

Calibration of Pressure Measurements – University of Porto Rico

Calibration of Pressure Measurements – USBR No 1040-1989

Discharge measurement structures – USBR; Agricultural research Service

Experimental Uncertainty and Measurement errors – An update - World Water and Environment Conference May 2005

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

11 : SELF STUDY PAPER I : DISASTER MANGEMENT

TEACHING SCHEME
Lectures : 04 Hrs/Week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Credits : 4

Unit – I **(**08 Hours)

Factors causing disaster & damage to properties & human lives- Natural man made, cause & short term / long term effects & needs to take measures.

Unit – II **(**08 Hours)

Extreme value conditions- Waves, flooding, storm surge, earthquake & Tsunami etc.

Unit – III **(**08 Hours)

Failure of hydraulic structures - dams, fires in plants, (Thermal, Nuclear etc.), oil tanker leakage, sinking etc.

Unit – IV **(**08 Hours)

Measures to avoid disasters (manmade), measures for minimum damage natural Disasters.

Unit – V **(**08 Hours)

Warnings systems pre disaster- remote sensing, satellite, media, (Radio, Tv), communication systems.

Unit – VI **(**08 Hours)

Rescue operation, -Helicopter, Life saving systems, transportation, detection of areas of disaster, Global, National, Local management systems for all various activities.

Text Books/References

Harsh K. Gupta, Disaster Management, Universities Press(India), 2003.
Sundar I., Sezhiyan T., Disaster Management,, Sarup and Sons, 2007.
Thomas D. Schneid and Larry R. Collins, Disaster Management and Preparedness, 2002.
Awasthy Amit, Disaster Management : Warning response and Community Relocation, Global India Publications, 2009.
Pinkowski Jack, Disaster Management Handbook, CRC Press, 2008.
Sharma Vinod K., Disaster Management : First India Disaster Management Training Country Workshop, New Delhi, 1993.

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

11 : SELF STUDY PAPER I : OPERATION AND MAINTENANCE OF HYDRAULIC STRUCTURES

TEACHING SCHEME
Lectures : 04 Hrs/Week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Credits : 4

Unit – I (08 Hours)
Introduction : Hydraulic structures, types, major hydraulic structures requiring operation and maintenance, dams, types.

Unit – II (08 Hours)
Dam failures : historic dam failures, their causes, modes of failures of Embankment dams, external erosion, internal erosion, structural failure, safety requirements/measures, Modes of failures of concrete dams, external erosion, internal erosion, structural failure, safety requirements/measures

Unit – III (08 Hours)
Guidelines for operations of dams, Operations of typical embankment dam and concrete dam

Unit – IV (08 Hours)
Inspection guidelines of dams, inspection of embankment dam : the crest, the upstream slope, the downstream slope, the abutments, the downstream toe etc. inspection of concrete dam , inspection, of appurtenant works, spillway, outlets etc.

Unit – V (08 Hours)
Monitoring and surveillance of embankment dams : Task and purpose of monitoring, Monitoring of pore pressure, seepage, monitoring of displacements, measurements of stresses, seismic measurements , general principles on the selection and positioning layout of measuring instruments, Monitoring and surveillance of concrete dams : On monitoring, surveillance and instrumentation of concrete dams in general, Monitoring by precise survey methods, urveillance with embedded instruments

Unit VI (08 Hours)
Maintenance of embankment dam, maintenance of concrete dam, maintenance of appurtenant works, spillway, outlets etc.

Text Books / References
Ljubomir Tanchev, *St. Cyril and Methodius University, Skopje, Macedonia (Emeritus),* Dams and Appurtenant Hydraulic Structures, Taylor & Francis, 2005.
British Columbia, Dam Safety Guidelines Inspection and Maintenance of Dams, 2011.
Texas commission on Environmental Quality, Guidelines for operation and Maintenance of dams in Texas

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

11 : SELF STUDY PAPER I: APPLICATION OF REMOTE SENSING TO HYDRAULICS

TEACHING SCHEME
Lectures : 04 Hrs/Week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Credits : 4

Unit – I (08 Hours)

Principles of electromagnetic remote sensing, electromagnetic spectrum. aerial photography, satellite imagery.

Unit – II (08 Hours)

Infra red photography, temperature difference in water, aeromagnetic surveys at Low Altitude.

