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

Question Paper Code : 11520

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2012.

Third Semester

Mechanical Engineering

ME 2204/CE 3213/ME 34/CE 1208/10122 ME 305/080180007 — FLUID MECHANICS AND MACHINERY

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

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define Newton's law of viscosity.

2. Write the continuity equation.

3. Write the Hagen-Poiseuille equation for laminar flow.

4. What is the use of moody's diagram?

5. Define Reynolds number.

6. State the Buckingham π theorem.

7. What is meant by hydraulic efficiency of turbine?

8. Define flow ratio of reaction radial flow turbine.

9. Mention the main parts of the Centrifugal pump.

10. Define slip of Reciprocating pump.

PART B — (5 × 16 = 80 marks)

11. (a) The space between two square flat parallel plate is filled with oil. Each side of the plate is 600 mm. The thickness of the oil films is 12.5 mm. The upper plate, which moves at 2.5 m/s requires a force of 98.1 N to maintain the speed. Determine

(i) The dynamics viscosity of the oil in poise and

(ii) The kinematic viscosity of the oil in strokes if the specific gravity of the oil is 0.95. (16)

Or

(b) Derive the Euler's equation of motion and deduce the expression to Bernoulli's equation. (16)

12. (a) (i) A plate of 600 mm length and 400 mm wide is immersed in a fluid of specific gravity 0.9 and kinematic viscosity of (υ) = 10^{-4} m^2/s. the fluid is moving with the velocity of 6 m/s. determine

(1) Boundary layer thickness

(2) Shear stress at the end of the plate and

(3) Drag force on one the sides of the plate. (10)

(ii) Derive Chezy's formula for loss of head due to friction in pipes. (6)

Or

(b) A 150 mm diameter pipe reduces in diameter abruptly to 100 mm diameter. If the pipe carries water at 30 liters per second, calculate the pressure loss across the contraction. Take coefficient of contraction as 0.6. (16)

13. (a) Derive on the basis of dimensional analysis suitable parameters to present the thrust developed by a propeller. Assume that the thrust P depends on the angular velocity w, speed of advance V, diameters D, dynamic viscosity μ, mass density ρ, and elasticity of the fluid medium which can be denoted by the speed of sound in the medium 'C'. (16)

Or

(b) A pipe of diameter 1.5 m is required to transport an oil of specific gravity 0.90 and viscosity 3×10^{-2} poise at the rate of 3000 litre/sec. Tests were conducted on a 15 cm diameter pipe using water at 20°C. Find the velocity and the rate of flow in the model. Viscosity of water at 20°C = 0.01 poise. (16)

14. (a) The following data is given for a Francis turbine. Net head H = 60 m, speed N = 700 rpm, shaft power = 294.3 kW, overall efficiency = 84%, hydraulic efficiency = 93%, flow ratio = 0.20, breadth ratio n = 0.1, outer diameter of runner = 2 × inner diameter of runner, the thickness of vanes occupies 5% of circumferential area of runner, velocity of flow is constant at inlet and outlet and discharge is radial at outlet. Determine :

(i) Guide blade angle

(ii) Runner vane angle at inlet and outlet

(iii) Diameter of runner at inlet and outlet

(iv) Width of the wheel at inlet. (16)

Or

(b) A pelton wheel has a mean bucket speed of 10 m/s with a jet of water flowing at the rate of 0.7 m^3/s under a head of 30 m. If the buckets deflect the jet through an angle of 160°. Calculate the power given by water to the runner and hydraulic efficiency of turbine. Assume the coefficient of velocity of 0.98. (16)

15. (a) The cylinder bore diameter and stroke of a single acting reciprocating pump are 150 mm and 300 mm respectively. The pump runs at 50 rpm and lifts water to a height of 25 m. The delivery pipe is 22 m long 100 mm in diameter. Find the theoretical discharge and theoretical power required to run the pump. If the actual discharge is 4.2 liters/s, find the percentage of slip. (16)

Or

(b) The internal and external diameters of the impeller of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1200 rpm, the vane angle of the impellor at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially and the velocity of flow is constant. Determine the work done by the impeller per unit weight of water. (16)
