IPS Academy, Institute of Engineering & Science

(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)

Scheme & Syllabus

Civil Engineering Department

(U.G.NBA Accredited up to June 2023)

Bachelor of Technology (B.Tech.)

Honors Certification in Water Resources & Flood-Risk Management

(To be offered to students of Civil Engineering Department)

S.No.	Semester	Subject Code	Subject Name	Contact Hours perweek			Total Credits
				L	T	P	
1	V	HOCE-WR-501	Groundwater Management	3	1	-	4
2	VI	HOCE-WR-601	Flow Diversion Structures & Design	3	1	-	4
3	VII	HOCE-WR-701	Advanced Water Management	2	1	-	3
4	VIII	HOCE-WR-801	Flood Analysis & Risk Management	3	1	-	4
Total				**11**	**4**	**-**	**15**
Total Academic Engagement and Credits				**15**			**15**

* L : Lecture, T: Tutorial, P:Practical

HOCE-WR-501	Groundwater Management	3L : 1T : 0P (4 hrs.)	4 credits

Course Objective:

The objective of this course is to understand groundwater resources and their optimal use.

Course Contents: (40 hrs.)

Module 1: **(08 hrs)**

Ground Water Resources: Confined and unconfined aquifers, aquifer properties, Ground water rechargenecessity and methods of improving ground water storage. Water logging-causes, effects and its prevention. Salt efflorescence causes and effects. Characteristic of ground water, Reclamation of water logged and salt affected lands. Role of groundwater in water resources system and their management,

Module 2: **(08 hrs)**

Well Hydraulics: Hydraulics of wells under steady flow conditions, infiltration galleries. Types of wells, well construction, yield tests, specific capacity and specific yield, advantages and disadvantages of well irrigation.

Module 3: **(08 hrs)**

Ground Water Management: Need for Management Model – Database for groundwater management –groundwater balance study – Introduction to Mathematical model – Conjunctive use – Collector well and Infiltration gallery

Module 4: **(08 hrs)**

Groundwater Transport Process: Hydrodynamic dispersion - occurrence of dispersion phenomena, coefficient of dispersion - Aquifer advection dispersion equation and parameters - initial and boundary conditions - method of solutions, solution of advection dispersion equation.

Module 5: **(08 hrs)**

Ground water Survey and Water Quality: Geophysical survey of ground water - Surface Geophysical techniques- electric logging & radioactive logging Method. Ground water quality - Factors affecting ground water quality. Water quality requirements, Groundwater quality degradation, Reasons of groundwater quality degradation.

Course Outcomes

CO 1. To understand the ground water properties, recharging, improvement and reclamation.

CO 2. To illustrate the hydraulics, construction and tests of well efflorescence.

CO 3. To illustrate the mathematical model, management and conjunctive use.

CO 4. To realize the process of ground water transportation

CO 5. To understand the modern techniques of water survey and its quality assessment.

List of Text / Reference Books

1. Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi, 2010.

2. Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York, 2000.

3. Engg. Hydrology by K. Subhramanya - Tata Mc Graw Hills Publ. Co.

4. Engg. Hydrology - J.NEMEC - Prentice Hall

5. Hydrology for Engineers Linsley, Kohler, Paulnus - Tata Mc.Graw Hill. 6. Engg. Hydrology by H.M. Raghunath

HOCE-WR-601	Flow Diversion Structures & Design	3L : 1T : 0P (4 hrs.)	4 credits

Course Objective:

To provide knowledge of various structures for flow diversion & canal regulation and also how to design them.

Course Contents: (40 hrs.)

Module 1: (08 hrs)

Introduction: Diversion scheme and their components, water distribution network, components of network Introduction to various structures provided in a distribution network.

Canals: Design of canals, Kennedy's and Lacey's Theory of Channel Design, Design of Stable Channels considering concepts of sediment transport, Design of Lined Channels.

Module 2: (08 hrs)

Structures On Pervious Formations: Introduction, Bligh's Creep Theory, Lane's Weighted Creep Theory, Potential Flow. Theory, Properties of Flow Net, Plotting of Flow Net, Khosla's Theory of Independent variables, Seepage Force and Safety against piping

Hydraulic Jump Phenomenon: Critical Flow, Normal and Sequent Depths, Critical Depth, Forms of Hydraulic Jump, Plotting of Pre-jump and Post jump Profiles, Energy Dissipation in Jump Formation.

Module 3: (08 hrs)

Canal Head Works: Weirs and Barrages, Distinction, Types of Weirs, Layout of Diversion Headwork, Design of Vertical Drop Weir, Concrete Weir, Design of Barrage, Effect of Construction of a Headwork on the River Regime, Design of Head Regulator as Intake at the Headwork site, Design of Wing walls.

Module 4: (08 hrs)

Canal Regulation Structures: Necessity of Functions and Regulation Structures like Head and Cross Regulators, Canal Falls, C.D. Works, Outlets etc. Type of Falls, C.D. Work and Outlets, Design of Junction (HR & CR), Design of Sharda Type Fall, Glacis Fall, Baffle Fall.

Module 5: **(08 hrs)**

Cross Drainage Works: Introduction to Transitions, Contracting Transitions, Expanding Transitions, Mitra's and Chaturvedi's Approach for Design of Transition, Hind's Transitions. Design of Aqueduct, Syphon Aqueduct, Super passage, Canal Syphon. Sediment Control and Exclusion at Headworks, Sediment Excluder & Ejector, Design of Sediment Excluder, Design of Sediment Ejector. Outlet works, Design of Sluice, Escapes.

Course Outcomes:

CO1. To understand the various organs of a diversion scheme and fundamental theories of it.
CO2. To understand the design of structures on pervious soil and basics of energy dissipation.
CO3. To estimate & design the structures for head & discharge regulation in canals.
CO4. To estimate & design the structures for regulating and safe working of canals.
CO5. To understand and design various types of cross drainage works for canal-stream junction.

