B.E./B.TECH. Degree Examination, December 2020

Third Semester

AE18303 – FLUID MECHANICS AND HYDRAULIC MACHINES

(Regulation 2018)

Time: Three hours Maximum : 80 Marks

Answer **ALL** questions

PART A - (8 X 2 = 16 marks)

1. If 'P' is the gauge pressure within a spherical droplet, then gauge pressure within a bubble of the same fluid and of same size will be

   (a) P/4 (b) P/2 (c) P (d) 2P

2. The pressure drop for laminar flow of a liquid in a smooth pipe at normal temperature and pressure is

   (a) directly proportional to density (b) inversely proportional to density

   (c) independent of density (d) proportional to (density)0.75

3. Which of the following quantities has the dimensions [M° L° T°]

   (a) Density (b) Stress (c) Strain (d) Strain Rate

4. Indicator diagram of a reciprocating pump is a graph between.....

   (a) Flow vs swept volume (b) Pressure in cylinder vs swept volume

   (c) Flow vs speed (d) Pressure vs speed

5. In a simple concentric shaft-bearing arrangement, the lubricant flows in the 2 mm gap between the shaft and the bearing. The flow may be assumed to be a plane couette flow with zero pressure gradients. The diameter of the shaft is 100 mm and its tangential speed is 10 m/s. The dynamic viscosity of the

   lubricant is 0.1 kg/m.s. The frictional resisting force (in Newton) per 100 mm length of the bearing is _____

6. What is the significance of the Reynolds number?

7. Classify the hydraulic models.

8. State any two faults and their remedies on centrifugal pump.

PART B - (4 X16 = 64 marks)

09. (a) Fluid flow analysis is based on the properties. Explain the concepts of **(16)**

    (i) Vapour pressure (ii) Partial pressure (iii) Surface tension

(OR)

(b) Two large plane surfaces are 3 cm apart. The space between the surfaces is filled with glycerine. What force is required to drag a very thin plate of surface area 0.5 square metre between the two large plane surfaces at a speed of 0.6 m/s, if: (i) the thin plate is in the middle of the two plane surfaces, and (ii) the thin plate is at a distance of 2 cm from one of the plane surfaces? **(16)**

Take the dynamic viscosity of glycerine = 8.10×10^{-1} Ns/m^2

10. (a) The thrust force, F generated by a propeller is found to depend on the following parameters: diameter D, forward velocity u, density ρ, viscosity μ and rotational speed N. Determine the dimensionless parameters to correlate the phenomenon. **(16)**

(OR)

(b) To predict the drag on an aircraft at a flight speed of 150 m/s, where the condition of air is such that the local speed of sound is 310 m/s, a pressurised low temperature tunnel is used. Density, viscosity and local sonic velocity at tunnel condition are 7.5 kg/m^3, 1.22×10^{-5} Ns/m^2 and 290 m/s. Determine the flow velocity and the scale of the model. Assume full dynamic similarity should be maintained. Density and viscosity at the operating conditions are 1.2 kg/m^3 and 1.8×10^{-5} Ns/m^2. **(16)**

11. (a) Why are Centrifugal pumps used sometimes in series and sometimes in parallel? Draw inlet and outlet velocity triangles for a Centrifugal pump and discuss the direction of various velocities. **(16)**

(OR)

(b) Compare single acting and double acting reciprocating pumps. Explain with neat sketch the working principle of single acting reciprocating pumps. **(16)**

12. (a) A Pelton wheel has mean bucket speed of 12 meters per second with a jet of water flowing at the rate of 700 liters/s under a head of 30 meters. The buckets deflect the jet through an angle of 165^0. Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume the Co-efficient of velocity as 0.98. **(16)**

(OR)

(b) In a Francis turbine installation, the runner inlet is at a mean height of 2 m from tailrace while the outlet is 1.7 m from the tailrace. A draft tube is connected at the outlet. The runner diameter is 1.5 m and runs at 375 rpm. The pressure at runner inlet is 35 m above atmosphere, while the pressure at exit is 2.2 m below the atmosphere. The flow velocity at
inlet is 9 m/s. At output it is 7 m/s. Available head is 62 m. Hydraulic efficiency is 90%. Determine the losses before the runner, in the
runner and at exit. **(16)**