

B.Tech II Year II Semester (R09) Supplementary Examinations December/January 2015/2016

FLUID MECHANICS & HYDRAULIC MACHINERY

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions
 All questions carry equal marks

- 1 (a) Explain Newton's law of viscosity. What is the effect of temperature on viscosity of water and that of air?
 (b) A body weighing 440 N with a flat surface area of 0.0095 m^2 slides down a lubricated inclined plate making a 30° angle with the horizontal. For viscosity of 0.1 Ns/m^2 and body speed of 3 m/s , determine the lubricant film thickness.
 (c) Calculate capillary rise in a glass tube of 3 mm diameter when immersed in water. Take surface tension for water as 0.07358 N/m . Find the percentage increase in capillary rise if the diameter of glass tube is 2 mm.
- 2 (a) Obtain Euler's equation of motion along a stream line & hence derive Bernoulli's equation for steady incompressible fluid flow.
 (b) If the expression for the stream function is described by $\Psi = x^3 - 3xy^2$, determine whether the flow is rotational or irrotational. The velocity vector in an incompressible flow is given by $V = (6xt + yz^2)\hat{i} + (3t + xy^2)\hat{j} + (xy - 2xyz - 6tz)\hat{k}$
 (i) Verify whether the continuity equation is satisfied.
 (ii) Determine the magnitudes of resultant velocity and acceleration at point A (2,1,2) at $t=2$ sec.
- 3 (a) An oil of Sp. gr. 0.9 and viscosity 0.06 poise is flowing through a pipe of diameter 200 mm and of length 500 m at the rate of 60 liters/sec. Find the head lost due to friction. Find the power required to maintain the flow.
 (b) Explain the working of venturimeter with neat diagram.
 (c) Explain briefly: (i) Hydraulic gradient line, (ii) Total energy line.
- 4 (a) Derive the equation between the angle, through which a hinged plate will swing in terms of force of jet and weight of the plate.
 (b) A 25 mm diameter jet exerts a force of 1 kN in the direction of flow against a flat plate, which is held at an angle of 30° with the axis of the stream. Find the rate of flow.
- 5 (a) List the elements of a hydroelectric power plant. What is meant by pumped storage plant?
 (b) How mass curve is used to estimate power generated?
- 6 (a) Compare impulse and reaction turbines.
 (b) Design a Pelton wheel for a head of 350 m at a speed of 300 rpm. Overall efficiency of the wheel is 85% and ratio of jet to wheel diameter is as 1/10.
- 7 (a) Explain the terms unit power, unit speed and unit discharge.
 (b) One of the Kaplan turbines installed is rated at 25000 kW when working under 30 m of head at 180 rpm. Find the diameter of the runner, if overall efficiency of the turbine is 0.91. Assume flow ratio of 0.65 and diameter of the runner hub equal to 0.3 times the external diameter of runner. Also find specific speed of the turbine.
- 8 (a) Compare centrifugal and reciprocating pumps.
 (b) Explain with a neat sketch working of centrifugal pumps.