3140611 Fluid Mechanics and Hydraulics

SEMESTER: 4

CIVIL ENGINEERING DEPARTMENT

GOVERNMENT ENGINEERING

COLLEGE DAHOD

Academic Year: 2024-25

:: VISION STATEMENT OF THE INSTITUTE ::

To be a value-based engineering institute to disseminate globally acceptable educationandnurturing research, innovation and entrepreneurship.

:: MISSION STATEMENTS OF THE INSTITUTE ::

1. To provide quality education in the engineering disciplines through creative balanceofacademics and extracurricular programs.

2. To provide learning environment for innovation and entrepreneurship.

3. To disseminate ethical values, social values and sensitivity towardsenvironmental issues.

:: VISION STATEMENT OF THE CIVIL ENGINEERING DEPARTMENT ::

To be a recognized department in the field of civil engineering education to produceprofessional civil engineers, innovators and entrepreneurs for the development of the society.

:: MISSION STATEMENTS OF THE CIVIL ENGINEERING DEPARTMENT ::

1. To provide quality education to civil engineering undergraduates through creative balance of academic, professional and extra-curricular activities.

2. To impart knowledge in the field of civil engineering for the development of infrastructure facilities with environmental concern for betterment of the society.

3. To contribute in the nation's development through innovative ideas in the fieldof civil engineering.

:: PROGRAM OUTCOMES (POs) ::

Program Outcomes (POs) as identified by National Board of Accreditation (NBA), India are the attributes that the students are expected to attain at the point of graduation. Following are the POs of B.E Civil Engineering program:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using firstprinciples of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

:: PROGRAM SPECIFIC OUTCOMES (PSOs) ::

Program Specific Outcomes (PSOs) are what the graduates of a specific undergraduateengineering program should be able to do at the time of graduation.

Civil Engineering Graduates shall have

PSO 1: Ability to analyze, design and rehabilitate the infrastructural projects of civilengineering.

PSO 2: Ability to use advanced civil equipment, software, techniques and work seamlessly inteams.

PSO 3: Ability to apply gained knowledge to choose from the innovative career paths, to bean entrepreneur, and a zest for higher studies.

:: PROGRAMME EDUCATION OBJECTIVES (PEOs) ::

Program Educational Objectives (PEOs) describe the career and professional accomplishments that programs are preparing graduates to attain within a few years (3-5 years) of graduation.

Following are the PEOs of B.E Civil Engineering Program:

1. Establish themselves as civil engineering professionals in government, public andprivate sectors
2. Manage infrastructural and sanitary facilities
3. Solve real world problems environmental concerns to serve society
4. Adapt to changing trends in analysis and design of civil engineering structures.
5. To do testing, survey and planning of civil engineering structures using modern tools

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	Tutorial- I ***Properties of Fluids***	
	Answer the following	**Mapped With**
1	Differentiate between Mass density and specific weight.	CO1
2	Define specific gravity, specific volume and vapour pressure.	CO1
3	Differentiate between elasticity and compressibility.	CO1
4	Define and explain surface tension and capillarity.	CO1
5	State and prove Newton's Law of Viscosity.	CO1
6	Write a note on different types of fluids.	CO1
7	What is viscosity and its types.	CO1

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	Tutorial- II ***Fluid Statics, Pressure measurement and Floating bodies***	
	Answer the following	**Mapped With**
1	Enlist different fluid pressure measuring apparatus/ instrument.	CO1
2	State and prove Pascal's Law	CO1
3	State and derive Hydrostatic Law.	CO1
4	Differentiate among different types of pressure.	CO1
5	Differentiate between U-tube manometer, Inverted U-tube manometer.	CO1
6	Write a note on total pressure and centre of pressure.	CO1
7	State Archimedes principle.	CO1
8	State the stability conditions for submerged fluid flow.	CO1
9	What is Meta centric height? Derive analytical equation of metacentric height.	CO1

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	Tutorial- III ***Fluid Kinematics and Fluid Dynamics***	
	Answer the following	**Mapped With**
1	Define Streamlines, Path lines, Streak lines and Stream tubes.	CO1
2	Enlist different types of fluid flow.	CO1
3	Differentiate steady-unsteady and uniform-non uniform flow.	CO1
4	Differentiate between rotational and irrotational flow	CO1
5	Compare Laminar and Turbulent flow for pipes and open channel flow	CO1, CO3 & CO4
6	Write a note on Subcritical, critical and Supercritical flow	CO1
7	Explain Velocity Potential function and streamline function.	CO1
8	Derive the Euler's Equation of Motion.	CO1
9	State Bernoull's Theorum. Explain its significance with applications.	CO1

