Code: 13A01307 **R13**

B.Tech II Year I Semester (R13) Supplementary Examinations November/December 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) State Newton's law of viscosity and briefly explain its importance in the analysis of the fluid flow.

(b) Calculate the mass density, specific weight, specific gravity and specific volume of an oil, 10 m^3 of which weighs 70 kN.

(c) State Bernoulli's theorem and discuss the assumptions of the theorem.

(d) State the difference between hydrodynamic head and pressure head.

(e) Define hydrodynamic force.

(f) What are the difference between impulse turbines and reaction turbines?

(g) Explain the differences between positive displacement and rotodynamic pumps.

(h) What are the functions of the following components in a centrifugal pump?
(i) Impeller. (ii) Casing

(i) What do you understand by flow duration curve? How is it prepared?

(j) Explain base load and peak load of a power plant.

PART – B

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

UNIT – I

2 (a) Derive an expression for the force exerted on a submerged vertical plane surface by a static fluid. Also get an expression for the position of centre pressure and prove that it is always below or coincides with the centroid of the area.

(b) The diameter of wider and narrow limbs of a single column mercury manometer is 0.16 m and 0.006 m respectively. Find out the rise in mercury column in the narrow limb if a pressure of 75 kPa is applied on the wider limb.

OR

3 (a) The velocity distribution along the cross section of a circular pipe of radius 20 mm is given by $u = 0.2y - 0.5y^2$, where *u* is the velocity of the flowing fluid at a distance *y* from the wall. Calculate the shear stress at the wall and at a distance 5 mm from the wall. Also calculate the total resistance to flow, if the length of the pipe is 50 m. Assume the dynamic viscosity of the flowing fluid as 0.05 Ns/m^2.

(b) A vertical pipe 2 m long rotates concentrically inside another fixed pipe of same length. The inner diameter of the outer pipe is 305 mm, whereas the outer diameter of inner pipe is 300 mm. The space between two pipes is filled with an oil of viscosity 0.125Pa. Determine the torque to be applied to maintain a speed of 60 rpm for the inner pipe. Also determine the viscosity of the oil required, if the available torque is 1 Nm.

UNIT – II

4 A 200 mm diameter to 150 mm diameter reducing bend having inclined angle of 120° is connected to a horizontal pipe carrying 0.3 m^3/s of water. The pressure at inlet to the bend is 300 kPa. Determine the magnitude and direction of the force exerted by the bend, if 10% of the exit kinematic energy is lost in the bend.

OR

5 When water flows through a 0.5 m diameter pipe, the frictional drop is 30 m. In order to reduce the power for pumping the same quantity of water, it was decided to lay another pipe of appropriate diameter along the side of the existing one so that the two pipes work in parallel for the entire length. With the new arrangement, the frictional head has to be 10 m. Find the diameter of the new pipe to be added, if except for diameter, it is similar to the existing one in every respect.

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UNIT – III

6 (a) Define angular momentum and show how it is used to determine the torque and work done by a vane in the case of a radial flow rotor.

(b) A jet of water having a velocity of 60 m/s enters a series of radial curved vanes at the outer periphery. The supply jet makes an angle of 25° with the tangent to the wheel at inlet tip. The water leaving the wheel has a flow velocity of 12 m/s. The outer and inner radii of the vanes are 0.6 m and 0.3 m respectively and the blade angles at outlet and inlet are 30° and 40° respectively. Find out the speed of the wheel and efficiency of vanes.

OR

7 What do you mean by?

(a) Volumetric efficiency.

(b) Hydraulic efficiency.

(c) Mechanical efficiency.

(d) Overall efficiency, in turbine practice.

UNIT – IV

8 (a) What are unit quantities as applied to turbo machines? Define the unit quantities employed in the performance study of turbines. Why are they important

(b) A Kaplan turbine with specific speed 600 is suggested for a power station to generate 50 MW at 50 cycles frequency. Available head is 15 cm. (i) Find out the speed and discharge through the turbine assuming that it has an overall efficiency of 90%. (ii) For a flow ratio of 0.62 and the hub to outer diameter ratio of 0.4, find the main dimensions of the turbine. (iii) For a vapor pressure of 0.25 m of water and critical Thoma factor of 0.7, find the maximum elevation of runner to avoid cavitation. (iv) Test runs of a geometrically similar model of 1/10 size were conducted in a laboratory where head available is 8 m. Find the discharge through the model, power developed and elevation of model runner above sump in the laboratory.

OR

9 Explain the following:

(a) Static suction lift.

(b) Suction head.

(c) Static head.

(d) Manometric head.

(e) Virtual head.

UNIT – V

10 What are the different types of hydropower plants? Describe each one briefly.

OR

11 Discuss following terms as applied to a hydropower plants:

(a) Flow duration curve.

(b) Power duration curve.

(c) Load duration curve.

(d) Installed capacity.

(e) Overall efficiency.

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