Unit – III (08 Hours)

Photographic techniques by aircrafts, satellites their principles & interpretation, aerial magnetic surveys a) subsurface rock structure b) flow of ground water.

Unit – IV (08 Hours)

Electrical conductance of rock, velocity of sound through different rocks , Electrical resistivity surveys.

Unit – V (08 Hours)

Preparation of maps on political land use, physiographic land gradient, methodology, geology of soil, hydrology and water shed , ground water potential, hydrogeology, agronomy, forestry, Civil engineering, A R. S. system classification a) Passive b) Active (A) Remote Sensing Characteristics i) Spatial resolution ii) Spectral resolution iii) Radiometric resolution iv) (B) Temporal resolution ,1D Extraction of information, fundamentals of Photogrammetric, Thermal infrared sensor (C) Side looking airborne radar (SLAR) (D) Land remote sensing satellite systems- satellites of different nations
their sensors, No. of bands.

Unit – VI (08 Hours)

Fundamental concepts in computer aided image classification, data preprocessing : radiometric correction, geometric correction, large classifications : soft x hard classifiers, Contextual x Neural networks Classifiers, integration of Remote Sensing & GIS – Separate but equal, Seamless integration, Total integration.

Text Books/References

Chor Pang Lo, Albert K. W. Yeung, Concepts & Techniques of geographic information system, Prentice Hall, 2002

Paul Longly, Geographic Information Systems and Science, John Wiley & Sons, 2005.

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

11 : SELF STUDY PAPER I : ENVIRONMENTAL IMPACT ASSESSMENT FOR WATER RESOURCES PROJECT

Unit – I (08 Hours)

Environmental Aspects of Water Resources Development, Rehabilitation of people affected by the project, submergence of the forest area, water logging and salinity in command areas, adverse effects on wild life ,water borne diseases, siltation of manmade reservoirs.

Unit – II **(**08 Hours)

Effect of dam construction on downstream river regime. Sediment transport, National water policy and recommendations for environmental monitoring of water resources projects.

Unit – III **(**08 Hours)

Environmental Impact Assessment methodology. Description of site and its Development description of present and projected conditions, assessment of probable impacts, compliance with regulations , review of alternatives.

Unit – IV **(**08 Hours)

Environmentally sound water resources management, Various Case studies, catchment area treatment, compensatory afforest ration, command area treatment , status of environmental monitoring of water resources development projects.

Unit – V **(**08 Hours)

Socio economic issues related to water resources project. Deforestation ,submergence of land, change in land use pattern, submergence of existing roads, construction of new approach roads, construction of new town ships and other infrastructure.

Unit – VI **(**08 Hours)

Environmental legislation in India with respect to water resources projects. Water-prevention and control of pollution act, wild life protection act, forest conservation act, environmental protection act.

Text Books/References

Government of India National water policy
Central water commission Guide lines for sustainable water resources development and management, 1992.
Central board of Irrigation and Power- Seminar on Environmental Management of Water Resources and Power Projects, 1995

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

11:SELF STUDY PAPER I– FLOODS AND FLOOD MANAGEMENT

TEACHING SCHEME
Lectures : 04 Hrs/Week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Credits : 4

Unit – I **(**08 Hours)

Introduction, Necessity, General information on flood damages at global level and in India. Various methods of flood estimation and models.

Unit – II **(**08 Hours)

Flood routing through channels , various method, with case studies.

Unit – III **(**08 Hours)

Flood Mitigation, Identification of floods and flood zones.

Unit – IV **(**08 Hours)

Flood control – Single & multipurpose reservoir , reservoir operation , rule curve, routing, zones of reservoir, structural and non structural measures.

Unit – V **(**08 Hours)

Special floods- Estimation , dam break, PMF, Application for damage evolution.

Unit – VI **(**08 Hours)

Aspects of flood management- identification of areas, extent & duration of flood, Environmental & Ecological aspects, economics of flood control project.

Text Books/References

"Flood & Flood control" Workshop proceedings at CWPRS Pune

"Flood forcasting & Warning" CWC guideline.

"Flood & Flood control" NIH Roorkey.

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

14 : SELF STUDY PAPER II : OFFSHORE STRUCTURES

TEACHING SCHEME
Lectures : 04 Hrs/Week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Credits : 4

Unit – I **(**08 Hours)

Types of ocean Structures,- Onshore / Offshore, Requirement of structures, its types/ classification- depth, function, design aspect.

