SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act, 1956)

Course & Branch: B.E - Mechanical/ Mechanical & Production/ Aeronautical
Title of the paper: Fluid Mechanics & Machinery
Semester: III Max. Marks: 80
Sub.Code: 6C0066 Time: 3 Hours
Date: 29-04-2008 Session: AN

PART – A (10 x 2 = 20)

Answer All the Questions

1. Define specific gravity of a fluid.

2. State Newton's law of viscosity.

3. State Bernoulli's theorem for steady flow of an incompressible fluid.

4. What is the difference between a notch and a weir?

5. What are hydraulic coefficients? Name them.

6. Explain the term: Equivalent pipe.

7. Why priming of pump is necessary?

8. Define slip of a reciprocating pump.

9. What is a draft tube?

10. Differentiate between the turbines and pumps.

PART – B (5 x 12 = 60)

Answer All the Questions

11. (a) The capillary rise in the glass tube is not to exceed 0.2mm of water. Determine its minimum size, given that surface tension for water in contact with air is 0.0725 N/m. (4)

(b) A flat plate of area 1.5×10^4 cm^2 is pulled with a speed of 0.4 m/s relative to another plate located at a distance of 0.15mm form it. Find the force and power required to maintain this speed, if the fluid separating them is having viscosity as 0.1 Ns/m^2. (8)

(or)

12. (a) define the following: Buoyancy and Metacentre. (4)

(b) A uniform body of size 3m long x 2m wide x 1m deep floats in water. What is the weight of the body if the depth of immersion is 0.8m? Determine the metacentric height. (8)

13. (a) state the assumptions made in the derivation of Bernoulli's equation. (4)

(b) The water is flowing through a pipe having diameters 20 cm and 10cm at a section 1 and 2 respectively. The rate of flow through the pipe is 35 1/s. the section 1 is 6m above datum and section 2 is 4m above datum. If the pressure at section 1 is 39.24 N/cm^2, find the intensity of pressure at section 2. (8)

(or)

14. (a) A horizontal venturimeter with inlet diameter 20cm and throat diameter 10cm is used to measure the flow of water. The pressure at inlet is 17.658 N/cm^2 and the vacuum pressure at the throat is 30cm of mercury. Find the discharge of water through Venturimeter. Take C_d=0.98 (8)

(b) What are the advantages of triangular notch over the rectangular notch? (4)

15. (a) Calculate (i) the pressure gradient along flow,
(ii) the average velocity, and
(iii) the discharge for an oil of viscosity 0.02 Ns/m^2 flowing between two stationary parallel plates 1m wide maintained 1cm apart. The velocity midway between the plate is 2m/s. (9)
(b) A rectangular orifice 0.9m wide and 1.2m deep is discharging water form a vessel. The top edge of the orifice is 0.6m below the water surface in the vessel. Calculate the discharge through the orifice if coefficient of discharge is 0.6. (3)

(or)

16. The difference in water surface levels in two tanks, which are connected by three pipes in series of lengths 300m, 170m and 210m and of diameter 30cm, 20cm, 40cm respectively is 12m. Determine the rate of flow of water if coefficient of friction are 0.005, 0.0052 and 0.0048 respectively, considering:
(a) minor losses also (b) neglecting minor losses.

17. The cylinder bore diameter of a single acting reciprocating pump is 150mm and its stroke is 300mm. The pump runs at 50 rpm and lifts water through a height of 25m. The delivery pipe is 22m long and 100mm in diameter. Find the theoretical discharge and the theoretical power required to run the pump. If the actual discharge is 4.2 1/s, find the % slip. Also determine the acceleration head at the beginning and middle of the delivery stroke.

(or)

18. The outer diameter of an impeller of a centrifugal pump is 40cm and outlet width 5cm. The pump is running at 800 rpm and is working against a total head of 15m. The vane angle at outlet is 40° and manometric efficiency id 75% Determine:
(a) Velocity of flow at outlet

(b) velocity of water leaving the vane, and
(c) angle made by the absolute velocity at outlet with the direction of motion at outlet, and
(d) discharge.

19. A Pelton wheel is to be designed for the following specifications: Power = 16kW, Head = 380m, Speed = 750 rpm. Overall efficiency = 86%, jet diameter is not exceed one sixth of the wheel diameter. Determine:

(a) the wheel diameter
(b) No of jets required, and
(c) Diameter of the jet. Take coefficient velocity as 0.985 and speed ratio as 0.45.

(or)

20. A Francis turbine has inner diameter of wheel, 0.6 times the outer diameter. Water enters the turbine at 12° tangents to the wheel. Blade angles are radial at inlet. Velocity of flow is constant through the turbine and is 2.5m/sec. Speed of the runner is 280 rpm. The width of the wheel at the inlet is 10cm. 5% of area of the flow is blocked by the runner blades. Determine:
(a) Working head,
(b) diameters at inlet and outlet,
(c) blade angle at outlet,
(d) power produced.