

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/ Backlog), November 2016

Bachelor of Technology 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 Objective type multiple choice questions (10 questions @ 1 mark)

10

- i. Fluid is a substance that offers no resistance to the change of
(a) Pressure (b) Flow (c) Shape (d) Volume (e) None of these
- ii. The property of a fluid which enables it to resist tensile stress is known as
(a) Adhesion (b) Surface tension (c) Cohesion (d) Viscosity
- iii. A balloon lifting in air follows the following principle
(a) Law of gravitation (c) Archimedes Principle
(b) Law of buoyancy (d) All of the Above
- iv. For a manometer a better liquid combination is one having
(a) Higher Surface Tension (c) Lower surface tension
(b) Higher density & low viscosity (d) Surface Tension is no criterion
- v. If Hg in a barometer is replaced by water, the 3.75 cm of mercury will be following cm of water
(a) 51 (b) 52 (c) 50 (d) 52.2 (e) 51.7
- vi. Alcohol is used in manometer because (find wrong statement)
(a) It has low vapor pressure
(b) It provides suitable meniscus for the inclined tube
(c) Its density is low
(d) It provides longer length for a given pressure difference
(e) It provides accurate readings
- vii. A one dimensional flow is one which
(a) Is a uniform flow (c) is steady uniform flow
(b) Takes place in straight lines (d) takes place in one dimension
(e) Involves zero transverse component of flow
- viii. The conditions for the stable equilibrium of a floating body are...
- ix. The centre of gravity of the volume of displaced liquid is called
(a) Meta centre (b) Centre of Pressure (c) Center of buoyancy (d) C.G.
- x. For measuring flow by a venturimeter it should be installed in
(a) Vertical line (b) Horizontal line (c) inclined line (d) In any direction

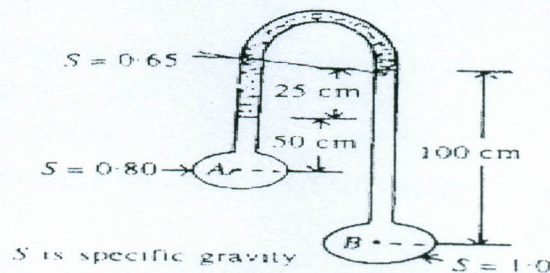
Q.2 Short answer type questions (4 questions @ 2.5 marks)

10

- A flat plate, $2\text{m} \times 0.4\text{m}$ is set parallel to a uniform stream of air (density 1.2kg/m^3 and viscosity 16 centistokes) with its shorter edges along the flow. The air velocity is 30 km/h. What is the approximate estimated thickness of boundary layer at the downstream end of the plate?
- What are the advantages and disadvantages of Eulerian and Lagrangian method for fluid flow analysis?
 - Explain terms: lift, drag, momentum thickness, energy thickness.
 - Give the physical significance of kinematic viscosity.

Q.3A Explain Phenomenon of capillarity. Derive the expression for capillary rise/fall. 05

Q.3B The pressure difference between point B and A in centimeters of water is ... 05



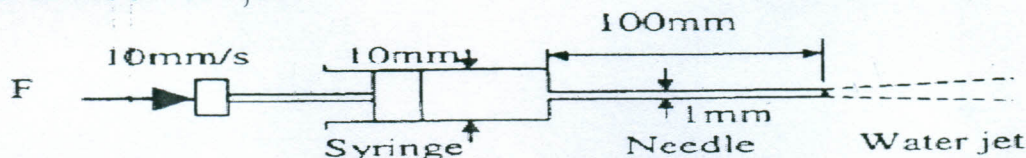
Q.4A A horizontal oil tank is in the shape of a cylinder with hemispherical ends. If it is exactly half full, what is the ratio of magnitude of the vertical component of resultant hydraulic thrust on one hemispherical end to that of the horizontal component? 05

Q.4B Derive the expression for Momentum thickness in case of BL formation over a flat plate. 05

Q.5A The velocity profile in a laminar boundary layer is given by $u/U = y/\delta$. The ratio of momentum thickness to displacement thickness for the boundary is given by. 05

Q.5B Derive Darcy-Weisbach equation for head loss in pipe due to friction. 05

Q.6A A syringe with a frictionless plunger contains water and has at its end a 100 mm long needle of 1 mm diameter. The internal diameter of the syringe is 10 mm. Water density is 1000 kg/m^3 . The plunger is pushed in at 10 mm/s and the water comes out as a jet. 05



Q.6B Prove hydrostatic law from the equation of fluid statics. 05

OR

Q.6B The loss of head in a pipe of certain length carrying a rate of flow of Q is found to be H . If a pipe of twice the diameter but of the same length is to carry a flow rate of $2Q$, then the head loss will be... 05

Q.7A A truck having a projected area of 6.5 m^2 travelling at 70 kmph has a total resistance of 2000N, of this 20% is due to rolling friction and 10% due to surface 05

friction. The rest is due to form drag. Find coefficient of form drag. Take $\rho = 1.22 \text{ kg/m}^3$ for air.

Q.7B Explain the conditions of equilibrium through neat diagrams. Showing meta-centre, centre of gravity and centre of buoyancy. 05

OR

Q.7B Derive the Bernoulli's equation. 05

Q.8 A circular disc of diameter 'd' is slowly rotated in a liquid of large viscosity ' μ ' at a small distance 't' from the fixed surface. Derive the expression for torque required to maintain the speed ' ω '. 10

Q.9A What is flow separation? Write down the methods to prevent it. Explain any two methods in detail. 10

Q.9B Derive Euler's equation of motion. Write all the assumptions. Draw neat diagrams. And, label each variable. 10

OR

Q.9B Find the expression for centre of pressure for an inclined submerged plane plate. 10