PAPER ID-311344

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

BTECH
(SEM III) THEORY EXAMINATION 2025-26
FLUID MECHANICS & FLUID MACHINES

TIME: 3 HRS **M.MARKS: 70**

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

SECTION A

1. Attempt *all* questions in brief. **02 x 7 = 14**

Q no.	Question	CO	Level
a.	Discuss the effect of temperature on viscosity of (i) liquids and (ii) gases.	1	K2
b.	Define *compressibility* and *bulk modulus.*	1	K1
c.	Differentiate between rotational and irrotational flows.	2	K2
d.	Define Froude's Number, discuss its significance	2	K1
e.	Formulate the Darcy-Weisbach equation in terms of discharge (Q).	3	K3
f.	Distinguish between Impulse and Reaction turbines.	4	K2
g.	Explain briefly, priming of a centrifugal pump.	5	K2

SECTION B

2. Attempt any *three* of the following: **07 x 3 = 21**

a.	Extend the following: (i) Newton's law of viscosity (ii) Absolute Pressure, Gauge Pressure and Vacuum Pressure.	1	K2
b.	Derive the continuity equation in Cartesian coordinates, for steady flow of an incompressible fluid.	2	K3
c.	With suitable diagram, illustrate the effect of pressure gradient on Boundary Layer Separation. Identify the conditions for separated and unseparated flow.	3	K3
d.	Illustrate the velocity triangles for Pelton wheel and derive the expressions for work done by water striking on runner, and maximum hydraulic efficiency of Pelton wheel.	4	K3
e.	Derive the expression of minimum speed for starting a centrifugal pump.	5	K2

SECTION C

3. Attempt any *one* part of the following: **07 x 1 = 07**

a.	The inlet and throat diameters of a horizontal venturimeter are 30 cm and 10 cm respectively. The liquid flowing through the meter is water. The pressure intensity at inlet is 13.734 N/cm^2 while the vacuum pressure head at the throat is 37 cm of mercury. Find: (i) the rate of flow (ii) value of C_d for the venturimeter. Assume that 4% of the differential head is lost between inlet and throat.	1	K3
b.	Describe surface tension. Also mention its units and dimensional formula. Find the surface tension in a soap bubble of 40 mm diameter when the inside pressure is 2.5 N/m^2 above atmospheric pressure.	1	K2

4. Attempt any *one* part of the following: **07 x 1 = 07**

a.	The stream function for a two dimensional flow is given by $\psi = 2xy$. Find: (i) velocity at point P(2,3) (ii) Velocity Potential Function Φ.	2	K2
b.	Explain *rotational* and *irrotational flow*. A fluid flow is given by $V = 8x^3i - 10x^2yj$. State whether the flow is rotational or irrotational.	2	K3

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5. Attempt any *one* part of the following: **07 x 1 = 07**

a.	Outline the following: (i) Frictional loss in pipe flow (ii) Prandtl Mixing Length theory for turbulent shear stress	3	K2
b.	A fluid of viscosity 0.7 Ns/m^2 and specific gravity 1.3 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is given as 196.2 N/m^2, find: (i) pressure gradient (ii) average velocity	3	K3

6. Attempt any *one* part of the following: **07 x 1 = 07**

a.	Explain the Governing of Pelton Turbine with neat sketch.	4	K2
b.	A jet of water of diameter 50 mm moving with a velocity of 40 m/s, strikes a curved fixed symmetrical plate at the centre. If the jet is deflected through an angle of 120° at the outlet, find: (i) rate of flow of water (ii) Force exerted by the jet of water in the direction of jet.	4	K3

7. Attempt any *one* part of the following: **07 x 1 = 07**

a.	Explain the phenomenon of cavitation. Discuss the effects of cavitation in centrifugal pumps, also outline some precautions against cavitation.	5	K2
b.	A single stage centrifugal pump with impeller diameter of 30 cm rotates at 2000 r.p.m. and lifts 3 m^3 of water per second to a height of 30 m with an efficiency of 75%. Find the number of stages and diameter of each impeller of a similar multistage pump to lift 5 m^3 of water per second to a height of 200 m when rotating at 1500 r.p.m.	5	K3