Reg. No.															

Question Paper Code	14006

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Third Semester

Mechanical Engineering

24CEPC305 - FLUID MECHANICS AND MACHINERY

Regulations - 2024

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Viscosity of a fluid is a measure of a) Its resistance to compression b) Its ability to flow c) Its resistance to shear deformation d) Its surface tension	1	K1	CO1
2.	The phenomenon responsible for the formation of droplets and bubbles is a) Viscosity b) Cavitation c) Surface tension d) Vapour pressure	1	K1	CO1
3.	A flow is defined as uniform when a) The velocity vector is constant at every point in the flow field. b) The velocity, pressure, and density do not change with respect to space at a given time. c) The flow parameters change with time at any point. d) The flow is rotational.	1	K1	CO2
4.	A Venturimeter measures the flow rate by a) Direct measurement of mass flow b) Measuring the differential pressure between two sections c) Measuring the temperature difference d) Measuring the fluid density	1	K1	CO2
5.	What is the primary characteristic of laminar flow? a) Smooth, orderly layers b) Turbulent motion c) Vortex formation d) Constant pressure gradient	1	K1	CO3
6.	The boundary layer is defined as the region in a fluid flow where a) The flow velocity is constant b) The fluid velocity decreases due to viscosity c) The flow velocity equals the free stream velocity d) The pressure remains constant	1	K1	CO3
7.	Which of the following quantities is dimensionless? a) Acceleration b) Strain c) Power d) Pressure	1	K1	CO4
8.	Which of the following is NOT required for complete similarity between model and prototype? a) Geometric similarity b) Kinematic similarity c) Dynamic similarity d) Thermal similarity	1	K1	CO4
9.	What type of turbine is a Pelton wheel? a) Axial flow turbine b) Radial flow turbine c) Impulse turbine d) Mixed flow turbine	1	K1	CO5
10.	Which type of pump is best suited for low flow rate and high pressure applications? a) Centrifugal pump b) Axial flow pump c) Reciprocating pump d) Diaphragm pump	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11.	State Newton's Law of viscosity.	2	K1	CO1
12.	Distinguish between gauge pressure and vacuum pressure.	2	K2	CO1
13.	Compare laminar flow and turbulent flow.	2	K2	CO2
14.	What is orifice-meter? Write the expression for the discharge through the orifice-meter.	2	K1	CO2
15.	Explain the term major energy loss in pipes.	2	K2	CO3
16.	Define boundary layer.	2	K1	CO3
17.	What is meant by dimensionally homogeneous equation?	2	K1	CO4
18.	Elaborate about distorted models.	2	K2	CO4
19.	Classify turbines.	2	K1	CO5
20.	Outline the purpose of a draft tube in reaction turbines.	2	K2	CO5
21.	Define the term "Net Positive Suction Head (NPSH)".	2	K1	CO6
22.	Outline the function of an impeller in a centrifugal pump.	2	K2	CO6

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	The space between a large surface and a plate is filled with oil. Each side of the plate is 50 cm. The thickness of the oil film is 15 mm. The plate, which moves at 5 m/s requires a force of 98.1 N to maintain the speed. Determine: (i) the dynamic viscosity of the oil and (ii) the kinematic viscosity of the oil if the specific gravity of the oil is 0.95.	11	K3	CO1
		OR			
	b)	State the Pascal's Law and Derive with the help of appropriate assumptions.	11	K3	CO1
24.	a)	The water is flowing through a pipe having diameters 20cm and 10cm at sections 1 and 2 respectively. The rate of flow through pipe is 35litres/sec. The section 1 is 6m above datum and section 2 is 4m above datum. If the pressure at section 1 is 39.24 N/cm², find the intensity of pressure at section 2.	11	K3	CO2
		OR			
	b)	Find the discharge of water flowing through a pipe 30 cm diameter placed in an inclined position where a venturimeter is inserted, having a throat diameter of 15 cm. The difference of pressure between the main and throat is measured by a liquid of sp.gr. 0.6 in an inverted U-tube which gives a reading of 30 cm. The loss of head between the main and throat is 0.2 times the kinetic head of the pipe.	11	K3	CO2
25.	a)	Three pipes of 400 mm, 200 mm and 300 mm diameters have lengths of 400 m, 200 m and 300 m respectively. They are connected in series to make a compound pipe. The ends of the compound pipe are connected with two tanks whose difference of water levels is 16 m. If the coefficient of friction for these pipes is same and equal to 0.005, determine the discharge through the compound pipe neglecting first the minor losses and then including them.	11	K3	CO3
		OR			
	b)	Find the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$.	11	K3	CO3

26. a) Using Buckingham's pi theorem, show that the velocity through a circular pipe orifice is given by, $V = \sqrt{2gH}\,.\,\phi\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$, Where H = Head causing flow, D = diameter of orifice, μ = coefficient of viscosity, ρ = mass density, g = acceleration due to gravity. *11 K4 CO4*

OR

b) The pressure drop in an aero plane model of size of its prototype is 80 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. *11 K4 CO4*

27. a) A Pelton wheel is having a mean bucket diameter of 1 m and is running at 1400 r.p.m. The net head on the Pelton wheel is 700 m. If the side clearance angle is 15° and discharge through nozzle is 0.1 m^3/s. Calculate: (i) Power available at the nozzle, and (ii) Hydraulic efficiency of the turbine. *11 K5 CO5*

OR

b) A Francis turbine with an overall efficiency is 75% is required to produce 148.25kw power. It is working under a head of 7.62 m. The peripheral velocity is 0.26 and the Radial velocity of flow at inlet is 0.96. The wheel runs at 150rpm and the Hydraulic losses in the turbine are 22% of the available energy. Assuming radial discharge, determine (i) Guide blade angle (ii) The wheel vane angle of inlet (iii) Diameter of the wheel at inlet (iv) Width of the wheel at inlet. *11 K5 CO5*

28. a) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1400 r.p.m. works against a total head of 50 m. The velocity of flow through the impeller is constant and equal to 5 m/s. The vanes are set back at an angle of 45° 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. *11 K4 CO6*

OR

b) A double-acting reciprocating pump, running at 90 r.p.m., is discharging 200 m^3/s of water per minute. The pump has a stroke of 400 mm. The diameter of the piston is 200 mm. The delivery and suction head are 25 m and 10 m respectively. Determine the slip of the pump and power required to drive the pump. *11 K4 CO6*