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	Tutorial- IV ***Flow Measuring Devices***	
	Answer the following	**Mapped With**
1	Define Venturimeter, orificemeter, rotameter and nozzlemeter.	CO2, CO3
2	What is Pitot tube?	CO2, CO3
3	What is Orifice? What are the different hydraulic coefficients associated with orifice.	CO2, CO3
4	Differentiate between orifice and mouthpiece.	CO2, CO3
5	Enlist different types of Mouthpiece.	CO2, CO3
6	Differentiate between Notches and Weirs.	CO2, CO3
7	Define velocity of Approach.	CO2, CO3

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Tutorial- V ***Flow Through Pipes***		
	Answer the following	**Mapped With**
1	Write the continuity equation of motion.	CO2, CO3
2	Derive the energy-momentum equation.	CO2, CO3
3	Enlist various major and minor losses in pipes.	CO2, CO3
4	What is Total Energy Line (T.E.L.) and Hydraulic Grade Line (H.G.L.)	CO2, CO3
5	Discuss Hardy Cross method to analyze pipe networks.	CO2, CO3
6	Derive the Hagen Poiseuille equation.	CO2, CO3
7	What is Prandtl's mixing length?	CO2, CO3
8	Differentiate among smooth and rough boundaries.	CO2, CO3
9	Explain the water hammer phenomenon in pipe flow.	CO2, CO3

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Tutorial- VI ***Open Channel Flow***		
	Answer the following	**Mapped With**
1	Differentiate between pipe flow and open channel flow.	CO2, CO3 & CO4
2	Classify open channel flow.	CO4
3	Sketch and detail the shape of Optimum cross section for uniform flow for rectangular, triangular and trapezoidal section.	CO3 & CO4
4	Write down the Chezy's eauation and Manning's equation.	CO3 & CO4
5	Calculate the discharge in an open channel having Chezy's constant C = 60, Channel dimensions for rectangular channel depth as 2 m and width as 3.5 m with channel slope as 0.010 and Mannings constant as 0.0035.	CO3 & CO4
6	What is Specific Energy. Derive the specific energy equation.	CO3 & CO4
7	Write the equation of gradually varied flow.	CO3 & CO4
8	Discuss direct step method.	CO3 & CO4
9	Write down the detailed equation of rapidly varied flow.	CO3 & CO4

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Tutorial- VII

Open Channel Flow

	Answer the following	**Mapped With**
1	What is Dimensional Homogeneity.	CO5
2	State and Explain the theorems associated with dimensional analysis.	CO5
3	Enlist the criteria of determining dimensionless parameters.	CO5
4	What is Model similitude?	CO5
5	What is Specific Energy. Derive the specific energy equation.	CO5
6	Differentiate among geometric, kinematic and dynamic similarity.	CO5

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Pick up the Most appropriate answer:

1	What is fluid Mechanics? Study of fluid behavior_____			
	A	At rest	B	At Motion
	C	At rest and Motion	D	All of Above
2	Which of the following is the basic principle in fluid mechanics			
	A	Momentum Principle	B	Energy Equation
	C	Continuity equation	D	All of the above
3	If a person studies about a fluid which is at rest, what will you call his domain of study?			
	A	Fluid Dynamics	B	Fluid Mechanics
	C	Fluid Statics	D	Fluid Kinematics
4	Which of the following method is used exclusively in fluid mechanics?			
	A	Eulerian method	B	Lagrangian method
	C	Neither Lagrangian nor Eulerian method	D	Both Lagrangian and Eulerian methods
5	When is a fluid called turbulent?			
	A	High viscosity of fluid	B	Reynolds number is greater than 2000
	C	Reynolds number is greater than 2000	D	The density of the fluid is low
6	Stagnation point is the point in fluid mechanics where the velocity of the fluid at that point is ___			
	A	Unity	B	constant
	C	Infinite	D	zero
7	Which among the following provides the third principle in fluid mechanics?			
	A	Conservation of Heat	B	Conservation of volume
	C	Conservation of linear momentum	D	Conservation of mass
8	Principle of fluid mechanics works on the utilization of____			
	A	Velocity	B	Accelerating mass
	C	Volume	D	Work
9	Open channel flow takes place ___			
	A	In a pump	B	Within a cylindrical depth
	C	On a free surface	D	In the pipe
10	Which of the following is a type of fluid based on viscosity?			
	A	Real Fluid	B	Ideal Fluid
	C	Newtonian Fluid	D	All of the mentioned
11	Pressure intensity or force due to pressure gradient for fluid at rest is considered as which of the following kind of force?			
	A	Body force	B	Force due to motion
	C	Surface force	D	None of the mentioned
12	Which of the following equation must be perfunctorily satisfied while dealing with fluid flow problems?			
	A	Newton's third law	B	Law of conservation of momentum

