

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Backlog), Nov 2017
B. Tech in Mechanical Engineering, Semester III

Roll No. 201667echmeola

ME 307: Fluid Mechanics

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A (10 questions @ 1 mark) 10

- i. Kinematic viscosity of air at 20°C is given to be $1.6 \times 10^{-5} \text{ m}^2/\text{s}$. Its kinematic viscosity at 70°C will be vary approximately
 - (a) $2.2 \times 10^{-5} \text{ m}^2/\text{s}$
 - (b) $1.2 \times 10^{-5} \text{ m}^2/\text{s}$
 - (c) $1.6 \times 10^{-5} \text{ m}^2/\text{s}$
 - (d) $3.2 \times 10^{-5} \text{ m}^2/\text{s}$
- ii. What is the pressure difference between inside and outside of a droplet of water?
 - (a) $2 \sigma / d$
 - (b) $4 \sigma / d$
 - (c) $8 \sigma / d$
 - (d) $12 \sigma / d$
- iii. What are the properties of real fluid?
- iv. Define Specific volume and Specific Gravity.
- v. What is Dupuit's equation?
- vi. When is a fluid considered steady?
- vii. Define Similitude.
- viii. Give an expression for loss of head at the entrance of the pipe.
- ix. At the interface of a liquid and gas at rest, the pressure is
 - (a) Higher on the concave side compared to that on the convex side
 - (b) Higher on the convex side compared to that on the concave side
 - (c) Equal to both sides
 - (d) Equal to surface tension divided by radius of curvature on both sides.
- x. What do you understand by the terms a) major energy losses, b) minor energy losses?

Q.2 Short answer type questions (4 questions @ 2.5 marks) 10

- i. What is syphon? Where it is used?
- ii. What are the basic educations to solve the problems in flow through branched pipes?
- iii. State Buckingham's Π theorem.
- iv. Define the terms a) Hydraulic gradient line [HGL], b) Total Energy line [TEL].

Q.3A A circular disc of diameter D is slowly in a liquid of a large viscosity (μ) at a small distance (h) from a fixed surface. Derive an expression of torque (T) 05

	necessary to maintain an angular velocity (ω).	
Q.3B	Explain vorticity and rotationality.	05
Q.4A	A vacuum gauge connected to a chamber reads 36 kPa at a location where the atmospheric pressure is 92 kPa. Determine the absolute pressure in the chamber.	05
Q.4B	A cylindrical buoy 2m in dia and 1.2m long, weighing 9806N is floating in water. Find the centre of buoyancy and metacentric height. Draw neat figure.	05
Q.5	Consider a steady two dimensional flow field $\vec{V} = (0.5 + 0.8x)\hat{i} + (1.5 - 0.8y)\hat{j}$ (mks units) Calculate (i) rate of translation, (ii) rate of rotation, (iii) linear strain rates & (iv) shear strain rate.	10
Q.6A	Find the expression for rise and fall of liquid in a capillary tube.	05
Q.6B	Give proof of Pascal's law.	05
	OR	
Q.6B	Derive the expression for Hydrostatic law.	05
Q.7A	Find the Bernoulli's equation for a streamline flow. Draw neat figures and mention all the assumptions.	05
Q.7B	Derive the expression for power absorbed in a hydro dynamically lubricated bearing.	05
	OR	
Q.7B	Derive the expression for the power absorbed by a dashpot.	05
Q.8A	Derive the expression for pressure loss for a viscous pipe flow over the length of the pipe. Also, find the expression for maximum velocity and average velocity for the same flow. Draw neat and labelled diagrams.	20
Q.9	Explain separation of boundary layer in detail.	10
	OR	
Q.9	Discuss various boundary layer theories/models to calculate shear stress for turbulent flow. Explain the advantages, flaws and practical applicability of them all.	10