Code: 13A01307 **R13**

B.Tech II Year I Semester (R13) Supplementary Examinations June 2016

FLUID MECHANICS & HYDRAULIC MACHINERY

(Electrical & Electronics Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Define and distinguish between surface tension and capillarity.
(b) Name different forces acting on a fluid element in static equilibrium.
(c) Define convective and local acceleration.
(d) What are different forms of energy in a fluid?
(e) Define coefficient of contraction.
(f) Depict the theoretical variation of hydraulic efficiency of a Pelton wheel w.r.t bucket to jet speed ratio.
(g) What is the function of spiral casing in reaction turbine?
(h) Define specific speed of a pump.
(i) State the factors limiting the suction head of a pump.
(j) How the runoff is measured and what is its unit?

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Distinguish between Newtonian and non-Newtonian fluids with the help of shear stress and velocity gradient plot

(b) Two square flat plates of size 50 cm X 50 cm are spaced 12 mm apart and the space between the two is filled with oil of specific gravity 0.95. The lower plate is stationary and on the upper plate a force of 100 N is applied to move it with a velocity of 2.5 m/s. Assuming linear velocity distribution in the oil film determine the dynamic viscosity and kinematic viscosity of the oil.

OR

3 (a) Define Path Line, Streak line and stream line. For what type of flow these lines are identical.

(b) Verify whether the following motions are kinematically possible for an incompressible fluid or not?

(i) $u = x^2 + y^2; v = x^2 + 2xy$.

(ii) $u = \frac{-ax}{y}$; $v = a \log xy$ where a is a numerical constant.

UNIT – II

4 (a) Derive Bernoulli's equation for steady flow incompressible fluid flowing through a non-uniform pipe

(b) Determine the discharge of water flowing through a vertical pipe 30 cm in diameter where a venture meter is inserted having a throat diameter of 15 cm. The difference of pressure between the main and the throat measured by a liquid of specific gravity 0.7 in an inverted U-tube gives a reading of 30 cm. The loss of head between the main and the throat is 0.2 times the kinetic head of the pipe. Consider the flow in upward direction.

OR

5 (a) What are minor losses? Under what circumstances they are negligible.

(b) A pipe line of 40 m length is connected to a water tank at one end and discharges freely in to atmosphere at the other end. The first 25 m length of the pipe is of 15 cm diameter and then it is suddenly enlarged to 30 cm. The height of water in the tank is 8 m above the center of the pipe. Determine the flow rate through the pipe considering all head losses. Use *4f = 0.04* in Darcy formula.

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UNIT – III

6 (a) Show that Maximum efficiency attainable is 50% when a jet impinges on series of flat plates mounted on a wheel.

(b) A jet of water 4 cm in diameter with 20 m/s velocity impinges on series of vanes mounted on a wheel moving with a velocity of 5 m/s. Find the force acting on the vanes and the jet efficiency.

OR

7 (a) Distinguish between impulse and Reaction turbines with regard to their operation and application.

(b) A Pelton wheel working under a head of 300 m develops a power of 5 MW. The speed of the wheel is 500 rpm. The overall efficiency is 87%. Assuming the speed ratio 0.46 determine the: (i) Wheel diameter. (ii) The discharge through the Pelton wheel.

UNIT – IV

8 (a) Differentiate between inward and outward flow turbines.

(b) A reaction turbine rotates at a speed of 500 rpm. Its inlet pipe diameter is 108 cm and the flow area is 0.4 m^2. The angles made by absolute and relative velocities at inlet are 20^0 and 60^0 respectively with the tangential velocity. Determine the: (i) Volume flow rate. (ii) Power developed. Assume whirl velocity at outlet is zero.

OR

9 (a) How do you classify centrifugal pumps? Explain working of any one type with a neat sketch.

(b) A multi stage centrifugal pump operating at a speed of 1200 rpm is used to lift water through a head of 100 m at the rate of 0.121 m^3/s. The specific speed of each impeller is 30. Assuming overall efficiency of the pump 80%, determine: (i) The head developed per stage. (ii) Number of stages required. (iii) The power required to run the pump.

UNIT – V

10 (a) What do you understand by a pump storage plant? What are the advantages and limitations of this type of plant?

(b) What is a penstock? What are the advantages and disadvantages of exposed penstock over buried penstock

OR

11 (a) Define: (i) Load factor. (ii) Power factor. (iii) Capacity factor. (iv) Diversity factor.

(b) Explain the construction of flow duration curve and discuss its significance

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