PAPER ID-311871

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

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

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.	What is buoyancy?	CO1	K2
b.	Define Newtonian and Non-Newtonian fluids.	CO1	K2
c.	Differentiate between Compressible and incompressible flow.	CO2	K2
d.	Define velocity potential function.	CO2	K2
e.	Define vena-contracta.	CO3	K2
f.	What do you mean by eddy viscosity?	CO4	K2
g.	What is Magnus effect?	CO5	K2

SECTION B

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

Q no.	Question	CO	Level
a.	Explain the working principle of a U-tube manometer. How is it used to measure pressure in a fluid?	CO1	K2
b.	Define subsonic, sonic, and supersonic flows. What are the characteristics and applications of each type of flow?	CO2	K2
c.	Explain the classification of orifices and mouthpieces based on their shape,size, and sharpness?	CO3	K2
d.	Derive an expression for the loss of head due to friction in pipes.	CO4	K3
e.	Explain the advantages and limitations of CFD compared to experimental methods in fluid dynamics research and engineering design.	CO5	K2

SECTION C

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

Q no.	Question	CO	Level
a.	The space between two square flat parallel plates is filled with oil. Each side of theplate is 60 cm. The thickness of the oil film is 12.5 mm. The upper plate, which moves at 2.5 meter persec requires a force of 98.1 N to maintain the speed. Determine: (i) the dynamic viscosity of the oil in poise, and (ii) the kinematic viscosity of the oil in stokes if the specific gravity of the oil is 0.95.	CO1	K3
b.	A rectangular pontoon is 5 m long, 3 m wide and 1.20 m high. The depth ofimmersion of the pontoon is 0.80 m in sea water. If the centre of gravity is 0.6 m above the bottom ofthe pontoon, determine the meta-centric height. The density for sea water = 1025 kg/m^3.	CO1	K3

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

Q no.	Question	CO	Level
a.	What is the irrotational velocity field associated with the potential $\varphi = 3x^2 - 3x + 3y^2 + 16t^2 + 12zt$. Does the flow field satisfy the incompressible continuity equation?	CO2	K3
b.	If for a two-dimensional potential flow, the velocity potential is given by $\varphi = x(2y - 1)$, determine the velocity at the point P (4, 5). Determine also the value of stream function ψ at the point P.	CO2	K3

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

Q no.	Question	CO	Level
a.	What is Euler's equation of motion? How will you obtain Bernoulli's equation from it?	CO3	K3
b.	A pipeline carrying oil of specific gravity 0.87, changes in diameter from 200 mm diameter at a position A to 500 mm diameter at a position B which is 4 meters at a higher level. If the pressures at A and 8 are 9.81 N/cm^2 and 5.886 N/cm^2 respectively and the discharge is 200 liters/s determine the loss of head and direction of flow.	CO3	K3

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

Q no.	Question	CO	Level
a.	For Laminar flow of an oil having dynamic viscosity μ = 1.766 Pa.s in a 0.3 m diameter pipe, the velocity distribution is parabolic with a maximum point velocity of 3 m/s at the centre of the pipe. Calculate the shearing stresses at the pipe wall and within the fluid 50 mm from the pipe wall.	CO4	K3
b.	Derive an expression for the velocity distributionfor viscous flow through a circular pipe. Alsosketch the distribution of velocity and shearstress across a section of the pipe.	CO4	K3

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

Q no.	Question	CO	Level
a.	Draw and explain the approximate flow pattern and the pressure distribution around a flat plate placed perpendicularly in a stream flow.	CO5	K3
b.	Calculate the total drag, shear drag and the pressure drag exerted on 1m length of an infinitecircular cylinder which has a diameter equal to 30 mm, air of density 1.236 kg/m^3 flowing past the cylinder withvelocity 3.6 m per minute. Take total drag coefficient equal to 1.4 and shear drag coefficient equal to 0.185.	CO5	K3