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

Question Paper Code : 80839

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Third/Fourth Semester

Mechanical Engineering

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

(Common to Manufacturing Engineering/Industrial Engineering and Management/ Aeronautical Engineering/Automobile Engineering/Industrial Engineering/ Mechanical and Automation Engineering/Mechatronics Engineering/ Production Engineering)

(Regulations 2008/2010)

(Also common to PTME 2204 for B.E. (Part-Time) Third Semester – Mechanical Engineering – Regulations 2009)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define relative or specific viscosity.

2. What do you understand by impulse momentum equation?

3. What are the uses of Moody's diagram?

4. State boundary layer thickness with a neat sketch.

5. State Buckingham's π theorem.

6. Define Reynolds number and state its significance.

7. What is the function of volute casing?

8. Define specific speed of a centrifugal pump, giving its importance.

9. Define Slip. What conditions lead to a negative slip?

10. When will you select reciprocating pump for your use?

PART B — (5 × 16 = 80 marks)

11. (a) (i) A liquid is compressed in a cylinder having a volume of 0.012 m^3 at a pressure of 690 N/cm^2. What should be the new pressure in order to make its volume 0.0119 m^3? Assume bulk modulus of elasticity (K) for the liquid = 6.9×10^4 N/cm^2. (8)

(ii) A 15 cm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 15.10 cm. Both cylinders are 25 cm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque of 12.0 Nm is required to rotate the inner cylinder at 100 r.p.m., determine the viscosity of the fluid. (8)

Or

(b) (i) State Bernoulli's theorem and assumptions for steady flow of an incompressible fluid. (4)

(ii) The water is flowing through a taper pipe of length 100 m having diameters 600 mm at the upper end and 300 mm at the lower end, at the rate of 50 litres/s. The pipe has a slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher level is 19.62 N/cm^2. (12)

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) A centrifugal pump is required to deliver 300 litres of water per second against a head of 20 m. If the vanes of the impeller are radial at outlet and the velocity of flow is constant and equal to 2 m/s find the proportions of the pump. Assume $\eta_{mano} = 80\%$ and the ratio of breadth to diameter at outlet as 0.1.

13. (a) The discharge Q through a pump depends on the brake horse power P, the diameter d, speed in rpm N, the energy to be imparted per unit mass gH, the dynamic viscosity μ and specific mass p. Find the dimensionless parameters affecting the phenomenon.

Or

(b) Model studies are done on a 1/5 scale model at 1200 rpm. The head developed and power input were found to be 10 m and 4.5 kW respectively. The discharge was found to be 35 liters/sec. Find the efficiency. If the prototype runs at 360 rpm, find the head developed, discharge and power required for the prototype.

14. (a) A reaction turbine 0.5 m diameter when running at 500 rpm develops 265 KW the flow through the turbine in 0.9 m^3/s. The pressure head at entrance to the turbine is 28 m, the elevation of the turbine above the tail water level is 1.5 n and the velocity of flow at entrance to the turbine in 3.5 m/s. Assuming the runner vane angle at inlet as 900, calculate the effective head on the turbine and the efficiency.

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 14 N/m^2. Determine

(i) Loss of head due to sudden

(ii) Pressure intensity in the large pipe and

(iii) Power lost due to enlargement. (16)

15. (a) Determine the maximum speed in rpm at which a single acting reciprocating pump without an air vessel of the following details can be operated without causing separation at any stage during the operation of the pump. Compute the discharge at this speed. What would be the speed and discharge if air vessel is fitted near the pump on the suction side? The fluid is water. Assume f = 0.01 for the pipes. Diameter of plunger = 15 cm, stroke = 22.5 cm. suction pipe diameter = 10 cm. length 50 m, static suction head = 4 m, static delivery head = 25 m, atmospheric pressure = 101 KPa and vapour pressure of water = 25.5 KPa (abs). (16)

Or

(b) Write a short note on following types of rotary pumps :

(i) Internal gear pump (4)

(ii) External gear pump (4)

(iii) Vanes pumps (4)

(iv) Roots pump. (4)