**A** **Reg. No. :** | | | | | | | | | | |

**Question Paper Code: 53704**

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

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)

1. If the velocity ,pressure density etc change at a point with respect to time , the flow is called CO1- R

   (a) Uniform (b) Compressible (c) ) Unsteady (d) Incompressible

2. Atmospheric pressure held in term of water column is CO1- R

   (a) 7.5 m (b) 8.5 m (c) 9.81 m (d) 10.30 m

3. Bernoullis theorem deals with the law of conservation of CO2- R

   (a) Mass (b) Momentum (c) Energy (d) Temperature

4. Continuity equation deals with the law of conservation of CO2- R

   (a) Mass (b) Momentum (c) Energy (d) Temperature

5. Kinematic similarity between model and prototype means CO3- R

   (a) Similarity of forces (b) Similarity of shape

   (c) Similarity of motion (d) Similarity of discharge

6. Geometric similarity between model and prototype means CO3- R

   (a) Similarity of discharge (b) Similarity of linear dimensions

   (c) Similarity of motion (d) Similarity of forces

7. If a centrifugal pump is noisy in operation, the cause may be CO4- R

(a) Priming faulty (b) Suction head too high

(c) Air in water (d) Mechanical defect

8. In axial flow turbines CO4- R

(a) Water enters radically but leaves axially (b) Water enters axially but leaves radically

(c) Water enters at angle but leaves axially (d) Water enters axially and leaves axially

9. Mixed flow turbineare CO5- R

(a) Radial inward flow type (b) Radial outward flow type

(c) Partly radial partially axial (d) Parallel flow type

10. Foot valve is provided on CO5- R

(a) Centrifugal pump (b) Reciprocating pump

(c) Pelton wheels (d) High pressure devices

PART – B (5 x 2= 10Marks)

11. List the significance of Reynolds number. CO1- R

12. Write the Navier Stokes equation. CO2- R

13. State the difference between model and prototype. CO3- R

14. List the functions of draft tube. CO4- R

15. Mention the advantages of reciprocating pump CO5- R

PART – C (5 x 16= 80Marks)

16. (a) Figure: 1 shows a truncated cone which rotates at 25 rad/sec. The viscosity of oil in the gap of 3 mm between the cone and fixed surface is 5 Poise. Calculate the torque required to rotate the truncated cone. CO1- App (16)

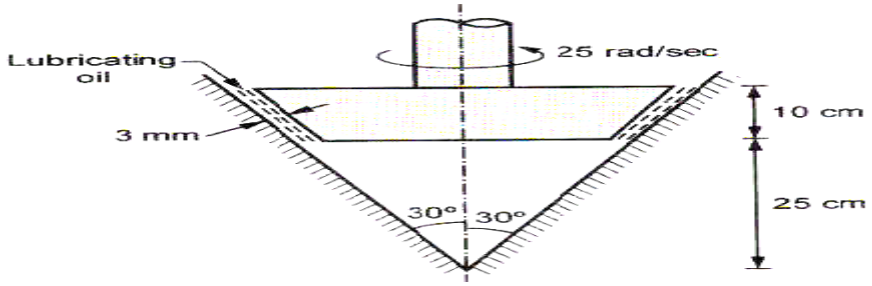


Figure -1

Or

(b) A glass tube of diameter 3 mm is dipped in water. Find the capillary effect if the surface tension of water in contact with air is 7.35 X $10^{-2}$ N/m. Also find the capillary effect if the glass tube is dipped in mercury. The surface tension of mercury in contact with air is 47.5 X $10^{-2}$ N/m. The contact angle for water with glass is 0° and mercury with glass is 130°. Find the tube diameters required, if it is decided to limit the capillary effect to 2 mm in water and 1 mm in mercury. CO1- App (16)

17. (a) A 2 m long pipe line tapers uniformly from 10 cm diameter to 20 cm diameter at its upper end. The pipe centre line slopes upwards at an angle of 30° to the horizontal and the flow direction is from smaller to bigger cross section. If the pressure gauges installed at the lower and upper ends of the pipe line read 200 kPa and 230 kPa respectively, determine the flow rate and the fluid pressure at the mid length of the pipe line. Assume no energy loss. CO2- App (16)

Or

(b) Two pipes of diameters 200 mm and 125 mm are connected by means of a flange such that the axis of the two pipes are in a straight line. Water at a rate of 0.05$m^3$/s flows from the larger pipe to the smaller pipe. The differential pressure reading on a water mercury manometer between the two pipe read 80mm. calculate the loss of head due to contraction and the coefficient of contraction? CO2- Ana (16)

18. (a) Show that the power P developed in a water turbine can be expressed as $P = \rho N^3 D^5 \Phi \{D/B , \rho D^2 N/\mu , ND/\sqrt{gh}\}$ where CO3- Ana (16)

ρ= mass density of the liquid
N=Speed in r.p.m
D=Diameter of the runner
B=Width of the runner
μ=co-efficient of dynamic viscosity.

Or

(b) (i) The pressure drop in aeroplane model of size 1/50 of its prototype is 4 N/$cm^2$. The model is tested in water. Find the corresponding pressure drop in the prototype. Take density of air = 1.24 kg/$m^3$. The viscosity of water is 0.01 poise while the viscosity of air is 0.00018 poise. CO3 Ana (8)

(ii) A 1:20 model of a flying boat is towed water. The prototype is moving in sea water of density 1024 kg/$m^3$ at a velocity of 15 m/s. Find the corresponding speed of the model. Also determine the resistance due to waves on model, if the resistance due to waves of prototype is 500 N. CO3 Ana (8)

19. (a) A Francis turbine produces 100 MW with an available head of 350 m. The impeller peripheral speed is $0.6\sqrt{2gH}$ and the radial flow velocity at inlet is $0.26\sqrt{2gH}$. The impeller runs at 360 rpm and the hydraulic efficiency is 0.85.Assume radial discharge. Interpret CO4-App (16)

(1) guide blade angle,
(2) impeller vane angle at inlet,
(3) diameter of the impeller,
(4) specific speed

Or

(b) The head available at a hydroelectric power plant site is 400 m. A Pelton turbine with a single jet is selected for use. The turbine wheel mean diameter is 2.58 m with a power output of 10 MW. The turning in the bucket is 165˚. Assuming an overall efficiency of 0.82, find the speed in rpm, volume flow rate V, and the jet diameter Assume nozzle discharge coefficient $k_N$ = 0.98 and the relative velocity is reduced in the bucket by 10% due to friction.. CO4- Ana (16)

20. (a) A centrifugal pump with a specific speed of 40 and running at 1500 rpm is used for delivering 0.90 cubic m /sec of water at a head at 35 m. Assuming an overall efficiency 7 of 75 %. Interpret the number of units and their arrangement. CO5-App (16)

Or

(b) A diameter and stroke of a single acting reciprocating pump are 15 cm and 30 cm respectively. The pump lift water through a head of 15 m above the centre of pump when running at 40 rpm. The diameter and length of delivery pipe are 10 cm and 25 cm. The position of air vessel to the delivery side from the centre of the pump is 2 m.Find the total pressure in the cylinder at the starting of delivery stroke and middle of delivery stroke. Take f=0.008 CO5-App (16)