Register Number: ………………

B.E. DEGREE EXAMINATIONS: NOV/DEC 2010

Third Semester

MECHATRONICS ENGINEERING

MCT 103: Fluid Mechanics and Machinery

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

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. A Newtonian fluid is defined as the fluid which

   a) is incompressible and non-viscous   b) obeys Newton's law of viscosity

   c) is highly viscous   d) is incompressible and non-viscous2.

2. Surface tension has the units of

   a) force per unit area   b) force per unit length

   c) force per unit volume   d) force per unit height

3. A streamline is a line

   a) which is along the path of a particle

   b) which is always parallel to the main direction of flow

   c) across which there is no flow

   d) on which tangent drawn at any point gives the direction of velocity

4. Continuity equation can take the form

   a) $A_1V_1=A_2V_2$ b) $\rho_1A_1=\rho_2A_2$ c) $\rho_1A_1V_1=\rho_2A_2V_2$ d) $p_1A_1V_1=p_2A_2V_2$

5. The range for co-efficient of discharge (C_d) for a venturi-meter is

   a) 0.6 to 0.7   b)0.7 to 0.8   c)0.8 to 0.9   d) 0.95 to 0.99

6. When the pipes are connected in series, the total rate of flow is

   a) equal to the sum of the rate of flow in each pipe

   b) equal to the reciprocal of the sum of the rate of flow in each pipe

   c) is the same as flowing through each pipe

   d) zero

7. A turbine is called impulse turbine, if the total energy at inlet is

   (a) only kinetic energy   (b) only pressure energy

   (c) sum of kinetic energy and pressure energy (d) less than kinetic energy

8. Main characteristics curves of a turbine means

   a) curves at constant speed   b) curves at constant efficiency

   c) curves at constant head   d) curves at constant energy

9. Air vessel in reciprocating pump is used

a) to obtain a continuous supply of water at uniform rate b) to reduce suction head

c) to increase the delivery head   d) to decrease the delivery head

10. Cavitations can take place in case of

   a) Pelton wheel pressure   b) Francis turbine

   c) Reciprocating pump   d) Centrifugal pump

PART B (10 x 2 = 20 Marks)

11. Calculate the mass density of 2 litre of petrol weighs 30 N.

12. What are manometers? How are they classified?

13. Write down the expression for discharge through a Venturi meter explaining each term in it.

14. Define Reynolds number.

15. Write down the Navier-Stokes equation.

16. Define drag and lift.

17. What is mixed flow turbine?

18. A turbine develops 5 MW under a head of 20m at 125 rpm. What is the specific speed?

19. Define "slip" of reciprocating pump. When does the negative slip occur?

20. How will you indicate the occurrence of cavitation in centrifugal pumps? Give the equation.

PART C (5 x 14 = 70 Marks)

21. a) A U- tube manometer is used to measure the pressure of water in a pipe line, which is in excess of atmospheric pressure. The right limb of the manometer contains mercury and is open to atmosphere. The contact between water and mercury is in the left limb. Determine the pressure of water in the main line, if the difference in level of mercury in the limbs of U- tube is 10cm and the free surface of mercury is in level with the centre of the pipe. If the pressure of water in the pipe line is reduced to 9810 N/m^2, calculate the new difference in the level of mercury. Sketch the arrangements in both cases.

(OR)

   b) Explain U Tube manometers and differential manometers.

22. a) What is Euler's equation of motion? How will you obtain Bernoulli's equation from it?

(OR)

   b) In a 100mm diameter horizontal pipe a venturimeter of 0.5 contraction ratio has been fixed. The head of water on the meter when there is no flow is 3 m(gauge). Find the

rate of flow for which the throat pressure will be 2 meters water absolute. The co-efficient of meter is 0.97. Take atmospheric pressure head = 10.3 m of water.

23. a) Three pipes of 400mm, 200mm, and 300mm diameters have lengths of 400m, 200m, and 300m respectively. They are connected in series to make a compound pipe. The ends of this compound pipes are connected in two tanks whose difference of water level is 16m. If the co-efficient of friction for this pipe is same and equal to 0.005, determine the discharge through the compound pipe neglecting first the minor losses and then include them.

(OR)

b) What is Hagen Poiseuille's formula? Derive an expression for Hagen Poiseuille's formula.

24. a) Explain the working principle of Pelton wheel turbine with neat sketch.

(OR)

b) An inward flow reaction turbine has external and internal diameters as 1.0 m and 0.6 meter respectively. The hydraulic efficiency of the turbine is 90% when the head on the turbine is 36m. The velocity of flow at outlet is 2.5 m/s and discharge at outlet is radial. If the vane angle at outlet is 15° and width of the wheel is 100mm at inlet and outlet, determine:

   (i) the guide blade angle
   (ii) the speed of the turbine
   (iii) vane angle of the runner at inlet
   (iv) volume flow rate of the turbine
   (v) power developed

25. a) Explain the working principle of centrifugal pump with neat sketch.

(OR)

b) The cylinder bore diameter of a single acting reciprocating pump is 150 mm and its stroke is 300 mm. The pump runs at 50 r.p.m. and lift water through a height of 25 m. the delivery pipe is 22 m long and 100 mm in diameter. Find the theoretical discharge and the theoretical power required to the pump. If the actual discharge is 4.2 liters, find the percentage slip. Also determine the acceleration head at the beginning and middle of the delivery stroke.

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