Reg. No.															

Question Paper Code	14702

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2026

Third Semester

Mechanical Engineering

24CEPC305 - FLUID MECHANICS AND MACHINERY

Regulations - 2024

Duration: 3 Hours | Max. Marks: 100

PART – A (i) (MCQ)
(16 × 1 = 16 Marks)
Answer ALL Questions

		Marks	K – Level	CO
1.	The branch of Engineering-science, which deals with water at rest or in motion is called a) Hydraulics b) Fluid Mechanics c) Applied Mechanics d) Kinematics	1	K1	CO1
2.	The ratio of the specific weight of the liquid to the specific weight of a standard fluid is known as a) Specific Volume b) Density c) Specific Gravity d) Viscosity	1	K2	CO1
3.	The magnitude of the buoyant force can be determined by a) Newton's second law of motion b) Archimedes' principle c) Principle of moments d) None of the above	1	K3	CO1
4.	If the Reynolds number is less than 2000, the flowinapipeis a) Laminar Flow b) Turbulent Flow c) Transition Flow d) None of the above	1	K1	CO2
5.	Bernoulli's equation, mathematically is written as a) $\frac{p}{\rho g}+\frac{v}{2g}+z=\text{Constant}$ b) $\frac{p}{\rho g}+\frac{v^2}{2g}+z=\text{Constant}$ c) $\frac{p}{\rho g^2}+\frac{v^2}{2g}+z=\text{Constant}$ d) $\frac{p^2}{\rho g}+\frac{v^2}{2g}+z=\text{Constant}$	1	K2	CO2
6.	Which of the following assumptions is made in the derivation of Bernoulli's equation? a) The liquid is ideal and incompressible b) The flow is steady and continuous c) The flow is one-dimensional d) All of the above	1	K3	CO2
7.	Darcy-Weisbach equation is used to find loss of head due to: a) Sudden Enlargement b) Sudden Contraction c) Friction d) None of the above	1	K1	CO3
8.	In turbulent flow the velocity a) Varies with time and space b) varies with time only, the patterns of fluctuation, with respect to time, being same at all points c) Is constant at every point d) None of the above	1	K2	CO3
9.	If the Reynolds number is more than 5×10^5, the boundary layer is called a) Laminar boundary layer b) Turbulent boundary layer c) Either of the above d) None of the above	1	K3	CO3
10.	A dimensionally homogeneous equation is applicable to a) C.G.S. system only b) F.P.S. system only c) M.K.S. and SI systems d) All systems of units.	1	K1	CO4

11.	Mach's number is defined as the square root of the ratio of the		*1*	*K2*	*CO4*
	a) Inertia force to the pressure force	b) Inertia force to the surface tension force			
	c) Inertia force to the elastic force	d) None of the above			
12.	Kinematic similarity between model and prototype is the		*1*	*K3*	*CO4*
	a) Similarity of discharge	b) Similarity of shape			
	c) Similarity of streamline pattern	d) None of the above.			
13.	Which of the following turbines is suitable for specific speed ranging from 300 to 1000 and heads below 30 m:		*1*	*K3*	*CO5*
	a) Francis	b) Kaplan			
	c) Propeller	d) Pelton			
14.	Cavitation in a draft tube occurs when		*1*	*K2*	*CO5*
	a) Temperature difference	b) Pressure drop			
	c) Kinetic energy difference	d) Density of flow			
15.	In centrifugal pumps, cavitation is reduced by		*1*	*K1*	*CO6*
	a) Increasing the flow velocity	b) Reducing the discharge			
	c) Throttling the discharge	d) Reducing the suction head.			
16.	Discharge through a double-acting reciprocating pump is given as		*1*	*K3*	*CO6*
	a) LAN/60	b) LAN/120			
	c) 2LAN/60	d) 2LAN/120			