Unit -II **(**08 Hours)

History of development of offshore structures, installation of platforms, development in Indian continental shelf in future, need for crude oil and availability

Unit -III **(**08 Hours)

Basic design criteria for drag/ lift forces, design principles for structural members , spacing, wave data and vibration analysis.

Unit -IV **(**08 Hours)

Additional facilities/ functions related for oil transportations, storage, transport, pumping from oil well to the refinery .

Unit -V **(**08 Hours)

Safety of offshore structures natural/ manmade ,accidental- case studies , factors affecting stability, design of pipe lines.

Unit -VI **(**08 Hours)

Environmental aspects- oil leakages, pollution, fire protection, extreme wave conditions-storm, Tsunami etc. Economic aspects in design, Installation, maintenance, and operations related to offshore structures

Text Books/References

Brunn Per, B. U. Naik, “Shore Protection Manual”, NIO Goa
Quinn A. D., “Port Planning”, McGraw Hill Book Co., New York
Richard Silvester, “ Coastal Engineering”’ Vol. I, II, University of western Australia.
Shore Protection Manual – 1984 and Coastal Protection Manual – 2002,
US Waterways Experiment Station, Corps of Engineer, Coastal Engineering research centre, Vicksburg , USA
Narasinhan and Kathiroli, “Harbor and Coastal Engineering”, Vol. I & II, Ocean and Coastal engineering Publication, NIOT, Chennai

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

14 : SELF STUDY PAPER II: URBAN WATER MANAGEMENT

TEACHING SCHEME
Lectures : 04 Hrs/Week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Credits : 4

Unit – I (08 Hours)

Drinking water qualities, potable limits, water softening processes, common impurities, alkalinity, acidity, Water purification, storage, treatment of waters, settling basins, slow sand filters, pressure and gravity filters

Unit – II (08 Hours)

Storage of water, service reservoirs, cisterns, elevated tanks, pressure equalizing Reservoirs, distribution of waters, demand of water for domestic and public purpose, wastage of water, prevention of leakages, different methods of distribution, design of distribution system, intermittent and constant system of supply

Unit – III (08 Hours)

Pipes of different metals, cement concrete pipes, Valves, meters taps

Unit – IV (08 Hours)

Pumping of water, suction and delivery pipes, water pumps, design of pumping stations

Unit – V (08 Hours)

Ground water and wells, water bearing strata, discharge from wells, tests of yields, depression head, cone of depression

Unit – IV (08 Hours)

Methods of boring, strainers, well lining

Text Books/References

Water supply and sanitary engineering by G. s Birdie and J. S. Birdie., Dhanpatrai Publications, 2006.

Water supply engineering by B. C. Punmia, Laxmi publications, 2009.

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

14 : SELF STUDY PAPER II : RIVER ENGINEERING

TEACHING SCHEME
Lectures : 04 Hrs/Week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Credits : 4

Unit – I **(**08 Hours)

Classification of Rivers: Based on different approach/criteria, River plan forms and their Characteristics, Development/variation of plan forms in meandering and migration, braiding, its characteristics and causes for their development.

Unit – II **(**08 Hours)

Rivers in equilibrium: Channel stability, regime relations and applications, Natural constraints and their effects on the river regime, Hydraulic structures and their effects in the river regime.

Unit – III (08 Hours)

Rivers in dynamics: Bed level changes, aggradation and degradation confluences and braiding, their causes and effects on river regime.

Unit – IV (08 Hours)

River flow control structures: weirs, barrages, intakes, bridges and diversion structures, design and operational concepts, river improvement methods.

Unit – V (08 Hours)

Rivers training works: Rivers training structures for weirs, barrages, intakes, bridges, diversion structures, hydraulic design and operational concepts, river improvement.

Unit – VI (08 Hours)

Rivers navigation: Advantages and disadvantages, hydraulic structures for river navigation, river dredging, necessity and effects.

Text Books/References

River mechanics, Pierre Y, Julian (2002), Cambridge University Press
Brown S. A. 1985a, “Design of spur – type, Stream stabilization structure, final report,” Federal highway administration.
Knighton, D., 1998, Fluvial forms and processes, Arnold, Baltimore.

