

B.E DEGREE EXAMINATIONS: OCTOBER/NOVEMBER-2008

Third Semester

MECHATRONICS ENGINEERING**U07MH302 -- Fluid Mechanics and Machinery****Time: Three Hours****Maximum Marks: 100****Answer ALL Questions:-****PART A (20 x 1 = 20 Marks)**

- A fluid is said to be ideal, if it is
 - incompressible
 - inviscid
 - viscous and incompressible
 - inviscid and incompressible
- A real fluid, in which the shear stress is directly proportional to the rate of shear strain is known as
 - perfect real fluid
 - perfect ideal fluid
 - Newtonian fluid
 - non-Newtonian fluid
- Liquid droplet formation is the effect of
 - capillary effect
 - surface tension
 - Boyle's law
 - Charles effect
- Absolute pressure is equal to
 - Atmospheric pressure + Gauge pressure
 - Gauge pressure + Vacuum pressure
 - Atmospheric pressure - Vacuum pressure
 - Gauge pressure - Vacuum pressure
- The flow in which velocity at any given time does not change with respect to space is
 - steady flow
 - unsteady flow
 - uniform flow
 - non-uniform flow
- The following are the convective acceleration components
 - $\frac{\partial u}{\partial t}, \frac{\partial v}{\partial t}, \frac{\partial w}{\partial t}$
 - $\frac{\partial u}{\partial x}, \frac{\partial v}{\partial y}, \frac{\partial w}{\partial z}$
 - $\frac{\partial u}{\partial x}, \frac{\partial v}{\partial x}, \frac{\partial w}{\partial x}$
 - $\frac{\partial u}{\partial y}, \frac{\partial v}{\partial y}, \frac{\partial w}{\partial y}$
- A scalar function of space and time such that its negative derivative with respect to any direction gives the fluid velocity in that direction is
 - flow function
 - velocity potential function
 - stream function
 - linear function
- Pitot- tube is used to measure the
 - discharge
 - density
 - specific gravity
 - flow velocity

PART B (5 x 16 = 80 marks)

21. (a) (i) Define and prove the Pascal's Law (8)
- (ii) The viscosity of oil, used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4 m and rotates at 190 rpm. Calculate the power lost in the bearing for a sleeve length of 90 mm. The thickness of the oil film is 1.5 mm. (8)

(OR)

(b) An inverted U tube manometer is connected to two horizontal pipes A and B through which water is flowing. The vertical distance between the axes of these pipes is 30 cm. when an oil of sp.gr 0.8 is used as a gauge fluid, the vertical heights of water columns in the two limbs of the inverted manometer (when measured from the respective centre lines of the pipes) are found to be same and equal to 35 cm. determine the difference of pressure between the pipes. (16)

22. (a) In a fluid, the velocity field is given by

$$v = (3x + 2y)i + (2z + 3x^2)j + (2t - 3z)k$$

Determine

- i) the velocity components u , v and w at any point in the flow field.
- ii) the speed at point (1, 1, 1)
- iii) the speed at time $t=2s$ at point (0, 0, 2).

Also classify the velocity fields as steady or unsteady, uniform or non-uniform and one, two or three-dimensional. (16)

(OR)

(b) In a vertical pipe conveying oil of specific gravity 0.8, two pressure gauges have been installed at A and B where the diameters are 16 cm and 8 cm respectively. A is 3 m above B. The pressure gauge readings have shown that pressure at B is greater than at A by 0.981 N/cm^2 . Neglecting all losses, calculate the flow rate. If the gauges at A and B are replaced by tubes filled with the same liquid and connected to a U-tube containing mercury, calculate the difference of level of mercury in the two limbs of the U-tube. (16)

23. (a) (i) For a flow of viscous fluid flowing through a circular pipe under laminar flow conditions show that the velocity distribution is a parabola. (8)
- (ii) Also show that the average velocity is half to the maximum velocity. (8)

(OR)

(b) Three pipes of 0.4m, 0.2m and 0.3m diameters have lengths of 400 m, 200 m, and 300 m respectively. They are connected in series to make a compound pipe. The ends of this compound pipe are connected with two tanks whose difference of water levels is 16 m. If the co-efficient of friction for these pipes is same and equal to 0.005, determine the discharge through the compound pipe neglecting first the minor losses and then including them.

(16)

24. (a) A pelton wheel is working under a gross head of 400m. The water is supplied through penstock of diameter 1m and length 4km from the reservoir to the pelton wheel. The coefficient of friction for the penstock is given as 0.008. The jet of water of diameter 150mm strikes the buckets of the wheel and gets deflected through an angle of 165° . The relative velocity of water at outlet is reduced by 15% due to friction between inside surface of the bucket and water. If the velocity of the buckets is 0.45 times the jet velocity at inlet and mechanical efficiency as 85%,

Determine a) Power given to the runner, b) Shaft power, c) Hydraulic efficiency and overall efficiency.

(16)

(OR)

(b) An inward flow reaction turbine has external and internal diameters 1m and 0.6m respectively, the hydraulic efficiency of the turbine is 90% when the head on the turbine is 36m. The velocity of flow at outlet is 2.5m/s and discharge at outlet is radial. If the vane angle at outlet is 150° and width of the wheel is 100mm at inlet and outlet, determine: a) the guide blade angle, b) Speed of the turbine, c) Vane angle of runner at inlet, d) Volume flow rate of turbine, e) Power developed.

(16)

25. (a) (i) Explain the different types of casings in centrifugal pump. (8)

(ii) A centrifugal pump is running at 1000 rpm. The outlet vane angle of the impeller is 45° and velocity of flow at outlet is 2.5 m/s. The discharge through the pump is 200 litres/sec when the pump is working against a total head of 20 m. If the manometric efficiency of the pump is 80%, Determine: (i) the diameter of the impeller, and (ii) the width of the impeller at outlet.

(8)

(OR)

(b) Describe the principle and working of reciprocating pump? Derive the expression for work done by reciprocating pump?

(16)
