Reg. No.												

Question Paper Code	12497

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023

Third Semester

Mechanical Engineering

20CEPC306 - FLUID MECHANICS AND MACHINERY

(Regulations 2020)

Duration: 3 Hours Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

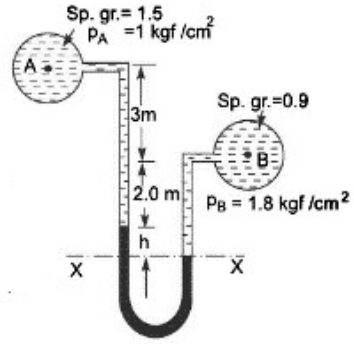
Answer ALL Questions

		Marks, K-Level, CO
1.	State Newton's Law of viscosity.	*2,K1,CO1*
2.	What is a manometer? How are they classified?	*2,K1,CO1*
3.	Compare Laminar flow and Turbulent flow.	*2,K2,CO2*
4.	Name any two assumptions made in Bernoulli's equation.	*2,K1,CO2*
5.	Write down the Darcy-Weisbach formula to calculate head loss due to friction.	*2,K1,CO5*
6.	Define boundary layer.	*2,K1,CO5*
7.	What is a dimensionally homogenious equation?	*2,K2,CO6*
8.	Recall the (i) Geometric Similarities (ii) Kinematic similarities?	*2,K1,CO6*
9.	List the main components of Centrifugal pump.	*2,K1,CO3*
10.	What is impulse turbine? Give example.	*2,K1,CO4*

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11.	a)	The dynamic viscosity of an oil, used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4 m and rotates at 190 rpm. Calculate the power lost in the bearing for a sleeve length of 90mm. The thickness of the oil film is 1.5 mm.	*13,K3,CO1*
		OR	
	b)	A differential manometer is connected at two points A and B of two pipes as shown in fig. The pipe A contains a liquid of specific gravity 1.5, while pipe contains a liquid of specific gravity 0.9. The pressure 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.	*13,K3,CO1*



12. a) Water flows through a pipe AB 1.2m diameter at 3m/s and then passes through a pipe BC 1.5m diameter. At C, the pipe branches. Branch CD is 0.8m in diameter and carries one- third of the flow in AB. The flow velocity in branch CE is 2.5m/s. Find the volume rate of flow in AB, the velocity in BC, the velocity in CD and diameter of CE. *13,K3,CO2*

OR

b) A lawn sprinkler has two nozzles of diameters 8 mm each at the end of a rotating arm and the velocity of flow of water from each nozzle is 12 m/s. One nozzle discharges water in the downward direction, while the other nozzle discharges water vertically up. The nozzles are at a distance of 40 cm from the centre of the rotating arm. Determine the torque required to hold the rotating arm stationary. Also determine the constant speed of rotation of arm, if it is free to rotate. *13,K3,CO2*

13. a) A pipe of diameter 20cm and length 2000m connects two reservoirs, having difference of water levels as 20m.Analyse the discharge through the pipe. If an additional pipe of diameter 20 cm and length 1200m is attached to the last 1200m length of the existing pipe, Determine the increase in the discharge. Take f = 0.015 and neglect minor losses. *13,K3,CO5*

OR

b) For the velocity profile for laminar boundary layer $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$ Identify the Displacement thickness, Momentum Thickness and Energy Thickness. *13,K3,CO5*

14. a) The resistance R to the motion of a supersonic aircraft of length L, moving with a velocity V in air of density ρ, depends on the viscosity μ and bulk modulus of elasticity K of air. Obtain using Buckingham's π - theorem, the following expression for the resistance R
$R= (\rho L^2V^2)\phi[(\mu/\rho LV), (K/\rho V^2)]$ *13,K3,CO6*

OR

b) A model of a hydro electric power station tailrace is proposed to be built by selecting vertical scale 1 in 50 and horizontal scale 1 in 100. If the design pipe has flow rate of 600m^3/sec and the allowable discharge *13,K3,CO6*

of 800m^3/sec. Calculate the corresponding flow rate for the model testing.

15. a) Explain the working principle of reciprocating pump with neat sketch. *13,K2,CO3*

OR

b) A Pelton wheel has to be designed for the following data. *13,K3,CO3*
Shaft power transmitted = 6000 kW, Net head available = 300 m, Speed = 500 rpm, Ratio of jet diameter to wheel diameter = 1/10 and overall efficiency is 85%. Find the no. of jet, diameter of the wheel and the quantity of water required.

PART - C (1 × 15 = 15 Marks)

16. a) A centrifugal pump delivers water against a net head of 10 m at a design speed of 1000 rpm. The vanes are curved backwards and make an angle of 30° with the tangent at the outer periphery. The impeller diameter is 30 cm and has a width of 5 cm at the outlet. Determine the discharge of the pump, if the manometric efficiency is 95%. *15,K3,CO4*

OR

b) (i) Explain with the help of a diagram, the essential features of a Kaplan Turbine. *12,K2,CO4*

(ii) Explain the functions of a draft tube. *3,K2,CO4*