List of Text / Reference Books

1. Theory & Design of Irrigation Structures Vol. II by Varshnay Gupta & Gupta.
2. Irrigation & Water Power Engg. By Punmia and Lal.
3. Irrigation & Hydraulic Structure by S.K. Garg.

HOCE-WR-701	Advanced Water Management	2L : 1T : 0P (3 hrs.)	3 credits

Course Objective:

To expose the students to various techniques used for on field management of water and irrigation scheduling & application.

Course Contents: (40 hrs.)

Module 1 **(08 hrs.)**

Introduction to Water Use: General, Surface Water Sources, Ground Water Sources, Need for Planned Utilization of Water Resources, Economics of Water Resources Utilization. Irrigation requirement: Soil Water Plant Atmospheric relationship, Irrigation Efficiency, Water Requirements of Field Crops, Evapo-transpiration, Effective Rainfall, Field Capacity and its determination, Wilting Coefficient, Crop Planning, Cropping Pattern, Criteria for Irrigation Scheduling.

Module 2 **(08 hrs.)**

On Farm Development: Introduction, On Farm Development, Land Consolidation, Water Courses Pipe System, Field Drains, Land Grading and Field Layout, Maintenance of Water Courses. Planning for Release of Water in Conveyance System, Methods of Water Measurement, Weirs, Parshall Flumes, Orifices and Metergates, Tracer Method, Measurement within outlet command.

Module 3 **(08 hrs.)**

Irrigation Scheduling: Delivery Systems, Delivery by Rotation, Continuous Supply, Rotation Planning, Operation of Canals and Branches, Night Irrigation, Improvement in Irrigation Efficiencies, Diversion Scheme.

Module 4 **(08 hrs.)**

Water Application Methods: Evaluation of Basic Variables and Efficiencies in Irrigation Methods, Border Irrigation, Check Basin Irrigation, Furrow Irrigation, Sprinkler Irrigation, Drip Irrigation, Sub-Surface Method.

Drainage: Introduction, Surface, Sub-Surface and Vertical Drainage, Conjunctive use of Ground and Surface Water.

Module 5 **(08 hrs.)**

Advanced Irrigation Technology: Application of remote sensing & GIS in irrigation, remote sensing & GIS techniques for assessing irrigation performance, Estimation of irrigated area and cropping pattern, land and water productivity, modeling and mapping flood-prone zones.

Course Outcomes:

CO1. To understand fundamentals of irrigation requirement and soil-water-crop relationship.

CO2. To understand the steps of on-farm development and water release techniques.

CO3. To understand the need & importance of irrigation scheduling along with its processes.

CO4. To evaluate the advantages and limitations of different types of irrigation techniques.

CO5. To understand the role of remote sensing & GIS in increasing agricultural performance.

Reference Books:

1. Irrigation & Water Power Engg. by Punmia & Pandey B.B.Lal
2. Engg. Hydrology by K. Subhramanya - Tata Mc Graw Hills Publ. Co.
3. Engg. Hydrology - J.NEMEC - Prentice Hall
4. Hydrology for Engineers Linsley, Kohler, Paulnus - Tata Mc.Graw Hill.
5. Hydrology & Flood Control by Santosh Kumar - Khanna Publishers

HOCE-WR-801	Flood Analysis And Risk Management	3L : 1T : 0P (4 hrs.)	4 credits

Course Objective:

To make students aware with concepts of flood occurrence & flood estimation and to assess the risk involved and techniques of flood control & risk mitigation.

Course Contents: (40hrs.)

Module 1 **(08 hrs.)**

Precipation Analysis: Types of Precipitations, Extreme events, Depth Area Relations, D.A.D. Analysis, maximization of Storm, Intensity Duration-Frequency Relationship, Probable Maximum Precipitation, Probable Maximum Maximum storm, Critical strom sequences for estimation of Design Flood Hydrograph.

Module 2 **(08 hrs.)**

Stremflow Measurement: Introduction, Measurement of Stage, Measurement of Streamflow, Area Velocity Method, Dilution Technique, Indirect Methods, Rating Curve and its Extension, Hydrometry Stations.

Runoff: Runoff Characteristics of Streams, Yields, Dependable Yield, Rainfall-Runoff Correlation, Watershed Simulation, Flow-Duration Curve.

Module 3 **(08 hrs.)**

Design Flood: Definition, Peak Flood Determination Methods, Rational Method, Empirical Formula, Unit Hydrograph Approach using PMS, Flood Frequency Studies, Frequency Factors, Gumbel's Method, Log Pearson Type III Method, Power Transformation Method.

Module 4 **(08 hrs.)**

Flood Routing: Reservoir Routing, Modified Puls Method: Channel Routing, Hydraulic and Hydrologic Routing, Saint Venant's Equation, Kinematic Wave Routng, Muskingham Method, Modified Muskingham Method, Muskingham Cunge Method, Variable Coefficient Method.

Module 5 **(08 hrs.)**

Risk Assessment And Control Measures: Extreme events, Return Period, Probability of exceedance, risk analysis, flood mapping & simulation models. Use of GIS, Flood modeling and control mechanisms.

Course Outcomes:

CO1. To understand fundamentals of precipitation analysis and flood hydrographs.

CO2. To understand the steps measurement of flow and extreme events.

CO3. To understand the concept of design flood and frequency analysis.

CO4. To understand the techniques of flood routing and flood management.

CO5. To understand the role of risk assessment in disaster management.

Reference Books:

1. Engg. Hydrology by Subramanya

2. Hydrology by K.N. Mutreja

3. Hydrology by Jaya Remi Raddy

4. NIH handbooks