Course Syllabus
Gyanmanjari Institute of Technology
Semester-4

Subject: Fluid Mechanics - BETCV14309

Type of course: Major core

Prerequisite: System of units, Laws of motion, Basic idea of force, Concept of centroid

Rationale:

To develop a basic understanding about the properties of fluids, their behavior under static and dynamic conditions. To enable the students to apply the basic principles of FluidMechanics to solve real life problems

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	0	2	5	60	30	10	20	30	150

Legends: CI-ClassRoom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Sr. No	Course Content	Hrs.	% Weightage
1	**Fluids And Their Properties & Fluid Pressure** Introduction, Scope and application of fluid mechanics, Physical properties of fluids, Newton's Law of Viscosity, Shear stress in a moving fluid, Classification of fluids, Hypothesis of continuum, Control volume concept.Pressure, Pascal's law of pressure at a	08	15%

	point, Equality of pressure at the same level in a static fluid, Pressure density height relationship & Measurement, General equation for the variation of pressure due to gravity from a point to point in astatic fluid, Hydrostatic paradox, pressure measuring equipment, Hydrostatic Forces on Surface, moment of inertial of geometric shapes. Buoyancy, Meta-centre and Meta-centric height,determination of the meta-centric height, Stability of floating bodies.		
2	**Fundamental Of Fluid Flow** Introduction, Fluid flow, Types of flow, Analyzing fluid flow, Motion of a fluid particle, path lines and streak lines,Stream lines, Stream Tube, Acceleration of a fluid particle,Continuity of flow, Continuity Equation in 1-D and 3-D,Continuity equations for 2-D and 3-D flow in Cartesian coordinates of system, Velocity potential and potential flow,Discharge and mean velocity, Streamlines and the Stream functions, Rotational and Irrotational flow, Circulation and Vorticity, Potential for uniform flow, vortex flow, Relationbetween stream function and velocity potential, Concept andApplication of Flow Net.	12	20%
3	**Fluid Kinetics and Its Application & Notch & Weirs** Introduction, Energy of a liquid in motion, H.G.L. andT.G.L., Forces acting on fluid in motion, hydraulic coefficient, Determine the hydraulic coefficient in the laboratory, Euler's equation of motion along a stream line,Mechanical energy of a flowing fluid, Derivation ofBernoulli's Equation from Newton's 2nd Law, Modified form of Bernoulli's Equation, Application of Bernoulli's Equation,Kinetic energy correction factor, Measurement devices of discharge, Measurement devices of velocity, Vortex motion.Momentum and fluid flow, Impulse momentum equation, Momentum equation for 2-D flow along a stream line momentum correction factor.Introduction, Deference between notch and weir, Classification of notch, Classification of weir	10	15%
4	**Flow Through Pipes:** Introduction, Laminar Flow and Turbulent Flow, Types of fluid equations, Energy of a liquid in motion, H.G.L. and T.G.L., Reynolds experiment, Classification of Flows based on Reynolds Number, Equation for head loss in pipes due to major losses, Equation for head loss in pipes due to minor losses, pipes in series, pipes in parallel, Water hammer in pipes, syphon, power transmission through pipe. Introduction, Flow of viscous fluid through circular pipe Hagen Poiseuille formula, Flow of viscous fluid between two parallel fixed plates, Flow of viscous fluid between two parallel relative motion plates, Power absorbed in viscous flow through – journal, Foot step and collar bearing, three	15	25%

	reservoir problemsCharacteristics of turbulent, Temporal mean velocity, Scale of turbulence and intensity of turbulence, FlowInstantaneous velocity, Shear stress and velocity distribution in turbulent Flow through pipes, Resistance of smooth and rough pipes, Moody's Diagram.		
5	**Open Channel Flow & Dimensional and Similitude** Introduction, Difference between pipe flow and channel flow,Types of flow in channels, Basic concept of open channel flow, Geometrical properties of channel Section, Velocity distribution in a channel section.Steady uniform flow, specific energy diagram, Velocity distribution, and most economical channel section.Introduction, Hydraulic jump, Location of hydraulic jump,type of Hydraulic jump, Examples of occurrence of HydraulicJump, Difference between Pumps and turbine, type of pumps,type of turbines.Introduction, Dimension reasoning, Dimensional homogeneity,Important dimensionless parameters, dimensional analysis using Rayleigh's method, Dimensional analysis usingBuckingham's theorem, Model studies Similitude Model laws,Geometric similarity, Dynamic similarity, Kinematic similarity, use of dimensionless, Numbers in experimental investigation, Model testing, Types of models, Undistorted and distorted models	15	25%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Create model for the most economical and eco-friendly channel section design:** Students will study open channel design in groups, using a variety of research methodologies. Open channel design can help you locate the most economical and eco-friendly channel section design. Students will be encouraged to collaborate in groups (of at least five) to create models based on Various Shapes of Open Channels design concepts and research results. Create a short video and post it to the GMIU website.	10
2	**Visit to Hydraulic Structure:** Faculty will suggest to students an industrial visit regarding hydraulic structures like dams, canals, water tanks, etc., in the local area. Student will prepare the report and upload it on GMIU Web Portal.	10
3	**Virtual lab practical:** Student will learn the laboratory practical of Orifices Experiment on virtual lab. Student will take the reading and prepare experimental report and upload it on GMIU Web Portal.	10
	Total	30

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage %	20%	20%	20%	20%	10%	10%

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

Course Outcome:

After learning the course, the students should be able to:	
CO1	Analyze forces on floating bodies and understand fluids in relative equilibrium
CO2	Calibrate and demonstrate fluid flow measuring devices like venturimeter, notches, orifice, mouthpieces. orificemeter,
CO3	Analyze fluid flow through pipes in series, parallel and pipe networks under laminar and turbulent flow conditions
CO4	Analyze open channel flow and design optimal sections; calculate forces on sluice gates considering specific energy and momentum principle
CO5	Carry out model studies for fluid flow problems

List of Practical

Sr.No	Descriptions	Unit No	Hrs
01	Determination of Viscosity	01	02
02	Study of Pressure Measuring Devices	02	02
03	Determination of hydrostatic force and its location on a vertically immersed surface	02	02
04	To determine metacentric height by metacentric height apparatus	02	02
05	Verification of Bernoulli's theorem	04	02
06	To measure the velocity of flow using orifice meter and venturimeter. OR Determination of Cd of	04	02

	Venturimeter and orifice meter		
07	To determine the coefficient of discharge through open channel flow over a notch. OR Determination of Cd of Notch	04	02
08	To determine the different types of flow patterns by Reynolds' experiment	05	02
09	To determine the friction factor for the different pipes.	05	04
10	Determination of loss coefficients for various types of pipe fittings	05	02
11	Study of Laminar flow Using Heleshaw's	05	04
12	Uniform flow in open channel	06	02
13	Similitude and Model Studies	07	02

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory.

The internal evaluation will be done on the basis of Active Learning Assignment.

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

[1] Engineering Fluid Mechanics, Grade R. J. and Mirajgaonkar, Scitech Publication
[2] Fluid Mechanics R.K. Rajput. S Chand Publications
[3] Fluid Mechanics, Modi P.N. and Seth S.M, Standard Book House
[4] Fluid Mechanics, Streeter, V.L., Wylie E. B. and Bedford, K.W, McGraw Hill