Reg. No.																

Question Paper Code	14742

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

Third Semester

Mechanical Engineering

20CEPC306 - FLUID MECHANICS AND MACHINERY

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

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

		Marks	K – Level	CO
1.	Dynamic viscosity is expressed in SI unit as: a) N/m² b) Pa·s c) kg/m³ d) N/m	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.	A fluid sample has a mass of 1600 kg and occupies a volume of 2 m^3. What is its specific gravity? a) 0.8 b) 1.6 c) 8.0 d) 0.16	1	K2	CO1
4.	Which fluid description approach focuses on tracking individual fluid particles over time? a) Eulerian Description b) Lagrangian Description c) Bernoulli Approach d) Reynolds Approach	1	K1	CO2
5.	The momentum equation used in fluid dynamics is derived directly from which of Newton's laws? a) First Law of Motion b) Second Law of Motion c) Third Law of Motion d) Law of Gravitation	1	K2	CO2
6.	A pipe diameter reduces to half its original diameter. For incompressible flow, velocity becomes a) Half b) Double c) Four times d) One-fourth	1	K2	CO2
7.	In rotodynamic pumps, the increase in energy level is due to a) Centrifugal energy only b) Pressure energy only c) Kinetic energy only d) Combination of a, b and c	1	K1	CO3
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9.	Discharge through a double-acting reciprocating pump is given as a) LAN/60 b) LAN/120 c) 2LAN/60 d) 2LAN/120	1	K2	CO3

10.	The device used to regulate speed of turbine is called a) Draft tube b) Nozzle c) Governor d) Runner	*1*	*K1*	*CO4*
11.	Which of the following draft tubes is suited particularly for helical flow? a) Conical type draft tube b) Elbow type draft tube c) Moody's spreading draft tube d) None of the above	*1*	*K2*	*CO4*
12.	.....of a turbine is defined as the ratio of power available at the turbine shaft to the power supplied by the water jet. a) Mechanical efficiency b) Hydraulic efficiency c) Overall efficiency d) Volumetric efficiency	*1*	*K2*	*CO4*
13.	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*	*K2*	*CO5*
14.	..... thickness is the distance through which the total loss of momentum per second be equal to if it were passing a stationary plate. a) Displacement b) Momentum c) Energy d) None of the above	*1*	*K3*	*CO5*
15.	Rayleigh's method of dimensional analysis is best limited to problems containing a maximum of how many variables? a) 1 or 2 b) 3 or 4 c) 10 d) Unlimited	*1*	*K2*	*CO6*
16.	Dynamic similarity between model and prototype means a) Same dimensions only b) Same geometry only c) Corresponding force ratios are equal d) Same material is used	*1*	*K3*	*CO6*

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

17.	Classify Manometers.	*3*	*K2*	*CO1*
18.	The diameter of a pipe at sections 1 and 2 are 10 cm and 15 cm respectively. Find the discharge through pipe, if the velocity of water flowing through the pipe at section 1 is 5 m/sec.	*3*	*K2*	*CO2*
19.	Elaborate the term "Net Positive Suction Head (NPSH)".	*3*	*K2*	*CO3*
20.	Explain the specific speed of a turbine.	*3*	*K2*	*CO4*
21.	Identify the characteristics that differentiate laminar flow from turbulent flow.	*3*	*K3*	*CO5*
22.	Infer the importance of dimensional homogeneity in deriving engineering formulas.	*3*	*K3*	*CO6*

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

23.	a)	Calculate the dynamic viscosity of oil which is used for lubrication between a square plate of size 0.8 m x 0.8 m and an inclined plane with angle of inclination 35°. The weight of the square plate is 330 N and it slide down the inclined plane with uniform velocity of 0.4 m/s. The thickness of the oil film is 1.8 mm.	*11*	*K2*	*CO1*

OR

b) A simple U – tube manometer containing mercury is connected to a pipe in which a fluid of sp.gr. 0.8 and having vacuum pressure is flowing. The other end of the manometer is open to atmosphere. Find the vacuum pressure in pipe, if the difference of mercury level in the two limbs is 40 cm. and the height of the fluid in the left tube from the centre of pipe is 15 cm below. *11 K2 CO1*

24. a) Derive the continuity equation in three dimensions. *11 K2 CO2*

OR

b) A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of water. The pressure at inlet is 17.658 N/cm² and the vacuum pressure at the throat is 30 cm of mercury. Find the discharge of water through venturimeter. Take $C_d = 0.98$. *11 K2 CO2*

25. a) A double acting reciprocating pump has a bore of 150 mm and stroke of 250 mm and runs at 35 rpm. The piston rod diameter is 20 mm. The suction head is 6.5 m and the delivery head is 14.5 m. The discharge of water was 4.7 lit/s. Determine the slip and the power required. *11 K2 CO3*

OR

b) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1400 rpm 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 K2 CO3*

26. a) A pelton wheel which is receiving water from a penstock with a gross head of 500 m. One – third of gross head is lost in the penstock. The rate of flow through the nozzle fitted at the end of the penstock is 2.5 m^3/sec. The angle of deflection of the jet is 160º. Determine:
(a) The power given by the water to the runner.
(b) Hydraulic efficiency of the pelton wheel. Take $C_v = 1$ and speed ratio = 0.45. *11 K2 CO4*

OR

b) A reaction turbine works at 450 rpm under a head of 120 m. Its diameter at inlet is 1.2 m and the flow area is 0.4 m^2. The angles made by absolute and relative velocities at inlet are 20° and 60° respectively with the tangential velocity. Determine: (i) the volume rate of flow, (ii) the power developed, and (iii) the hydraulic efficiency. Assume whirl at outlet to be zero. *11 K2 CO4*

27. a) A 500 mm diameter horizontal pipe is suddenly contracted to a diameter of 250 mm. The pressure intensities in the large and smaller pipe is given as 13.734 N/cm^2 and 11.772 N/cm^2 respectively. Find the value of co-efficient of contraction C_c, if the rate of flow of water is 300 liters/s. *11 K3 CO5*

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 CO5*

28. a) Analyze the relationship between the pressure difference Δp in a pipe of diameter D and length l due to viscous flow depends on the velocity V, viscosity μ and density ρ. Using Buckingham's π-theorem, obtain an expression for Δp. *11* *K3* *CO6*

OR

b) A ship 250 m long moves in sea-water, whose density is 1030 kg/m³. A 1:125 model of the ship is to be tested in a wind tunnel. The velocity of air in the wind tunnel around the model is 20 m/s and the resistance of the model is 50 N. Determine 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* *K3* *CO6*