Code: 9A01404

R09

B.Tech II Year II Semester (R09) Supplementary Examinations December/January 2014/2015

FLUID MECHANICS & HYDRAULIC MACHINERY

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

*****

1 (a) Define fluid properties : surface tension & capillarity.

(b) Calculate the dynamic viscosity of oil which is used for lubrication between a square plate of size 0.8 m x 0.8 m and inclined plane with angle of inclination of 30°. The weight of square plate is 300 N and it slides down the inclined plane with a uniform velocity of 0.3 m/s. The thickness of oil film is 1.5 mm.

(c) The right limb of a simple U tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of sp.gr. 0.9 is flowing. The centre of the pipe is 12 cm below the level of mercury in the right limb. Find the pressure of the fluid in the pipe if the difference of mercury level in the two limbs is 20 cm.

2 (a) Define steady, unsteady flow & laminar, turbulent flow.

(b) Obtain Euler's equation of motion along a stream line & hence drive Bernoulli's equation for steady incompressible fluid flow.

(c) A fluid flow is given by $V = xy^2i-2y^2j-(zy^2-2z^3/3)\ k$. Prove that it is possible case of fluid flow. Calculate velocity & acceleration at the point (1, 2, 3).

3 (a) Explain with a neat sketch Reynolds experiment to classify flow.

(b) A 20 x 10 cm venturimeter is provided in a vertical pipe line carrying oil of specific gravity 0.8, the flow being upward. The difference in elevation of the throat section and entrance section of the venturimeter is 50 cm. The differential U-tube mercury manometer shows a guage deflection of 40 cm. Calculate: (i) The discharge of oil. (ii) The pressure difference between the entrance section and the throat section take. Take $C_d = 0.98$.

4 (a) A jet of water having velocity 20 m/s strikes a curved vane, which is moving with a velocity of 10 m/s. The jet makes an angle of 20° with the direction of motion of vane at inlet and leaves at angle of 130° to the direction motion of vane at outlet. Calculate (i) Vane angles at inlet. (ii) Work done per sec per unit weight of water per sec.

(b) Derive equation for work done and efficiency for a jet impinging on series of vanes.

5 (a) List the elements of a hydroelectric power plant.

(b) How mass curve is used to estimate power generated?

6 (a) A pelton wheel has a tangential velocity of buckets of 15 m/s. The water is being supplied under a head of 150 meters at the rate of 200 liters/s. The buckets deflect the jet through an angle of 160°. If the coefficient of velocity for the nozzle is 0.98, find the power produced by the wheel and hydraulic efficiency.

(b) Write a short note on draft tube.

7 (a) Explain the terms unit power, unit speed and unit discharge.

(b) An impulse turbine develops 4500 kW under a head of 200 meters. The turbine runner has a speed of 200 rpm and discharge of 0.8 cubic meter of water per second. If the head on the same turbine falls during summer to 184.3 meters, find the new discharge, power and speed of the turbine.

8 (a) Compare centrifugal and reciprocating pumps.

(b) A centrifugal pump of 1.5 meter diameter runs at 210 rpm and pumps 180 liters of water per second. The angle which the vane makes at exit with the tangent to the impeller is 25°. Assuming radial entry and velocity of flow throughout as 2.5 m/s determine the power required to drive the pump. If manometric efficiency of the pump is 65%, find the average lift of the pump.

*****