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

14 : SELF STUDY PAPER II : PLANNING OF PORTS

TEACHING SCHEME
Lectures : 04 Hrs/Week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Credits : 4

Unit – I **(**08 Hours)

Port development requirement, world port development- Major, Minor Fisheries, Indian port service, General planning of port requirement, Roll of modeling in planning of port, present status of Indian port & future demands of next four decades

Unit -II **(**08 Hours)

Modern port facilities, roll of road / rail link with planning of ports, Automation in port development

Unit- III **(**08 Hours)

Analysis of case studies- evaluation , comments suggestions
Special purpose berths in ports- Container, oil, Car transport .

Unit -IV **(**08 Hours)

Port cost analysis and economics', maintenance of port structures, Modern trends- Roll of management techniques , skill in operation for safety purpose ,concept of GDP/GNP.

Unit -V **(**08 Hours)

Concept of mother port, outer to outer port, offshore port etc. SBM linked transport, efficacy of port-Transport ,cost per tonne, VLCC

Unit -VI **(**08 Hours)

Limiting factors for planning of ports-facilities, pollution, draft requirement, maintenance of port, measures for various aspects, development, National policy

Text Books/References

Quinn A. D., "Port Planning", McGraw Hill Book Co., New York.
Shore Protection Manual – 1984 and Coastal Protection Manual – 2002, US Waterways Experiment Station, Corps of Engineer, Coastal Engineering research centre, Vicksburg , USA
Narasinhan and Kathiroli, "Harbor and Coastal Engineering", Vol. I & II, Ocean and Coastal engineering Publication, NIOT, Chennai

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

14 : SELF STUDY PAPER II : SOIL CONSERVATION AND WATERSHED MANAGEMENT

TEACHING SCHEME
Lectures : 04 Hrs/Week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Credits : 4

Unit – I **(**08 Hours)

Watershed concept-Size , shape, physiographic , climate, drainage, land use, vegetation, geology and soils, hydrology , hydrogeology.

Unit – II **(**08 Hours)

Water Erosion- Mechanics of water erosion, types of erosion, estimation of water erosion losses, measurement of water erosion.

Unit – III **(**08 Hours)

Water erosion control- land classification for soil conservation, mechanical methods of water erosion control , biological methods of water erosion control.

Unit – IV **(**08 Hours)

Soil conservation in special problem areas – hilly areas, control of gullies, ravine reclamation, waterlogged and wetlands**.**

Unit – V **(**08 Hours)

Land use management practices in semiarid and arid zones –problems of soil and water Management in semi arid and arid zones of India, control measures.

Unit – VI **(**08 Hours)

Watershed Management- Planning for watershed management, measures for watershed management , land use planning, water harvesting and recycling ,socio economic aspects, recent trends in watershed management.

Text Books/References

Watershed Management-JVS Murthy, New Age International Publishers, 2009
Soil Erosion and conservation, R.P. Tripathy , H.P.Sing, New Age International Publishers, 2008

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

14 : SELF STUDY PAPER II : RESERVOIR SEDIMENTATION

TEACHING SCHEME
Lectures : 04 Hrs/Week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Credits : 4

Unit – I **(**08 Hours)

Introduction : Scope and significance of reservoir sedimentation, properties of sediments. Basic concepts of sedimentation, bed load, suspended load sediment inflow, sediment out flow, trap efficiency, retention time.

Unit – II **(**08 Hours)

Reservoir sedimentation process Settling of sediments, Density currents, pattern of reservoir sedimentation . Aggredation above dams, Degradation below dams, sources of sediments.

Unit – III **(**08 Hours)

Reservoir sedimentation Prediction , Factors affecting sedimentation, various methods of predicting sedimentation Empirical studies, Mathematical modeling.

Unit – IV **(**08 Hours)

Measurement of reservoir sedimentation , need for measurement , measurement of sediments in Rivers, streams etc. Measurements of suspended load, reservoir survey for sediments methods of measurements of sediments , sediments transport ,capacity survey, remote sensing techniques.

Unit – V **(**08 Hours)

Sedimentation of reservoirs in India case studies, control of reservoir sedimentation, soil conservation measures, vegetation land treatment measures to check inflow of sediments in to reservoirs. Removal of sediments from reservoir.

Unit – VI **(**08 Hours)

Estimate life of reservoir , different concepts and procedures practiced in USA, Japan, India.

