LIB

3/6/13AN

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

Question Paper Code : 23574

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Third Semester

Mechanical Engineering

ME 1202/CE 1207/070120003 — FLUID MECHANICS AND MACHINERY

(Common to Aeronautical Engineering /Automobile Engineering /Mechatronics Engineering and Production Engineering)

(Regulation 2004/2007)

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

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define "Mass Density" and express its unit.

2. What is Newtonian Fluid?

3. Name any two device used for measuring the rate of flow of a fluid flowing through a pipe.

4. State "Buckingham's π theorem".

5. Write down the Darcy-weisback's equation to estimate the loss of head due to friction in pipes.

6. Define the terms "Drag" and "Lift".

7. Differentiate Turbines and Pumps.

8. Define "Specific speed of a Turbine".

9. Define "Slip" of the reciprocating pump.

10. Mention the components of a reciprocation pumps.

PART B — (5 × 16 = 80 marks)

11. (a) (i) State and prove Pascal's law. (10)

(ii) Define the following terms:

(1) Specific weight

(2) Specific Gravity

(3) Dynamic Viscosity. (6)

Or

(b) (i) Prove that the relationship between surface tension and pressure inside a hollow bubble in excess of outside pressure is given by $P=8\sigma/d$. (8)

(ii) The right limb of a simple U-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The center of the pipe is 12 cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 20 cm. (8)

12. (a) (i) Derive the Bernoulli's equation from Euler's equation of motion. State its assumptions. (10)

(ii) A horizontal venturimeter with inlet and throat diameters 30cm and 15cm respectively is used to measure the flow of water. The reading of differential manometer connected to the inlet and the throat is 20 cm of mercury. Determine the rate of flow. Take $C_d = 0.98$. (6)

Or

(b) (i) The frictional torque T of a disc of diameter D rotating at a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given by $T= D^5 N^2 \ \rho\phi\left[\frac{\mu}{D^2 N\rho}\right]$. Prove this by method of dimensions using Buckingham's π theorem. (10)

(ii) A stream function is given by $\Psi = 5x-6y$. Calculate the velocity components and also magnitude and direction of the resultant velocity at any point. (6)

13. (a) (i) Calculate the discharge through a pipe of diameter 200 mm when the difference of pressure head between the two ends of a pipe 500m apart is 4m of water. Take the value of f=0.009 in the Darcy-weisback's equation. (8)

(ii) Find the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $\frac{u}{U}=\frac{y}{\delta}$ where u is the velocity at a distance y from the plate and u=U at y=δ where δ=boundary layer thickness. (8)

Or

(b) Derive the Hagen-Poiseuille formula used to find the loss of pressure head when viscous fluid flow through circular pipe. Also derive the condition of maximum velocity.

14. (a) (i) The hub diameter of a Kaplan turbine, working under a head of 12m is 0.35 times the diameter of the runner. The turbine is running at 100rpm. If the vane angle of the extreme edge of the runner at outlet is 15^0 and flow ration 0.6, find

(1) Diameter of the runner.

(2) Diameter of the boss, and.

(3) Discharge through the runner.

The velocity of whirl at outlet is given as zero. (8)

(ii) A pelton turbine develops 3000kW under a head of 300m. The overall efficiency of the turbine is 83%. If speed ratio = 0.46, C_v = 0.98 and specific speed is 16.5, then find out

(1) Diameter of the Turbine, and. (4)

(2) Diameter of the jet. (4)

Or

(b) (i) With a neat sketch, explain the working of a pelton wheel. (8)

(ii) Compare impulse turbine and reaction turbine. (8)

15. (a) Draw a neat sketch of a reciprocating pumps. List the components and briefly explain their functions.

Or

(b) (i) Explain in detail the working of a vane pumps with a neat diagram. (8)

(ii) Define Specific speed of a centrifugal pump. Derive an expression in terms of head 'H', discharge 'Q' and speed 'N'. (8)