PAPER ID-311885

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM III) THEORY EXAMINATION 2024-25
FLUID MECHANICS

TIME: 3 HRS **M.MARKS: 100**

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

Q no.	Question	CO	Level
a.	What is the difference between an ideal fluid and a real fluid?	CO1	K2
b.	What is center of buoyancy?	CO1	K2
c.	Differentiate between rotational and irrotational flow.	CO2	K2
d.	What is velocity potential?	CO2	K2
e.	Define potential head.	CO3	K2
f.	What are the limitations of Bernoulli's equation?	CO3	K2
g.	What are the applications of momentum equation?	CO4	K2
h.	What is laminar sub-layer?	CO4	K2
i.	Define drag and lift force.	CO5	K2
j.	What is meant by Magnus effect?	CO5	K2

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

Q no.	Question	CO	Level
a.	Differentiate between: (i) Absolute and gauge pressure, (ii) Simple manometer and differential manometer.	CO1	K2
b.	Explain the concept of a stream function in fluid mechanics. How is it used to describe fluid motion?	CO2	K2
c.	What is water hammer in fluid systems? What causes it, and how is it mitigated to prevent damage to pipes and equipment?	CO3	K2
d.	Define separation in boundary layer flow. What factors influence separation, and how can it be controlled?	CO4	K2
e.	Explain the factors influencing drag on a sphere moving through a fluid. How is drag on a sphere related to its size and velocity?	CO5	K2

SECTION C

3. Attempt any *one* part of the following: **10 x 1 = 10**

Q no.	Question	CO	Level
a.	Derive an expression for the depth of center of pressure from free surface of liquid of an inclined plane surface sub-merged in the liquid.	CO1	K3
b.	U-tube manometer containing mercury was used to find the negative pressure in the pipe, containing water. The right limb was open to the atmosphere. Find the vacuum pressure in the pipe, if the difference of mercury level in the two limbs was 100 mm and height of water in theleft limb from the center of the pipe was found to be 40 mm below.	CO1	K3

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4. Attempt any *one* part of the following: 10 x 1 = 10

Q no.	Question	CO	Level
a.	What do you mean by equipotential line and a line of constant stream function?	CO2	K2
b.	In an incompressible flow, the velocity vector is given by: $V = (6xt + yz^2)\, i + (3t + xy^2)j + (xy - 2xyz - 6\, tz)k$ (i) Verify whether the continuity equation is satisfied. (ii) Determine the acceleration vector at point L (2, 2, 2) at t = 2.0.	CO2	K3

5. Attempt any *one* part of the following: 10 x 1 = 10

Q no.	Question	CO	Level
a.	The following data relate to an orifice meter: Diameter of the pipe = 240 mm Diameter of the orifice = 120 mm Sp. gravity of oil = 0.88 Reading of differential manometer = 400 mm of mercury Co-efficient of discharge of the meter = 0.65. Determine the rate of flow of oil.	CO3	K3
b.	State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's equation.	CO3	K3

6. Attempt any *one* part of the following: 10 x 1 = 10

Q no.	Question	CO	Level
a.	Determine the wall shearing stress in a pipe of diameter 100 mm which carries water. The velocities at the pipe Centre and 30 mm from the pipe center are 2 m/s and 1.5 m/s respectively. The flow in pipe is given as turbulent.	CO4	K3
b.	A lubricating oil of viscosity 1 poise and specific gravity 0.9 is pumped through a 30 mm diameter pipe. If the pressure drop per meter length of pipe is 20 kN/m^2, determine: (i) The mass flow rate in kg/min, (ii) The shear stress at the pipe wall, (iii) The Reynolds number of flow, and (iv) The power required per 50 m length of the pipe to maintain the flow.	CO4	K3

7. Attempt any *one* part of the following: 10 x 1 = 10

Q no.	Question	CO	Level
a.	What is the difference between friction drag and pressure drag? In what position should a flat plate be held in a flow to subject the plate to these forces?	CO5	K3
b.	Assuming the cross-sectional area of a passenger car to be 2.7 m^2 with a drag co-efficient of 0.6, estimate the energy requirement at a speed of 60 km/h. Assume the weight of car to be 30 kN and co-efficient of friction 0.012. Assume ρ to be 1.208 kg/m^3.	CO5	K3