Text Books/References

Reservoir sedimentation and control Central water Commission 1991,New Delhi.
Sedimentation of reservoirs-National Institute of Hydrology Dept. RN – 26-1985-86.
Life of reservoir – Technical report No.19. CBIP – New Delhi

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

14 : SELF STUDY PAPER II: TIDES AND TIDAL HYDRAULICS

TEACHING SCHEME
Lectures : 04 Hrs/Week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Credits : 4

Unit I

Definition of tide, Generation of tides, reasons for formation , Role of celestial bodies, Global tidal Phenomenon, Amphedormic point, Co-tidal lines, tidal constituents, coriolis force, Harmonic analysis, Hign water, low water, intertidal zones.

Unit II

Sidereal day ,Solar day, Lunar day, Declination of moon, Sidereal year, Lunar month, Apibelion, Peribelion , Apogee, Perigee, Force diagram for tide generation, if of lunar and earth axis

Unit III

Theories of tides, Tidal predictions, tidal inequality, types of tides, tidal duration, Amplitude, tidal variaties, spring tides, neap tides, Effects of tide, tidal scenario in India and world, Diurnal tides, mixed tides, semi-dia tides, shift of tides.

Unit IV

Different similitude's, similarities, Hydraulic models, tidal in Distortions in model, Reasons for distortions, Fixed bed and movable bed tidal models, Layout of tidal model, different instruments for tidal model studies, Automatic tide generator in model, inferances from tidal model studies.

Unit V

Definition of tidal inlet, different features, stability of tidal inlet, Hydraulic processes near tidal inlet, tidal prism, formulae for assessment of stability of tidal inlets, different types of tidal inlets, meaowees for stabilization of inlet effect of littoral drift, jarretts clarification, kenlegen's k, importance of tides in port and harbor operations.

Unit VI

Global tide ranges, range variation along Indian coast, different forms of unconventional/renewable energy their cheeris sources, tidal power, economies of tidal power, potential locations of tidal power plants around world and in India, single basin/double basin-single cycle/double cycle model of power generation, case study of existing/operating tidal power plants.

Text Books/References

Coastal Engineering Manual (CEM) USA corps of engineering
Ven Te Chow-Open Channel Hydraulics.
Jarrette M.A. : Stability of coastal inlets.
CWPRS Brochures on model Studies.
Indian institute of Ocean Technology : Coastal Manual Dr.Kathiroli, at Chennai.

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV

14 : SELF STUDY PAPER II : DAM BREAK ANALYSIS

TEACHING SCHEME
Lectures : 04 Hrs/Week

EXAMINATION SCHEME
Theory : 60 Marks
Duration : 03 Hours
Internal Assessment : 40 Marks
Credits : 4

Unit – I **(**08 Hours)
Introduction: Review of dams in India, Necessity of Dam Break Analysis

Unit – II **(**08 Hours)
Design criteria of Dams: Earth, Gravity, Arc Dams with likelihood of Exceedence

Unit – III **(**08 Hours)
Types of Failures : Type of dam, Structural, Purpose, Parameters of Failure

Unit – IV **(**08 Hours)
Aspects in Dam Break Analysis : Economic, Managerial, Social, Environmental

Unit – V **(**08 Hours)
Hydraulics of Dam Break Analysis : St. Venant's equations - forms, methods of Solution Simulation Models – DAMBRK, FLDWAV, MIKE 11, HECRAS

Unit – VI **(**08 Hours)
Case Study, Review of Literature, Data Collection and Compilation.

Text Books/References

F M Henderson "Open Channel Flow", Macmillan Publishing Co, NY
Ven Te Chow " Open Channel Hydraulics", McGraw Hill Book Co. NY
Rouse H "Engineering Hydraulics", John Wiley & Sons, Inc.
Streeter V L and Wylie E B "Hydraulic Transients", McGraw Hill Book Co. NY
"HEC-RAS 4.1 : River Analysis System", US Army Corps Of Engineers, Hydrologic Engineering Centre, 'Hydraulic Reference Manual', CPD – 69, January 2010
"HEC-RAS 4.1 : River Analysis System", US Army Corps Of Engineers, Hydrologic Engineering Centre, 'User's Manual', CPD – 68, January 2010
"HEC-RAS 4.1 : River Analysis System", US Army Corps Of Engineers, Hydrologic Engineering Centre, 'Applications Guide', CPD – 70, January 2010

Syllabus for Unit Test

Unit Test 1	Units I, II & III
Unit Test 2	Units IV, V & IV