01 FEB 2023

Reg. No.												

Question Paper Code	11678

B.E./B.Tech. - DEGREE EXAMINATIONS, NOV/DEC 2022

Third Semester

Civil Engineering

(Common to 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.	Define viscosity and state the effect of temperature on viscosity in liquids and gases.	*2,K1,CO1*
2.	State Pascal's law.	*2,K1,CO1*
3.	Differentiate between steady and unsteady flow.	*2,K2,CO2*
4.	What is momentum equation?	*2,K1,CO2*
5.	What is the expression for head loss due to friction in Darcy formula?	*2,K1,CO5*
6.	Define boundary layer.	*2,K1,CO5*
7.	State Buckingham's Π theorem.	*2,K1,CO6*
8.	Write the similitude that exists between model and prototype.	*2,K2,CO6*
9.	Define Slip of reciprocating pump. When the negative slip does occur?	*2,K2,CO3*
10.	What is meant by Cavitation?	*2,K1,CO3*

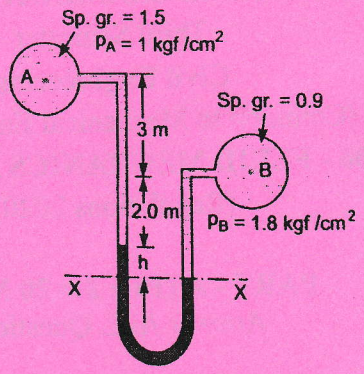
PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11.	a)	Calculate the capillary rise in a glass tube of 4 mm diameter, when immersed in (i) water, and (ii) mercury. The temperature of the liquid is 20°C and the values of the surface tension of water and mercury at 20°C in contact with air are 0.073575 N/m respectively. The angle of contact for water is zero that for mercury 130°. Take density of water at 20°C as equal to 998 kg/m^3.	*13,K2,CO1*

OR

b) (i) A differential manometer is connected at the two points A and B of two pipes as shown below. The pipe A contains a liquid of specific gravity 1.5 while pipe B contains a liquid of specific gravity 0.9. The pressures at A and B are 1 kgf/cm^2 and 1.80 kgf/cm^2 respectively. Find the difference in mercury level in the differential manometer. *8,K2,CO1*



(ii) Find the surface tension in a soap bubble of 40 mm diameter when the inside pressure is 2.5 N/m^2 above atmospheric pressure. *5,K3,CO1*

12. a) Derive Bernoulli's equation with basic assumptions. *13,K2,CO2*

OR

b) A 30 cm x 15 cm venturimeter is provided in a vertical pipe line carrying oil of specific gravity 0.9, the flow being upwards. The difference in elevation of the throat section and entrance section of the venturimeter is 30 cm. The differential U tube mercury manometer shows a gauge deflection of 25 cm. Calculate: (i) the discharge of oil. (ii) The pressure difference between the entrance section and the throat section. Take C_d=0.98 and specific gravity of mercury as 13.6. *13,K2,CO2*

13. a) Derive the Hagen Poiseuille's formula for the flow through circular pipes? *13,K2,C05*

OR

b) The velocity distribution in the boundary layer is given by $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$, δ being boundary layer thickness. Calculate the following: i. Displacement thickness, ii. Momentum thickness and iii. Energy thickness. *13,K2,CO5*

14. a) The pressure difference ΔP in a pipe of diameter D and length l due to turbulent flow depends on the velocity V, viscosity μ, density ρ and roughness K. By using dimensional analysis, obtain an expression for the pressure difference ΔP. *13,K2,CO6*

OR

b) A 1:100 model is used for model testing of ship. The model is tested in wind tunnel the length of the ship is 400m the velocity of the wind tunnel around the model is 25 m/s and the resistance is 55 N Determine the length of the model. Also find the velocity of the ship as well as resistance developed. Take density of air and sea water as 1.24 kg/m^3 and 1030 kg/m^3. The kinematic viscosity of air and sea water are 0.018 stokes and 0.012 stokes respectively. *13,K2,CO6*

15. a) The impeller of a centrifugal pump having external and internal diameters 500 mm and 250 mm respectively, width at outlet 50 mm and running at 1200 r.p.m. works against a head of 48 m. The velocity of flow through the impeller is constant and equal to 3.0 m/s. The vanes are set back at an angle of 40° at outlet. Find: (i) Inlet vane angle (i) Work done by the impeller on water per second (iii) Manometric efficiency. *13,K2,CO3*

OR

b) The diameter and stroke of a single acting reciprocating pump are 120 mm and 300 mm respectively. The water is lifted by a pump through a total head of 25 m. The diameter and length of delivery pipe are 100 mm and 20 mm respectively. Find out:
(i) Theoretical discharge and theoretical; power required to run the pump if its speed is 60rpm.
(ii) Percentage slip, if the actual discharge is 2.35 litres/s
(iii) The acceleration head at the beginning and middle of the delivery stroke. *13,K2,CO3*

PART - C (1 × 15 = 15 Marks)

16. a) The following data is given for Francis turbine: Net head = 60 m, speed = 700 rpm, shaft power = 294.3 kW, η_o = 84%. η_h = 93 %, flow ratio = 0.2, breadth ratio = 0.1, outer diameter of the runner = 2 inner diameter of the runner. The thickness of vanes occupies 5% of the circumferential area of the runner. Velocity of flow is constant at inlet and outlet and discharge is radial outlet. Determine: 1. The guide blade angle, 2. Runner vane angle the inlet and outlet. 3. Diameter of the runner at inlet and outlet. 4. Width of the wheel at the inlet. *15,K2,CO4*

OR

b) With a neat sketch, explain the construction and working of Pelton wheel turbine. Also list its advantages, disadvantages and applications. *15,K2,CO4*