

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Special), Jan 2016

B. Tech in Mechanical Engineering, Semester III

Roll No.....

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 Short answer questions / MCQ (each question @ 1 mark) 10

- i. Write the unit of dynamic viscosity in CGS, MKS and SI units.
- ii. Define & explain the physical significance of the term specific gravity.
- iii. Explain Pascal's law.
- iv. Explain Hydrostatic law.
- v. The vertical component of the total pressure on an inclined surface is equal to weight of liquid above the surface. (True/False)
- vi. What is total energy line and hydraulic gradient line?
- vii. Describe the use and limitations of flow nets.
- viii. What are the differences between ideal fluid and real fluid?
- ix. Reynolds stresses are caused due to.....
- x. What is boundary layer?

Q.2A Write your thoughts on velocity distribution for turbulent flow in pipes. With mathematical expressions. 10

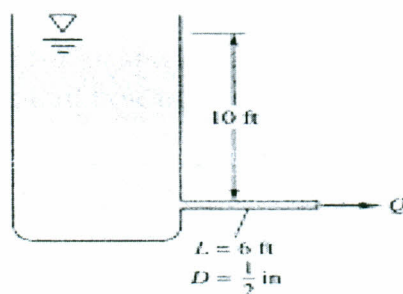
OR

Velocity components of a fluid flow are given as $u = (6xy^2 + t)$, $v = (3yz + t^2 + 5)$, $w = (z + 3ty)$, where x, y, z are given in meters and time t in seconds. Determine velocity vector at point P (4, 1, 2) at time $t = 4$ seconds. Also determine the magnitude of velocity and acceleration of the flow for given location and time.

Q.2B A pitot tube is inserted in a pipe of 30mm dia. The static pressure in pipe is 10cm of Hg (vacuum). The stagnation pressure at the center of pipe is recorded by the pitot tube is 0.981 N/cm^2 . Calculate the rate of flow of water through pipe if the mean velocity of the flow is 0.85 times the central velocity & co-efficient of velocity is 0.9. 10

Q.3A A pipe line carrying oil of specific gravity 0.9, changes in diameter from 250 mm diameter at a position 1, to 450 mm diameter at a position 2 which is 6 meter at a higher level. If the pressure at 1 and 2 are 12 N/cm^2 and 6 N/cm^2 respectively and the discharge is 250 litre/sec. calculate the loss of head and direction of flow. 07

- Q.3B Explain source and sink flow. 03
- Q.4A Give the pictorial representation of various energy heads at various points of a fluid flow flowing in a pipe of uniform dia. 05
- Q.4B A solid cylinder of dia 3.0 meter has a height of 2.0 meter. Find the metacentric height of the cylinder when it is floating in water with its axis vertical. The specific gravity of the cylinder is 0.7. 05
- Q.5A Calculate the sp. wt., density and sp. gravity of one liter of a liquid which weighs 7N. 05
- Q.5B Derive the expression for power absorbed in journal bearing. 05
- Q.6A Define surface tension and capillarity. Derive the expression for capillarity rise for any fluid. 05
- Q.6B Explain the phenomenon of terminal velocity of a body falling in a fluid medium. 05
- Q.7A Put some light on Prandtl's mixing length theory for turbulent shear stress. Also, give the mathematical formulation of the same. 05
- Q.7B Explain density, sp. weight, sp. volume, viscosity. Write the expression for Newton's law of viscosity with meaning of notations. 04+01
- OR
- Q.7B Prove that equipotential lines and lines of constant stream function are orthogonal to each other. 05
- Q.8 An oil (SG = 0.9) issues from the pipe in Fig. at $Q = 35 \text{ ft}^3/\text{h}$. What is the kinematic viscosity of the oil in ft^2/s ? Is the flow laminar? 10



OR

- Q.8 Derive Bernoulli's equation for the flow of an incompressible friction less fluid from consideration of momentum. 10
- Q.9 Write short notes on (draw neat and clean diagrams if required): 2.5x4
- Stream line and bluff bodies
 - Lift and drag on a cylinder and airfoil
 - Equivalent pipe in series and parallel connections
 - Laminar and turbulent boundary layer flows