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Question Paper Code : 60847

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Third Semester

Mechanical Engineering

ME 2204/CE 3213/ME 34/CE 1208/080180007/IE 41/10122 ME 305 – FLUID MECHANICS AND MACHINERY

(Common to Aeronautical Engineering, Automobile Engineering, Production Engineering, Mechatronics Engineering, Mechanical and Automation Engineering and Fourth Semester Manufacturing Engineering, Industrial Engineering and Industrial Engineering and Management)

(Regulations 2008/2010)

(Common to PTME 2204/10122 ME 305 – Fluid Mechanics and Machinery for B.E. (Part-Time) Third Semester – Mechanical Engineering-Regulations 2009/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define specific gravity of fluid.

2. What are the properties of ideal fluid?

3. Mention the general characteristics of laminar flow.

4. What are the factors influencing the frictional loss in pipe flow?

5. State the methods of dimensional analysis.

6. What are the limitations of dimensional analysis?

7. Define hydraulic efficiency of a turbine.

8. What is the difference between radial flow and axial flow turbo machines?

9. What is the function of air vessel in reciprocating pumps?

10. Write the classification of positive displacement rotary pumps.

PART B — (5 × 16 = 80 marks)

11. (a) The velocity distribution for flow over a flat plate is given by $u=(2/3)y-y^2$, Where u is the point velocity in metre per second at a distance y metre above the plate. Determine the shear stress at y=0 and y=15 cm. Assume dynamic viscosity as 8.63 poise. (16)

Or

(b) Calculate the capillary rise in glass tube of 3 mm diameter when immersed in mercury, take the surface tension and angle of contact of mercury as 0.52 N/m and 130° respectively. Also determine the minimum size of the glass tube, if it is immersed in water, given that the surface tension of water is 0.0725 N/m and Capillary rise in tube is not to exceed 0.5 mm. (16)

12. (a) A main pipe divides into two parallel pipes, which again forms one pipe. The length and diameter for the first parallel pipe are 2000 m and 1 m respectively, while the length and diameter of second parallel pipe are 2000 m and 0.8 m respectively. Find the rate of flow in each parallel pipe, if the total flow in the main is 3 m^3/s. The coefficient of friction for each parallel pipe is same and equal to 0.005. (16)

Or

(b) The rate of flow of water through a horizontal pipe is 0.3 m^3/s. The diameter of the pipe is suddenly enlarged from 25 cm to 50 cm. The pressure intensity in the smaller pipe is $14N/m^2$. Determine (i) Loss of head due to sudden enlargement. (ii) Pressure intensity in the large pipe and (iii) Power lost due to enlargement. (16)

13. (a) (i) State Buckingham's π-theorem.

(ii) The efficiency η of a fan depends on density ρ, dynamic viscosity μ of the fluid, angular velocity ω, diameter D of the rotor and the discharge Q. Express η in terms of dimensionless parameters. (16)

Or

(b) The pressure difference Δp in a pipe of diameter D and length l due to turbulent flow depends on the velocity V, viscosity μ, density ρ and roughness k. Using Buckingham's π-theorem, obtain an expression for Δp. (16)

14. (a) A pelton turbine is required to develop 9000 kW when working under a head of 300 m. The impeller may rotate at 500 rpm. Assuming a jet ratio of 10 and an overall efficiency of 85% calculate (i) Quantity of water required. (ii) Diameter of the wheel (iii) Number of jets (iv) Number and size of the bucket vanes on the runner. (16)

Or

(b) A Kaplan turbine develops 20000 kW at a head of 35 m and at rotational speed of 420 rpm. The outer diameter of the blades is 2.5 m and the hub diameter is 0.85 m. If the overall efficiency is 85% and the hydraulic efficiency is 88%. Calculate the discharge, the inlet flow angle and the blade angle at the inlet. (16)

15. (a) The cylinder bore diameter of a single acting reciprocating pump is 150 mm and its stroke is 300 mm. The pump runs at 50 RPM and lifts water through a height of 25 m. The delivery pipe is 22 m long and 100 mm in diameter. Find the theoretical discharge and the theoretical power required to run the pump. If the actual discharge is 4.2 litre/s, find the percentage slip. Also determine the acceleration head at the beginning and middle of the delivery stroke. (16)

Or

(b) A single-acting reciprocating pump has a plunger 10 cm diameter and a stroke of length 200 mm. The centre of the pump is 4 m above the water level in the sump and 14 m below the level of water in a tank to which water is delivered by the pump. The diameter and length of suction pipe are 40 mm and 6 m while of the delivery pipe are 30 mm and 18 m respectively. Determine the maximum speed at which the pump may be run without separation, if separation occurs at 7.848 N/cm^2 below the atmospheric pressure. Take atmospheric pressure head = 10.3 m of water. (16)