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Question Paper Code: 53074

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

Third Semester

Mechanical Engineering

15UME304 - FLUID MECHANICS AND MACHINERY

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- The specific gravity of a liquid has
 - the same unit as that of mass density
 - the same unit as that of weight density
 - the same unit as that of specific volume
 - no unit
- Which one of the following is the dimension of mass density?
 - $[M^1 L^{-3} T^0]$
 - $[M^1 L^3 T^0]$
 - $[M^0 L^{-3} T^0]$
 - $[M^0 L^3 T^0]$
- The value of the Bulk Modulus of elasticity for an incompressible fluid is
 - zero
 - unity
 - infinity
 - very low
- A soap bubble of d mm diameter is observed inside a bucket of water. If the pressure inside the bubble is 0.075 N/cm^2 , what will be the value of d ? (Take surface tension as 0.075 N/m)
 - 0.4mm
 - 0.8mm
 - 1.6mm
 - 4mm
- Boundary layer thickness is the distance from the boundary to the point where velocity of the fluid is
 - equal to 10% of free stream velocity
 - equal to 50% of free stream velocity
 - equal to 90% of free stream velocity
 - equal to 99% of free stream velocity

6. Shear stress in static fluid is
- (a) always zero (b) always maximum
(c) between zero to maximum (d) unpredictable
7. Head loss in a flowing fluid is experienced due to
- (a) Friction at surface (b) Change of direction
(c) Change of section of passage (d) all of the above
8. Power required to drive a centrifugal pump is proportional to
- (a) speed (N) (b) N^2 (c) N^3 (d) $1/N^2$
9. Medium specific speed of a pump implies it is
- (a) Centrifugal pump (b) Mixed flow pump
(c) axial flow pump (d) none of these
10. Air vessels in reciprocating pump are used to
- (a) smoothen flow (b) reduce acceleration to minimum
(c) save pump from cavitation (d) increase pump head

PART - B (5 x 2 = 10 Marks)

11. Define specific gravity with respect to density.
12. What purpose orifice meter is used? Define it.
13. How will you determine the loss of head due to friction in pipes?
14. List the characteristic curves of Hydraulic turbine.
15. Why negative slip occurs in reciprocating pump?

PART - C (5 x 16 = 80 Marks)

16. (a) 250litres/sec. of water is flowing in a pipe having a diameter of 300mm. If the pipe is bent by 135° Find the resultant force and direction on the bend. The pressure of water flowing is 400kN/m^2 . Take specific gravity of water is 9.81 kN/m^3 . (16)

Or

- (b) A liquid is filled in the annular space between two concentric cylinders 30cm long. The inner cylinder of radius 10cm rotates inside the outer cylinder which is stationary and has an internal radius of 10.05cm. Determine the viscosity of the liquid if a torque of 10 N-m is required to maintain an angular velocity of 60 rpm. (16)

17. (a) Two pipes have a length L each, one of them has a diameter D and other diameter d . If the pipes are arranged in parallel the loss of head when a total qty of water Q flows through them is h , but if the pipes are arranged in series and the same qty Q flows through, them, the loss of head is H . If $d = 0.5D$, find the ratio of H to h . Neglect minor losses and assume that both the pipes are having same coefficient of friction. (16)

Or

- (b) The velocity distribution in boundary layer is given by, $\frac{u}{U} = \frac{y}{\delta}$, U is velocity at a distance y from the plate $u=U$ at $y=\delta$. (16)
18. (a) A 7.2 m high & 15 m long spillway discharges $94 \text{ m}^3/\text{s}$ discharges under a head of 2.03m. If 1:9 scale model of this spillway is to be constructed, determine model dimensions,
 (i) head over spill way model & model discharge. If model experiences a force of 7500 N,
 (ii) Determine force on the prototype. (16)

Or

- (b) The thrust force, F generated by a propeller is found to depend on the following parameters: diameter D , forward velocity u , density ρ , viscosity μ and rotational speed N . Determine the dimensionless parameters to correlate the phenomenon. (16)
19. (a) A Pelton wheel turbine runs under a head of 400m at a speed of 1000rpm. It develops a power of 5000kW. Find the least diameter of jet and the pitch circle diameter of wheel. assume overall efficiency of turbine is 85% $C_v = 0.99$ as speed ratio is 0.45. also find the number of buckets. Assume any other relevant data is required. (16)

Or

- (b) The following data is given for a Francis turbine: Net head: 50m, Speed=600rpm; $\eta_h = 90\%$; $\eta_o = 84\%$; SHP = 400HP; flow ratio=0.2; breath ratio =0.1; The outer diameter of runner is two times the inner diameter of runner. The thicknesses of the vanes occupy 5% of circumferential area of the runner. The velocity of flow is constant at inlet and also outlet and discharge is radial at outlet. Determine
 i) Guide blade angle and Runner vane angle at inlet and outlet
 ii) Diameter of runner at inlet and outlet and width of the wheel at inlet (16)
20. (a) A single acting reciprocating pump has a plunger diameter of 25m and stroke length of 45m. A suction pipe is 12.5m diameter and 12m long with suction lift of 3m. An air vessel is fitted to the suction pipe at a distance of 1.5m from the cylinder and

10.5 m from the sump water level. If the barometer reads 10m of water and separation take place at 2.5m vacuum, find the speed at which the crank operate without separation to occur. (16)

Or

- (b) Explain the working of the following pumps with the help of neat sketches and mention two applications of each. (i) External gear pump, Lobe pump (ii) Vane pump. (16)
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