Register Number: ……..

B.E DEGREE EXAMINATIONS:APRIL/MAY 2014

(Regulation 2009)

Third Semester

MECHATRONICS ENGINEERING

MCT103**:** Fluid Mechanics and Machinery

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Capillarity is a function of
   a) Surface tension b) Diameter of the tube
   c) Both surface tension and tube diameter d) Viscosity
2. The unit of kinematic viscosity is
   a) m^2/s b) m^3/s
   c) m/s d) m/s^2
3. The range of coefficient of discharge for a venturimeter is
   a) 0.5 to 0.99 b) 0.8 to 0.9
   c) 0.90 to 0.95 d) 0.95 to 0.99
4. Which of the following is used to measure the difference in pressure between two points in a pipe, or in two different pipes?
   a) Piezometer b) Barometer
   c) Differential manometer d) Single column manometer
5. Due to which of the following phenomena water hammer is caused
   a) Sudden opening of a valve in a pipeline b) Sudden closure (partial or complete) of a valve in pipe flow
   c) Incompressibility of fluid d) Elastic nature of pipe material
6. The maximum efficiency for maximum transmission of power through pipes is
   a) 33.33% b) 66.66%
   c) 50% d) 70%
7. Which among the following is an impulse turbine?
   a) Pelton wheel turbine b) Kaplan turbine
   c) Francis turbine d) Propeller turbine

8. In a reaction turbine
   a) Flow can be regulated without loss b) Outlet must be above the tail race
   c) There is only partial conversion of available head to velocity head before entry to the runner d) Water may be allowed to enter a part or whole of wheel circumference.
9. Which of the following does not belong to the class of positive displacement pumps
   a) Centrifugal pump b) Gear pump
   c) Reciprocating pump d) Vane pump
10. What will happen to the pressure of liquid inside a centrifugal pump which is made to run with the delivery valve kept fully closed?
   a) Becomes zero b) Remains constant
   c) Falls d) Rises

PART B (10 x 2 = 20 Marks)

11. Define the terms density and specific weight.
12. Distinguish between Newtonian and Non-Newtonian fluids.
13. How to determine laminar flow and turbulent flow based on Reynold's number?
14. List four devices which apply Bernoulli's equation.
15. State Hagen-Poissueille's equation.
16. Mention some uses of siphon.
17. Give the range of head of water recommended for Pelton wheel, Francis turbine and Kaplan turbine.
18. What is the necessity of draft tube in a turbine?
19. Brief a reciprocating pump.
20. What is meant by cavitation in centrifugal pumps?

PART C (5 x 14 = 70 Marks)

21. a) A cylindrical shaft of diameter 90 mm rotates about a vertical axis inside a fixed cylindrical tube of length 50 cm and 95 mm internal diameter. If the space between the tube and the shaft is filled by a lubricant of dynamic viscosity 2.0 poise, determine the power required to overcome viscous resistance when the shaft is rotated at a speed of 240 rpm.

(OR)

b) A pipe containing water at 170 kN/m^2 pressure is connected by a differential gauge to another pipe 1.5 m lower than the first pipe and containing water at high pressure. If the difference of heights of two mercury columns of gauge is equal to 7.5 cm, find pressure in the lower pipe. Take specific gravity of mercury as 13.6

22. a) Derive the continuity equation for the three dimensional flow.

(OR)

b) Calculate the flow rate through a venturimeter placed at 30˚ to the horizontal carrying gasoline of specific gravity 0.8. The diameters at inlet and throat are 50 mm and 30 mm respectively. A mercury manometer reads a level difference of 100 mm at these two points.

23. a) In a smooth pipe of 200 mm diameter and 0.8 m length, an oil of specific gravity 0.8 is flowing at the rate of 0.5 m^3/s. Find (i) head loss due to friction (ii) power required to maintain the flow. Take kinematic viscosity of oil as 0.3 stoke.

(OR)

b) Pipe line of 600 mm diameter is 1.5 m long. To increase the discharge, another line of same diameter is introduced parallel to the first in the second half of the length. If f =0.01 and head at inlet is 300 mm, calculate the increase in discharge. Neglect minor losses.

24. a) A Kaplan turbine develops 15000 kW power at a head of 30 m. 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.

(OR)

b) Write notes on the following:

(i) Definition and classification of fluid machines (7)

(ii) Euler's equation for turbo machines (7)

25. a) In a single acting reciprocating pump, diameter of the cylinder is 152 mm and stroke is 304 mm. Water is raised through a height of 18 m at a pump speed of 40 rpm. Calculate the theoretical power required and the discharge in litres per second. If the actual discharge is 0.2122 m^3/ min, determine the coefficient of discharge and percentage slip.

(OR)

b) Calculate the vane angle at inlet of a centrifugal pump impeller having 300 mm diameter at inlet and 600 mm diameter at outlet. The impeller vanes are set back at an angle of 45˚ to the outer rim and entry to the pump is radial. The pump runs at 1000 rpm and the velocity of flow through the impeller is constant at 3 m/s. Calculate the work done per kilogram of water and direction of water at the outlet.

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