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Question Paper Code: 53704

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

Third Semester

Mechanical Engineering

15UME304 - FLUID MECHANICS AND MACHINERY

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

PART A - (10 x 1 = 10 Marks)

- Dynamic viscosity of most of the gases with rise in temperature CO1- R
(a) increases (b) decreases
(c) remains unaffected (d) unpredictable
- Which one of the following is the dimension of mass density? CO1- R
(a) $[M^1 L^{-3} T^0]$. (b) $[M^1 L^3 T^0]$. (c) $[M^0 L^{-3} T^0]$. (d) $[M^0 L^3 T^0]$.
- Bernoulli's theorem deals with the law of conservation of CO2- R
(a) mass (b) momentum (c) energy (d) none of these
- A soap bubble of d mm diameter is observed inside a bucket of water. CO2 -R
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)
(a) 0.4mm (b) 0.8mm (c) 1.6mm (d) 4mm
- Boundary layer thickness is the distance from the boundary to the point CO3- R
where velocity of the fluid is
(a) equal to 10% of free stream velocity (b) equal to 50% of free stream velocity
(c) equal to 90% of free stream velocity (d) equal to 99% of free stream velocity

6. Shear stress in static fluid is CO3- R
- (a) always zero (b) always maximum
(c) between zero to maximum (d) unpredictable
7. Francis turbine is a CO4 -R
- (a) radial flow turbine (b) axial flow turbine
(c) mixed flow turbine (d) inward flow radial type turbine
8. Power required to drive a centrifugal pump is proportional to CO4 -R
- (a) speed (N) (b) N^2 (c) N^3 (d) $1/N^2$
9. Medium specific speed of a pump implies it is CO5 -R
- (a) Centrifugal pump (b) Mixed flow pump
(c) axial flow pump d) none of the above
10. Air vessels in reciprocating pump are used to CO5- R
- (a) smoothen flow (b) reduce acceleration to minimum
(c) save pump from cavitation (d) increase pumps head

PART – B (5 x 2= 10Marks)

11. Define Newton's law of viscosity. CO1 -R
12. What purpose orifice meter is used? Define it CO2- R
13. How will you determine the loss of head due to friction in pipes? CO3- R
14. List the characteristic curves of Hydraulic turbine. CO4- R
15. How will you classify the reciprocating pump? CO5- R

PART – C (5 x 16= 80Marks)

16. (a) Determine the torque, power required to turn 0.12 *cm* long 6 *cm* diameter shaft at 500 *rpm* in a 6.2 *cm* concentric bearing flooded with a lubricating oil of viscosity 0.1 *Ns/m²*. 100centipoise). CO1 -App (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. CO1 -App (16)
17. (a) Two pipes have a length L each, one of them has a diameter D , & 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. CO2 -App (16)

Or

- (b) Derive Euler's equation of motion along a stream line for an ideal fluid and derive Bernoulli's equation from Euler's equation. CO2- Ana (16)
18. (a) A 7.2 m high & 15 m long spillway discharges 94 m³/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. CO3- Ana (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. CO3- Ana (16)
19. (a) The penstock supplies water from a reservoir to the Pelton wheel with a gross head of 500 m. One third of the gross head is lost in friction in the penstock. The rate of flow of water through the nozzle fitted at the end of the penstock is 2.0 m³/s. The angle of deflection of the jet is 165°. Determine the power given by the water to the runner and also hydraulic efficiency of the Pelton wheel. Take speed ratio = 0.45 and $C_v = 1.0$. CO4 -U (16)

Or

- (b) A Pelton wheel is to develop 13250 kW under a net head of 800 m while running at a speed of 600 rpm. If coefficient of velocity = 0.97, speed ratio = 0.46 and the ratio of jet diameter is 1/15 of wheel diameter. Calculate (i) number of jets (ii) diameter of jets (iii) diameter of wheel (iv) quantity of water supplied to wheel. Assume $\eta_o=85\%$ CO4 -Ana (16)
20. (a) A single acting reciprocating pump has a plunger diameter of 25cm and stroke length of 45cm. A suction pipe is 12.5cm 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. CO5- U (16)
- Or
- (b) Illustrate the working principle of external gear pump with a neat sketch. Also mention its advantages and disadvantages. CO5- U (16)