Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 91636

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

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)

(Regulation 2008/2010)

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

Time : Three hours Maximum : 100 marks

Any missing data can be suitably assumed with justification.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Brief on the significance of vapour pressure.

2. State the empirical pressure density relation for a liquid.

3. What is meant by laminar flow instability?

4. State the importance of Moody's chart.

5. Brief on dimensional variables with examples.

6. What is meant by kinematic similarity?

7. Draw the velocity triangles for the pelton wheel.

8. Define – Net Positive Suction Head.

9. What are the materials used for manufacturing reciprocating pumps?

10. List the advantages of double acting reciprocating pumps.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Determine the velocity of a jet directed at 35° to the horizontal to clear 8 m height at a distance of 22 m. Also determine the maximum height this jet will clear and the total horizontal travel. What will be the horizontal distance at which the jet will be again at 8 m height? (10)

(ii) The viscosity of a fluid is to be measured by a viscometer constructed of two 80-cm-long concentric cylinders. The outer diameter of the inner cylinder is 16 cm, and the gap between the two cylinders is 0.12 cm. The inner cylinder is rotated at 210 rpm, and the torque is measured to be 0.8 N m. Determine the viscosity of the fluid. (6)

Or

(b) (i) A cylinder of radius 0.65 m filled partially with a fluid and axially rotated at 18 rad/s is empty upto 0.3 m radius. The pressure at the extreme edge at the bottom was 0.3 bar gauge. Determine the density of the fluid. (10)

(ii) Determine the gage pressure inside a soap bubble of diameter 0.25 cm and 6 cm at 22°C. (6)

12. (a) (i) Kerosene (SG = 0.810) at a temperature of 22°C flows in a 75-mm diameter smooth brass pipeline at a rate of 0.90 lit/s. Find the friction head loss per meter, For the same head loss, what would be the flow rate if the temperature of the kerosene were raised to 40°C? (10)

(ii) Discuss on minor losses in pipe flow. (6)

Or

(b) (i) Water at 20°C flow through a 160-mm-diameter pipe with roughness of 0.015 mm. If the mean velocity is 6 m/s, what is the nominal thickness of the viscous sub-layer? What will be the viscous sub-layer if the velocity is increased to 7.2 m/s? (10)

(ii) Discuss on hydraulic and energy gradient. (6)

13. (a) (i) Vortex shedding at the rear of a structure of a given section can create harmful periodic vibration. To predict the shedding frequency, a smaller model is to be tested in a water tunnel. The air speed is expected to be about 75 kmph. If the geometric scale is 1 : 6.5 and the water temperature is 25°C determine the speed to be used in the tunnel. Consider air temperature as 38°C. If the shedding frequency of the model was 60 Hz, determine the shedding frequency of the prototype. The dimensions of the structure are diameter 0.12 m and height 0.36 m. (10)

(ii) Discuss on the applications of dimensionless parameters. (6)

Or

(b) (i) Oil is moved up in a lubricating system by a rope dipping in the sump containing oil and moving up. The quantity of oil pumped Q, depends on the speed u of the rope, the layer thickness δ, the density and viscosity of the oil and acceleration due to gravity. Obtain the dimensionless parameters to correlate the flow. (10)

(ii) Discuss on Buckingham's Π theorem. (6)

14. (a) (i) A centrifugal pump delivers 0.18 m^3/s of water against a head of 15 m and runs at 620 rpm. The outer and inner diameters of impeller are 0.4 m and 0.2 m respectively and the vanes are bent back at 38° C to the tangent at exit. If the area of flow remains at 0.1 m^2 from inlet to outlet, calculate manometric efficiency, vane angle at inlet and loss of head at inlet to impeller when the discharge is reduced by 40% without changing the speed. (10)

(ii) Discuss on the performance characteristics of centrifugal pumps. (6)

Or

(b) (i) Calculate guide blade angles, vane angles, runner diameters at inlet and outlet and width of the wheel at outlet for a Francis turbine with the following data : Net head : 70 m; Speed : 720 rpm; Shaft Power : 310 kW; Overall efficiency : 0.85; Hydraulic efficiency : 0.9; Flow ratio : 0.2; Breadth ratio : 0.1; OD/ID ratio : 1.8; The thickness of vanes occupy 7.5% of circumferential area of runner velocity of flow is Constant and discharge is radial at outlet. (10)

(ii) Discuss on the cascade theory. (6)

15. (a) Explain the various types of rotary pumps with its construction details and its applications. (16)

Or

(b) Explain in detail about the concept of pressure vessels with its characteristics. (16)
