Program :	**Diploma in Civil Engineering**
Course Code : **4012**	Course Title: **Hydraulics and Irrigation Engineering**
Semester : **4**	Credits: **4**
Course Category: **Program Core**	
Periods per week: **4 (L:3, T:1, P:0)**	Periods per semester: **60**

Course Objectives:

- To learn the Fluid properties and fundamentals of Fluid statics and fluid flow
- To introduce the concepts of flow measurements and flow through pipes
- To describe the layout of hydroelectric power plant
- To summarize basic methods of irrigation and compute water requirement of crops.
- To introduce the purposes of various hydraulic structures.

Course Prerequisites:

Topic	Course code	Course name	Semester
Elementary Mathematics		Engineering Mathematics	1
Basic concepts of Engineering Mechanics		Engineering Mechanics	2

Course Outcomes:

COn	Description	Duration (Hours)	Cognitive level
CO1	Compute the parameters associated with fluid flow and hydrostatic pressure	15	Applying
CO2	Explain the flow through pipes and open channels and describe the layout of hydroelectric power station	14	Applying
CO3	Compute water demand of crops and classify irrigation projects	14	Applying
CO4	Outline major and minor irrigation structures	15	Understanding
	Series Test	2	

CO – PO Mapping:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3						
CO2	3						
CO3	3						
CO4							

3-Strongly mapped, 2-Moderately mapped,   1-Weakly mapped

Course Outline:

On completion of the course, the student will be able to:

Module Outcomes	Description	Duration (Hours)	Cognitive Level
CO1	**Compute the parameters associated with fluid flow and hydrostatic pressure**		
M1.01	Define the various physical properties of fluid	4	Remembering
M1.02	Illustrate various types of fluid pressure and outline the use of various fluid pressure measuring devices	4	Understanding
M1.03	Determine total pressure and locate Centre of pressure	4	Applying
M1.04	Illustrate the fluid flow parameters and Bernoulli's theorem.	3	Applying

Contents:

Fluid, fluid mechanics, hydraulics, hydrostatics and hydrodynamics - ideal and real fluid, application of hydraulics. Physical properties of fluid - density-specific volume, specific gravity, surface tension, capillarity, viscosity.

Various types of pressure - Atmospheric Pressure, Gauge Pressure, Absolute Pressure, Vacuum Pressure. Concept of Pressure head and its unit, Pascal's law of fluid pressure.

Pressure measuring devices - piezometer tubes, manometers - U-tube - simple, differential and inverted tubes only - Mechanical Gauges - Bourdon's tube pressure gauge (Brief description with sketch).

Pressure on a plane surface immersed in liquid. Total pressure and center of pressure on horizontal, vertical and inclined surfaces immersed in liquids.

Types of flow - Gravity and pressure flow, Laminar, Turbulent, Uniform, Non uniform, Steady, Unsteady flow (Definitions only). Reynolds number. Discharge and its unit, continuity equation of flow. Energy of flowing liquid: potential, kinetic and pressure energy. Bernoulli's theorem: statement, assumptions, equation.

CO2	**Explain the flow through pipes and open channels and to describe the layout of hydroelectric power station**		
M2.01	Demonstrate various discharge measuring devices.	3	Understanding
M2.02	Explain flow through pipes	4	Understanding
M2.03	Demonstrate geometrical properties and most economical section of open Channel	4	Applying
M2.04	Outline layout of a hydroelectric Installation and discuss about types of pumps and turbines.	3	Understanding
	Series Test – I	1	

Contents:

Discharge measuring devices - Venturi meter, orifice and mouthpieces, notches and weirs.

Venturi meter - working and simple problems. Orifices - (definition and uses only). Notches (simple problems only) -weirs (definition only)

Flow through pipes - Major head loss in pipe- Frictional loss and its computation by Darcy - Weisbach equation, Minor losses in pipe: loss at entrance, exit, sudden contraction, sudden enlargement and fittings. (Definition only). Hydraulic gradient line and total energy line. (Definition only). Water hammer in pipes.