	C	Continuity equation	D	Newton's second law
13	Which among the following is an assumption of Hagen-Poiseuille equation?			
	A	Fluid is uniform	B	Fluid is laminar
	C	Fluid is turbulent	D	Fluid is compressible
14	Which of the following is a formula for the friction factor of circular pipes?			
	A	Re/64	B	16/Re
	C	64/Re	D	Re/16
15	Which among the following is not global parameters of fluid?			
	A	Mass flow rate	B	Density
	C	Viscosity	D	External diameter
16	Which among the following have the same forces acting on them?			
	A	Dynamic similarity	B	Geometric similarity
	C	Conditional similarity	D	Kinematic similarity
17	In a stationary fluid, how does the local pressure of the liquid vary?			
	A	In the horizontal direction, only	B	With depth only
	C	Neither with depth nor along the horizontal direction	D	Both with depth and along the horizontal direction
18	Which of the following cannot be the value of a fluid's absolute pressure at any point?			
	A	1.013 bar	B	0
	C	200 bar	D	- 1 bar
19	In a U-tube manometer, one end is open to the atmosphere, the other end attached to a pressurized gas of gauge pressure 40 kPa. The height of the fluid column on the atmospheric side is 60 cm, and that on the gas side is 30 cm. The manometric fluid used is: (Take g = 9.8 m/s2).			
	A	Liquid ammonia	B	Water
	C	Mercury	D	Oil
20	What happens to the buoyant force acting on the airship as it rises in the air?			
	A	Buoyant force decreases	B	Buoyant force increases
	C	Buoyant force first increases then show a decrease	D	Buoyant force remains constant
21	What type of flow can be taken for granted in a pipe of a uniform cross-section?			
	A	Unsteady	B	Steady
	C	Non-Uniform	D	Uniform
22	"The velocity of entrance and exit through a nozzle remains the same." Is this even possible?			
	A	only if the flow is laminar	B	only if the flow is compressible
	C	never possible	D	only if the flow is rotational
23	Permissible settlement is maximum in the case of What will be the shape of the pathline for a one-dimensional flow be like?			

	A	Parabolic	B	Straight line
	C	Elliptical	D	Hyperbolic
24	For incompressible fluid flow, if area reduces, then what is the effect on the velocity.			
	A	Decreases	B	Increases
	C	first decreases, then increase	D	first increases, then decrease
25	When a fluid element moves from one position to another, what type of motion is it?			
	A	Linear Deformation	B	Linear Translation
	C	Rotation	D	Angular Deformation
26	The flow of fluid along a curvilinear or curved path is known as			
	A	Vortex Flow		Sink Flow
	C	Circular Flow		Curvilinear Flow
27	What type of liquids are measured using a manometer?			
	A	Medium Liquids	B	Heavy Liquids
	C	Heavy and light liquid	D	Light Liquid
28	Which device is popularly used for measuring the difference of low pressure?			
	A	U-tube Differential Manometer	B	Downward movement of pile Inverted U-tube Differential Manometer
	C	Vertical Single column manometer	D	Inclined Single column manometer
29	The minimum centre to centre distance of a friction pile should be Which term is associated with dimensional analysis,			
	A	Similitude,	B	Laminar
	C	Turbulent	D	One Dimensional
30	Forces are considered and cause of forces are also considered in analysis in which			
	A	Fluid Statics	B	Fluid Kinematics
	C	Fluid Dynamics	D	All of above