



PAPER ID-311876

Printed Page: 1 of 2
Subject Code: BME302

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BTECH
(SEM III) THEORY EXAMINATION 2024-25
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.

2 x 07 = 14

Q no.	Question	CO	Level
a.	Define viscosity of fluid.	1	K 2
b.	Define surface tension.	1	K 2
c.	What is potential function in fluid flow?	2	K 2
d.	Write the rotation velocity components in a fluid flow.	2	K 2
e.	What is boundary layer thickness?	3	K 3
f.	What is impulse turbine?	4	K 3
g.	Define specific speed of a centrifugal pump.	5	K 2

SECTION B

2. Attempt any three of the following:

07 x 3 = 21

Q no.	Question	CO	Level
a.	What is a venturimeter? Prove that the discharge through an venturimeter is given by the relation $Q = C_d a_1 a_2 \sqrt{2gh / \sqrt{a_1^2 - a_2^2}}$ where a_1 = cross sectional area of pipe a_2 = area of throat	1	K 2
b.	Derive the continuity equation for a three-dimensional steady and incompressible fluid flow.	2	K 2
c.	Find out the velocity distribution and shear stress distribution across a section of pipe for the viscous flow.	3	K 3
d.	Derive the expression for the maximum hydraulic efficiency of a Pelton Wheel.	4	K 3
e.	Compare the working principles, applications, advantages, and disadvantages of a centrifugal pump and a reciprocating pump.	5	K 2

SECTION C

3. Attempt any one part of the following:

07 x 1 = 07

Q no.	Question	CO	Level
a.	Differentiate between dynamic and kinematic viscosity and discuss the effect of temperature on viscosity.	1	K 2
b.	The velocity distribution for flow over a plate is gives by $u = 2y - y^2$ where u is the velocity in m/s at a distance y metres above the plate. Determine the velocity gradient and shear stress at the boundary and 1.5 m from it. Take dynamic viscosity of fluid as 0.9 N.s/m^2 .	1	K 2

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4. Attempt any *one* part of the following:

07 x 1 = 07

Q no	Question	CO	Level
a.	Distinguish between: i) Steady and unsteady flow (ρ, μ) ii) Uniform and non uniform flow: iii) Rotational and irrotational flow	2	K 2
b.	The velocity components in a fluid flow are given by: $u = 2xy; v = a^2 + x^2 - y^2$ i) Show that the flow is possible. ii) Derive the relative stream function.	2	K 2

5. Attempt any *one* part of the following:

07 x 1 = 07

Q no.	Question	CO	Level
a.	Explain the following with the suitable diagram. i) Water Hammer ii) Siphon	3	K 3
b.	An oil having viscosity of 705 poise of specific gravity 0.85 flows through a horizontal pipe of 50mm diameter with a pressure drop 18KN/m per meter length of pipe. Determine i) The flow rate of oil and the center line velocity ii) Power required maintaining the flow in 100 m length of pipe iii) Velocity and shear stress at 8mm from the wall.	3	K 3

6. Attempt any *one* part of the following:

07 x 1 = 07

Q no.	Question	CO	Level
a.	Explain the construction and working of the Pelton wheel.	4	K 3
b.	A reaction turbine works at 450 r.p.m. under a head of 120 m. Its diameter at inlet is 1.2 m and the flow area is 0.4 m ² . The angles made by absolute and relative velocities at inlet are 20° and 60° respectively with the tangential velocity. Determine i) The volume flow rate, ii) The power developed, and iii) The hydraulic efficiency.	4	K 3

7. Attempt any *one* part of the following:

07 x 1 = 07

Q no.	Question	CO	Level
a.	What is an air vessel? Explain working of air vessel.	5	K 2
b.	The impeller of a centrifugal pump has an external diameter of 450 mm and internal diameter of 200 mm and it runs at 1440 r.p.m. Assuming a constant radial flow through the impeller at 2.5 m/s and that the vanes at exit are set back at an angle 25°, determine: i) Inlet vane angle, ii) The angle, absolute velocity of water at exit makes with the tangent iii) The work done per N of water.	5	K 2