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

Question Paper Code : C 1366

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2010.

Third Semester

Mechanical Engineering

ME 1202 — FLUID MECHANICS AND MACHINERY

(Regulation 2004)

(Common to B.E. Aeronautical Engineering, Automobile Engineering, Production Engineering and Mechatronics Engineering)

(Common to B.E. (Part-Time) Second Semester – Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by vapour pressure of a fluid?

2. Distinguish between atmospheric pressure and gauge pressure.

3. Define: Stream function

4. What are the applications of Bernoulli's theorem?

5. State the characteristics of laminar flow.

6. Mention the types of minor losses.

7. Classify fluid machines.

8. What is meant by specific speed of a turbine?

9. Why is priming necessary in centrifugal pumps?

10. What are the functions of an air vessel?

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) The velocity distribution over a plate is given by $u = 2y - y^2$, where u is the velocity in m/sec at a distance of y metre above the plate. Determine the velocity gradient and shear stress at the boundary and 1.5 m from it. Dynamic viscosity of the fluid is 0.9 N.s/m^2. (8)

(ii) State and prove Pascal's Law. (8)

Or

(b) (i) Determine the mass density, specific volume and specific weight of a liquid whose specific gravity 0.85. (8)

(ii) What is capillarity? Derive an expression for capillary rise. (8)

12. (a) (i) In a three dimensional incompressible fluid flow, the velocity components in x and y directions are $u = x^2 + y^2 z^3$ and $v = -(xy + yz + zx)$. Use continuity equation to evaluate an expression for the velocity component w in the z direction. (8)

(ii) State the similarity laws used in model analysis. (8)

Or

(b) (i) Derive Bernoulli's theorem and state its limitations. (10)

(ii) A horizontal venturimeter with inlet diameter 200 mm and throat diameter 100 mm is employed to measure the flow of water. The reading of the differential manometer connected to the inlet is 180 mm of mercury. If $C_d = 0.98$, determine the rate of flow. (6)

13. (a) Derive an expression for head loss through pipes due to friction. (16)

Or

(b) The velocity distribution in the boundary layer is given by $u/U = y/\delta$, where u is the velocity at a distance y from the plate $u = U$ at $y = \delta$, δ being boundary layer thickness. Find the displacement thickness, momentum thickness and energy thickness. (16)

14. (a) (i) Write a note on performance curves of turbine. (4)

(ii) Explain the component parts and working of a Pelton wheel turbine. (12)

Or

(b) A Francis turbine with an overall efficiency of 76% and hydraulic efficiency of 80% is required to produce 150 kW. It is working under a head of 8 m. The peripheral velocity is $0.25\sqrt{2gH}$ and radial velocity of flow at inlet is $0.95\sqrt{2gH}$. The wheel runs at 150 rpm. Assuming radial discharge, determine (i) Flow velocity at outlet (ii) The wheel angle at inlet (iii) Diameter and width of the wheel at inlet.

15. (a) (i) Show that the work done by a reciprocating pump is equal to the area of the indicator diagram. (6)

(ii) Classify pumps. Explain the working of a double acting reciprocating pump with a neat diagram. (10)

Or

(b) A centrifugal pump running at 800 rpm is working against a total head of 20.2 m. The external diameter of the impeller is 480 mm and the outlet width is 60 mm. If the vane angle at outlet is 40° and manometric efficiency is 70%, determine (i) Flow velocity at outlet, (ii) Absolute velocity of water leaving the vane. (iii) Angle made by the absolute velocity at outlet with the direction of motion. (iv) Rate of flow through the pump.

———————