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SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act,1956)

Course & Branch :B.E - AERO/AUTO/M&P/MECH
Title of the Paper :Fluid Mechanics and Machinery Max. Marks :80
Sub. Code :6C0066 Time : 3 Hours
Date :12/11/2009 Session :FN

PART - A (10 x 2 = 20)

Answer ALL the Questions

1. What is the difference between kinematic viscosity and dynamic viscosity? State their units of measurements.

2. Define the terms 'buoyancy' and 'centre of buoyancy'.

3. Distinguish between steady flow and unsteady flow.

4. Find the discharge of water flowing over rectangular notch of 3 m length when the constant head of water over the notch is 40 cm. Take coefficient of discharge $C_d = 0.6$.

5. Define co-efficient of velocity of an orifice.

6. What do you understand by turbulent flow? What factor decides the types of flow in pipes?

7. Define cavitation. What are the effects of cavitation?

8. Define slip and negative slip of a reciprocating pump.

9. What is a draft tube? What are its functions?

10. What do you mean by fundamental units and derived units?

PART – B (5 x 12 = 60)

Answer All the Questions

11. (a) Explain the following fluid properties

(a) Density (b) viscosity

(c) Specific weight (d) Capillarity (8)

(b) State Newton's law of viscosity and give examples of its application. (4)

(or)

12. (a) Determine the total pressure on a circular plate of diameter 1.5 m which placed vertically in water in such a way that centre of plate is 2 m below the free surface of the water. Find the position of centre of pressure also.

(b) A uniform body of size 4 m long X 2 m wide X 1 m deep floats in water. What is the weight of the body if the depth of immersion is 0.6 m? Determine the meta-centric height also.

13. The water is flowing through a pipe having diameters of 20 cm and 15 cm at sections 1 and 2 respectively. The rate of flow through the pipe is 40 liters/s. The section 1 is 6 m above the datum line and section 2 is 3 m above the datum. If the pressure at section 1 is 29.43 N/cm^2, Find the intensity of pressure atsection 2.

(or)

14. A horizontal venturimeter with inlet and throat diameter 300 mm and 100 mm respectively is used to measure the flow of water. The pressure intensity at inlet is 130 kN/m^2 while the vacuum pressure head at throat is 350 mm of mercury. Assuming 3% head lost between the inlet and the throat, find the value of co-efficient of discharge for the venturimeter and also determine the rate of flow.

15. (a) Find the discharge through a rectangular orifice 3.0 m wide and 2 m deep fitted to a water tank. The water level in the tank is

4 m above the top edge of the orifice, take co-efficient of discharge $C_d = 0.62$

(b) A 25 mm diameter nozzle discharges 0.76 m^3 of water per minute when the head is 60 m. The diameter of the jet is 22.5 mm. Determine the values of three hydraulic co-efficients.

(or)

16. The difference in water surface levels in two tanks which are connected by three pipes in series of lengths 300 m, 170 m and 210 m and diameters 300 mm, 200 mm and 400 mm respectively, is 12 m. Determine the rate of flow of water if co-efficient of friction are 0.005, 0.0052 and 0.0048 respectively, considering:
(a) minor losses also (b) neglecting minor losses.

17. (a) Sketch the operating characteristic curves of a centrifugal pump. (4)

(b) A centrifugal pump impeller has an outer diameter of 30 cm and an inner diameter of 15 cm. the pump runs at 1200 r.p.m. The impeller vanes are set at a blade angle of 30° at the outlet. If the velocity of flow constant at 2.0 m/s, calculate
(i) the velocity and direction of water at outlet,
(ii) the head developed assuming a manometric efficiency of 0.85, and
(iii) the blade angle at the inlet. (8)

(or)

18. (a) Define indicator diagram. Prove that area of indicator diagram is proportional to the work done by the reciprocating pump

(b) A single acting reciprocating pump runs at 30 r.p.m., delivers 0.012 m^3/s of water. The diameter of the piston is 25 cm and stroke length 50 cm. Determine
(i) the theoretical discharge of the pump,
(ii) co-efficient of discharge, and
(iii) percentage slip of the pump.

19. The pressure difference Δp in pipe of diameter D and length L due to viscous flow depends on the velocity V, viscosity μ and density ρ. Using Buckingham's - Π theorem, obtain an expression for Δp.

(or)

20. (a) What are unit quantities? Define the unit quantities of a turbine. (4)

(b) A Kaplan turbine develops 15000 kW power at a head of 30m. the diameter of the boss is 0.35 times the diameter of the runner.

Assuming a speed ratio of 2.0, a flow ratio of 0.65 and an overall efficiency of 90% calculate

(i) diameter of the runner,

(ii) rotational speed and

(iii) specific speed (8)