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Question Paper Code	12094

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B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2023

Third Semester

Mechanical Engineering

20CEPC306 - FLUID MECHANICS AND MACHINERY

(Regulations 2020)

Duration: 3 Hours

Max. Marks: 100

PART-A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level, CO
1.	Differentiate between steady and unsteady flow.	2,K2,CO1
2.	Define Newton's law of viscosity.	2,K1,CO1
3.	State Bernoulli's theorem.	2,K1,CO2
4.	Differentiate compressible and incompressible flow.	2,K2,CO2
5.	What are the factors influencing the frictional loss in pipe flow?	2,K1,CO5
6.	Give an expression for loss of head due to sudden contraction.	2,K2,CO5
7.	Define dimensional homogeneity.	2,K1,CO6
8.	What are the applications of model analysis?	2,K2,CO6
9.	Classify the reciprocating pump.	2,K2,CO3
10.	Mention the main components of Centrifugal pump.	2,K1,CO3

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11.	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 it 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 10 cm and the free surface of mercury is in level with the centre of the pipe. If the pressure of water in pipe line is reduced to 9810 N/m^2, Calculate the new difference in the level of mercury. Sketch the arrangement in both cases.	13,K3,CO
		OR	
	b)	If the velocity profile of a fluid over a plate is a parabolic with the vertex 0.2 m from the plate, where the velocity is 1.2m/s. Calculate the velocity gradients and shear stresses at a distance of 0, 0.1 and 0.2m from the plate, if the viscosity of the fluid is 8.5 poise.	13,K3,C

12. a) A horizontal venturimeter with inlet and throat diameter 300 mm and 100 mm respectively is used to measure the flow of water. The pressure intensity at inlet is 130 kN/m while the vacuum pressure head at throat is 350 mm of mercury. Assuming that 3% head lost between the inlet and throat. Find the value of coefficient of discharge for the venturimeter and also determine the rate of flow. *13,K3,CO2*

OR

b) The inlet and throat diameters of a horizontal venturimeter are 30 cm and 10 cm respectively. The liquid flowing through the meter is water. The pressure intensity at inlet is 13.734 N/cm^2 while the vacuum pressure head at the throat is 37 cm of mercury. Find the rate of flow. Assume that 4% of the differential head is lost between the inlet and throat. Also find the value of C_d for the venturimeter. *13,K3,CO2*

13. a) The rate of flow of water through a horizontal pipe is 0.25 m^3/s. The diameter of the pipe which is 200 mm is suddenly enlarged to 400 mm. The pressure intensity in the smaller is 11.772 N/cm^2. Identify the (i) loss of head due to sudden enlargement, (ii) pressure intensity in the large pipe, (iii) power lost due to enlargement. *13,K3,CO5*

OR

b) A pipe of diameter 20 cm and length 2000 m connects two reservoirs, having difference of water levels as 20 m. Analyse the discharge through the pipe. If an additional pipe of diameter 20 cm and length 1200 m is attached to the last 1200 m length of the existing pipe, find the increase in the discharge. Take f = 0.015 and neglect minor losses. *13,K2,CO5*

14. a) Using Buckingham's pi theorem, examine whether the velocity through a circular pipe orifice is given by, $V=\sqrt{2gH\phi}\ [D/H,\mu/\ \rho vH]$ where H = Head causing flow, D = diameter of orifice, μ = coefficient of viscosity ρ = mass density, g = acceleration due to gravity. *13,K3,CO6*

OR

b) A 7.2 m height and 15 m long spillway discharges 94 m3/s discharges under a head of 2.0 m. If a 1:9 scale model of this spillway is to be constructed, determine model dimensions, head over spillway model and the model discharge. If model experiences a force of 7500 N, determine force on the prototype. *13,K3,CO6*

15. a) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 rpm works against a total head of 40 m. The velocity of flow through the impeller is constant and equal to 2.5 m/s. The vanes are set back at an angle of 400 at outlet. If the outer diameter of the impeller is 500 mm and width at outlet is 50 mm, determine: i) Vane angle at inlet, ii) Work done by impeller on water per second and iii) Manometric efficiency. *13,K3,CO3*

OR

b) A single acting reciprocating pump running at 50 rpm, delivers $0.01 m^3/s$ of water. The diameter of the piston is 200 mm and stroke length 400 mm. Determine the theoretical discharge of the pump, coefficient of discharge and slip and the percentage slip of the pump. *13,K3,CO3*

PART C (1 × 15 = 15 Marks)

16. a) A Francis turbine with an overall efficiency of 76% and hydraulic efficiency of 80% is required to produce 150 kW. It is working under a head of 8 m. The peripheral velocity is 0.25 $\sqrt{2gH}$ and radial velocity of flow at inlet is 0.95 $\sqrt{2gH}$. The wheel runs at 150 rpm. Assuming radial discharge, determine(K) *15,K3,CO4*
(i) Flow velocity at outlet.
(ii) The wheel angle at inlet.
(iii) Diameter and width of the wheel at inlet.

OR

b) In an inward radial flow turbine, water enters at an angle of 22° to the wheel tangent to the outer rim and leaves at 3 m/s. The flow velocity is constant through the runner. *15,K3,C04*
The inner and outer diameters are 300 mm and 600 mm respectively. The speed of the runner is 300 mm. The discharge through the runner is radial. Find the
(i) Inlet and outlet blade angles.
(ii) Taking inlet width as 150 mm and neglecting the thickness of the blades, find the power developed by the turbine.