PART – A (ii) (Short Answer Questions)
(6 × 3 = 18 Marks)
Answer ALL Questions

17.	Differentiate and apply the concepts of: (i) Mass density (ii) Weight density.	*3*	*K3*	*CO1*
18.	Analyze the assumptions involved in deriving Bernoulli's equation of motion.	*3*	*K4*	*CO2*
19.	Identify the characteristics that differentiate laminar flow from turbulent flow.	*3*	*K3*	*CO3*
20.	Analyze the importance of dimensional homogeneity in deriving engineering formulas.	*3*	*K4*	*CO4*
21.	Apply the conditions required for maximum hydraulic efficiency of a Pelton wheel.	*3*	*K3*	*CO5*
22.	Compare single acting reciprocating pump with double acting reciprocating pump.	*3*	*K4*	*CO6*

PART - B (Descriptive Answer Questions)
(6 × 11 = 66 Marks)
Answer ALL Questions

23.	a)	Apply the concept of capillarity to calculate the capillary effect in millimetres 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 and 0.51 N/m respectively. The angle of contact for water is zero and that for mercury is 130°. Take density of water at 20°C as equal to 998 kg/m³.	*11*	*K3*	*CO1*
		OR			
	b)	An open tank contains water up to a depth of 2 m and above it an oil of sp. gr. 0.9 for a depth of 1 m. Solve the pressure intensity (i) at the interface of the two liquids, and (ii) at the bottom of the tank.	*11*	*K3*	*CO1*
24.	a)	Develop the continuity equation for a three-dimensional fluid flow.	*11*	*K3*	*CO2*
		OR			

b) The water is flowing through a pipe having diameters 20 cm and 10 cm at sections 1 and 2 respectively. The rate of flow through pipe is 35 liters/s. The section 1 is 6 m above datum and section 2 is 4 m above datum. If the pressure at section 1 is 39.24 N/cm², Utilize Bernoulli's theorem to solve the intensity of pressure at section 2. *11 K3 CO2*

25. a) A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of water level in the tank is 8 m above the centre of the pipe. Considering all losses of head which occur in a fluid flow. Solve the rate of flow. Take f = .01 for both sections of the pipe. *11 K3 CO3*

OR

b) Apply boundary layer concepts to solve the displacement thickness and energy thickness for the velocity distribution in the boundary layer given by *11 K3 CO3*

$$\frac{u}{U} = \frac{y}{\delta}$$

where u is the velocity at a distance y from the plate and $u = U$at $y = \delta$, where δ= boundary layer thickness.

26. a) The frictional torque $T$of a disc of diameter D rotating at a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given by *11 K4 CO4*

$$T = D^5 N^2 \rho \, \phi \left[\frac{\mu}{D^2 N \rho}\right]$$

Examine the relation by the method of dimensions.

OR

b) A ship 300 m long moves in sea-water, whose density is 1030 kg/m³. A 1: 100 model of this ship is to be tested in a wind tunnel. The velocity of air in the wind tunnel around the model is 30 m/s and the resistance of the model is 60 N. Examine the velocity of ship in sea-water and also the resistance of the ship in sea-water. The density of air is given as 1.24 kg/m³. Take the kinematic viscosity of sea-water and air as 0.012 stokes and 0.018 stokes respectively. *11 K4 CO4*

27. a) Analyze the functions of the main components of a Pelton turbine with the help of a neat sketch. *11 K4 CO5*

OR

b) The following data is given for a Francis Turbine. *11 K4 CO5*
Net head $= 60\,m$; Speed $N = 700\,r.p.m.$; shaft power $= 294.3\,kW$; $\eta_o = 84\%$; $\eta_h = 93\%$; flow ratio $= 0.20$; breadth ratio $n = 0.1$; Outer diameter of the runner $= 2 \times$inner diameter of runner. The thickness of vanes occupies 5% of circumferential area of the runner, velocity of flow is constant at inlet and outlet and discharge is radial at outlet. Examine: (i) Guide blade angle, (ii) Runner vane angles at inlet and outlet,(iii) Diameters of runner at inlet and outlet, and(iv) Width of wheel at inlet.

28. a) Construct and explain the working principle of a centrifugal pump. *11 K3 CO6*

OR

b) A single-acting reciprocating pump, running at 50 r.p.m., delivers 0.01 m³/s of water. The diameter of the piston is 200 mm and stroke length 400 mm. Solve : *11 K3 CO6*
(i) Theoretical discharge of the pump, (ii) Co-efficient of discharge, and (iii) Slip and the percentage slip of the pump.