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Question Paper Code : 21847

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

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. Give the dimensions of the following : (a) Torque (b) Momentum.

2. Define capillarity and surface tension.

3. What are the minor losses in pipes?

4. Explain what is meant by a smooth pipe?

5. Give the applications of dimensional analysis.

6. What are distorted models? What are their advantages and disadvantages?

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 horizontal shaft of diameter 5cm rotates at a speed of 1200 rpm, inside a sleeve of length 10cm. The clearance between the shaft and the sleeve is 1mm. If it is lubricated with an oil of dynamic viscosity 3.5 poise, find the HP lost in the bearing. (8)

(ii) A 30cm diameter pipe conveying water, branches into two pipes of diameter 20cm and 15cm respectively. If the average velocity in the 30cm diameter pipe is 2.5m/s, find the total discharge in this pipe. Also determine the velocity in the 15cm pipe if the average velocity in the 20cm diameter pipe is 2 m/s. (8)

Or

(b) A discharge of 30 liters/sec of oil (SG = 0.81) occurs downwards through a conveying pipe line held inclined at 60° to the horizontal. The inlet diameter is 2cm and the outlet diameter is 15cm and the length of the pipe is 2m.If the pressure at the top of the inlet is 0.8 kgf/cm^2, find the pressure at the outlet. Neglect the energy loss.

12. (a) A smooth pipe carries 6.5 liters/sec of water at 20°C (Kinematic viscosity = 10^{-6} m^2/s) with a head loss of 7.5cm per 10m length. Determine the diameter of the pipe.

Or

(b) Two reservoirs are connected by a pipe line consisting of a 400m long pipe of 20cm diameter in series with a 600m long pipe of 30cm diameter. The difference in water level between the reservoirs is 8m. If friction factor for the bigger pipe is 0.01 and for the smaller pipe is 0.016, find the discharge. Account for all the losses. Sketch the hydraulic grade line.

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 ρ. 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 l0m and 4.5 kW respectively. The discharge was found to be 35 liters/sec. Find the efficiency. If the prototype runs at 360rpm, find the head developed, discharge and power required for the prototype.

14. (a) Give the classification of turbo machines. Explain the working principle, construction and operation of a centrifugal pump and also discuss the velocity triangles for flow in a centrifugal pump.

Or

(b) An inward flow reaction turbine is required to produce a power of 280 kW at 200rpm. The effective head on the turbine is 20m. The inlet diameter is twice as the outlet diameter. Assume hydraulic efficiency as 80%. The radial velocity is 3.5m/s and is constant. The ratio of breadth to wheel diameter is 0.1 and 5% of the flow area is blocked by vane thickness. Determine the inlet and outlet diameters, inlet and exit vane angle and guide blade angle at the inlet. Assume radial discharge.

15. (a) What are air vessels? Explain their purpose and principle of working. Derive an expression for the work saved against friction in the case of a single acting pump with an air vessel.

Or

(b) Explain the working principle of double acting reciprocating pump, external gear pump and vane pump with neat diagram in detail.