Reg. No.															

Question Paper Code	13522

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Third Semester

Mechanical Engineering

20CEPC306 - FLUID MECHANICS AND MACHINERY

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Which of the following is measured in the poise? (a) Dynamic viscosity (b) Kinematic viscosity (c) Velocity of flow (d) Discharge	1	K1	CO1
2.	A simple manometer consists of: (a) A U-shaped tube filled with a liquid (b) A straight tube filled with gas (c) A diaphragm (d) A spring-loaded needle	1	K1	CO1
3.	A control volume is defined as: (a) A fixed region in space through which fluid flows (b) The total volume of the fluid (c) The volume occupied by solid boundaries (d) The volume of the fluid at rest	1	K1	CO2
4.	An orifice meter is used to measure: (a) Temperature of a fluid (b) Pressure of a fluid (c) Flow rate of a fluid (d) Density of a fluid	1	K2	CO2
5.	The term "NPSH" in pump terminology stands for: (a) Net Positive Suction Head (b) Non-Positive Suction Head (c) Nominal Pressure Suction Head (d) New Pump Suction Head	1	K1	CO3
6.	The characteristic curve of a centrifugal pump shows the relationship between: (a) Discharge and head (b) Discharge and diameter (c) Speed and power (d) Impeller size and head	1	K1	CO3
7.	The main component that directs water flow to the buckets in a Pelton wheel turbine is called the: (a) Runner (b) Nozzle (c) Guide vane (d) Draft tube	1	K1	CO4
8.	The Kaplan turbine is classified as which type of flow turbine? (a) Radial (b) Mixed (c) Axial (d) Tangential	1	K1	CO4
9.	What is the main cause of the development of the boundary layer in fluid flow? (a) Gravity (b) Viscosity (c) Temperature gradient (d) Pressure gradient	1	K1	CO5
10.	Which of the following quantities is dimensionless? (a) Acceleration (b) Strain (c) Power (d) Pressure	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

		Marks	K – Level	CO
11.	What is specific gravity? How is it related to density?	2	K2	CO1
12.	Name the devices that are used to measure the pressure of a fluid.	2	K1	CO1
13.	Compare laminar flow and turbulent flow.	2	K2	CO2
14.	What are the applications of Bernoulli's equation?	2	K1	CO2
15.	Outline the function of an impeller in a centrifugal pump.	2	K2	CO3
16.	Define mechanical and hydraulic efficiency.	2	K1	CO3
17.	Classify turbines.	2	K2	CO4
18	What is the role of the nozzle in a Pelton wheel turbine?	2	K1	CO4
19.	Outline the important characteristics of turbulent flow.	2	K2	CO5

20.	Define boundary layer.		*2*	*K1*	*CO5*
21.	Give the dimensions of Velocity and Weight.		*2*	*K1*	*CO6*
22.	Write the expression for Reynold's Number.		*2*	*K1*	*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 60 cm. The thickness of the oil film is 12.5 mm. The plate, which moves at 2.5 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 in stokes if the specific gravity of the oil is 0.95.	*11*	*K3*	*CO1*
		OR			
	b)	A simple U-tube manometer containing mercury is connected to a pipe in which a fluid of specific gravity 0.8 and having vacuum pressure is flowing. The other end of the manometer is open to atmosphere. Determine the vacuum pressure in pipe, if the difference of mercury level in the two limbs is 40 cm and the height of fluid in the left from the centre of pipe is 15 cm below.	*11*	*K3*	*CO1*
24.	a)	Water flows through a pipe AB 1.2 m diameter at 3 m/s and then passes through a pipe BC 1.5 m diameter. At C, the pipe branches. Branch CD is 0.8 m in diameter and carries one-third of the flow in AB. The flow velocity in branch CE is 2.5 m/s. Calculate the volume rate of flow in AB, the velocity in BC, the velocity in CD and the diameter of CE.	*11*	*K3*	*CO2*
		OR			
	b)	A 45^0 reducing bend is connected in a pipe line; the diameters at the inlet and outlet of the bend are 0.6 m and 0.3 m respectively. Determine the force exerted by water on the bend if the intensity of pressure at inlet to bend is 8.829 N/cm^2 and discharge is 0.6 m^3/s.	*11*	*K3*	*CO2*
25.	a)	A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1100 r.p.m. works against a total head of 50 m. The velocity of flow through the impeller is constant and equal to 3 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, Find : (i) Vane angle at inlet, (ii) Work done by impeller on water per second, and (iii) Manometric efficiency.	*11*	*K2*	*CO3*
		OR			
	b)	Explain the working principle of double acting reciprocating pumps with neat diagram in detail. Also list its Applications, Advantages and Disadvantages.	*11*	*K2*	*CO3*
26.	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, find : (i) Power available at the nozzle, and (ii) Hydraulic efficiency of the turbine.	*11*	*K2*	*CO4*
		OR			
	b)	Explain the construction and working principle of a Kaplan turbine. Also discuss about its advantages, disadvantages and applications.	*11*	*K2*	*CO4*

27. a) A horizontal pipe line 40 m long is connected to a water tank at one end discharge freely into atmosphere 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 center of the pipe. Considering all losses of head which occur. Determine the rate of flow. Take f = 0.01 for both sections of the pipe. *11 K3 CO5*

OR

b) Determine the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $\frac{u}{U} = \frac{y}{\delta}$, where u is the velocity at a distance y from the plate, and u = U at $y = \delta$, where δ – boundary layer thickness. Also calculate the value of δ^*/θ. *11 K3 CO5*

28. 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. Using Buckingham's π -theorem, obtain an expression for Δp. *11 K3 CO6*

OR

b) A 7.2 m height and 15m long spill way discharges 94 m^3/s discharge under a head of 2.0m. 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 experience a force of 7500N, determine force on the prototype. *11 K3 CO6*