Flow through Open Channel - Geometrical properties of channel section: Wetted area, wetted perimeter, hydraulic radius for rectangular and trapezoidal channel section. Determination of discharge by Chezy's equation and Manning's equation. Conditions for most economical rectangular and trapezoidal channel section. Velocity measurement devices: current meter, floats and Pitot's tube.

Hydroelectric Installation Layout - intake works, pressure tunnel, penstock, surge tank, anchor blocks and tail race

Turbine - (description only)-Impulse turbines - Pelton wheel, Reaction turbines- Francis and Kaplan turbines

Hydraulic Pumps (description only) - Concept of pump, Types of pump – centrifugal and reciprocating.

CO3	**Compute water demand of crops and classify irrigation projects**		
M3.01	Classify Irrigation.	3	Understanding
M3.02	Compute water requirement of crops	4	Applying
M3.03	Classify irrigation projects	3	Understanding
M3.04	Classify canals and design most economical section	4	Applying

Contents:

Irrigation and its classification. Crop Water requirement: Cropping seasons, Cropping Calendar (Kerala), Crop period, base period, Duty, Delta, Command area, intensity of irrigation, factors affecting duty, Simple problems on duty.

Classification of irrigation projects-Major, Medium and Minor schemes (Definition only)

Canals - Classification according to alignment and position in the canal network, Cross section of canal in embankment and cutting, partial embankment and cutting, balancing depth. Design of most economical canal section.

Canal lining - Purpose, material used and its properties, advantages.

CO4	Outline major and minor irrigation structures		
M4.01	Summarize different types of Irrigation structures	3	Understanding
M4.02	Illustrate various storage head works	4	Understanding
M4.03	Illustrate various diversion head works	4	Understanding
M4.04	Explain different types of Cross Drainage works	4	Understanding
	Series Test – II	1	

Contents:

Irrigation structures - classification of head works - storage and diversion head works - their suitability under different conditions.

Storage Headworks: Dams and its classification: Earthen dams and Gravity dams (masonry and concrete). Earthen Dams and spillway - Components with function, typical cross section. Gravity Dams - typical cross section, drainage gallery.

Spillways-Definition, function, location, Energy dissipaters.

Diversion head works - Layout, components and their function.

Weirs - components, parts, types

Barrages - components and their functions. Difference between weir and Barrage.

Canal regulators - Head regulator, Cross regulator, Escape, Falls and Outlets (Brief description only)

Cross Drainage works - Aqueduct, siphon aqueduct, super passage, level crossing (Brief description only)

Text / Reference:

T/R	Book Title/Author
T1	Dr. R.K.Bansal : Fluid Mechanics & Hydraulic Machine ; Laxmi Publishers
R1	R.S.Khurmi : Hydraulics, Fluid Mechanics & Hydraulic Machines; S. Chand & Co.
R2	Modi &Sethi : Hydraulics & Hydraulic Machines ; Standard Publishers
R3	R.K.Rajput : Hydraulics ; S.Chand& Co.
R4	Jagdish lal : Hydraulics; Dhanpat Rai & Sons
R5	B.C. Punmia : Irrigation Engineering ; Laxmi Publishing Co:
R6	Modi &Sethi : Irrigation Engineering ; Standard Publishing House
R7	S.K.Garg : Irrigation Engineering ; Khanna Publishers.
R8	B S Birdie : Irrigation Engineering & Water Power Engg ; Standard Publishing House
R9	N.N. Basak : Irrigation Engineering ; McGraw Hill Publishing
R10	Dr. R.K.Bansal : Fluid Mechanics & Hydraulic Machine ; Laxmi Publishers

Online Resources:

Sl.No	Website Link
1	https://nptel.ac.in/
2	http://egyankosh.ac.in/ https://www.coursera.org › learn › construction-cost-estimating
3	https://swayam.gov.in/