Reg. No.												

Question Paper Code	12912

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2024

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.	What is specific gravity? How is it related to density?	2	K2	CO1
2.	State Newton's Law of viscosity.	2	K1	CO1
3.	Distinguish between steady flow and unsteady flow.	2	K2	CO2
4.	Distinguish between Newtonian and non-Newtonian fluid interms of viscosity.	2	K1	CO2
5.	What is meant by Displacement thickness?	2	K1	CO3
6.	List out possible minor energy losses in pipes.	2	K1	CO3
7.	Define specific speed of the turbine.	2	K1	CO4
8.	How can you define a reaction turbine? Give an example.	2	K2	CO4
9.	What is venturi-meter? Write the expression for the discharge through the venturi-meter.	2	K1	CO5
10.	What is Pitot tube?	2	K1	CO5

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

			Marks	K – Level	CO
11.	a)	The space between two square flat parallel plates is filled with oil. Each side of the plate is 60 cm. The thickness of the oil film is 12.5 mm. The upper 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.	13	K4	CO1
		OR			
	b)	The right limb of a simple U-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The centre of the pipe is 12 cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 20 cm.	13	K3	CO1

12. a) Discuss in detail about the distinguishing features between the following types of fluid flow with suitable practical cases: *13 K2 CO2*
(i) Steady flow and unsteady flow.
(ii) Uniform and non-uniform flow.
(iii) Laminar and turbulent flow.
(iv) Rotational and irrotational flow.

OR

b) Compare the different types of fluids and give practical example for each. *13 K2 CO2*

13. a) Derive Darcy-Weisbach equation to calculate head loss due to friction. *13 K2 CO3*

OR

b) Determine the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$. *13 K3 CO3*

14. a) i) Explain the working principle of double acting reciprocating pumps with neat diagram in detail. *7 K2 CO4*

ii) Explain the working principle of centrifugal pump with neat diagram in detail. *6 K2 CO4*

b) A Pelton wheel is having a mean bucket diameter of 1 m and is running at 1000 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: *13 K3 CO4*
(i) Power available at the nozzle and
(ii) Hydraulic efficiency of the turbine.

15. a) Obtain the Euler's equation of motion and deduce that to Bernoulli's equation. *13 K2 CO5*

OR

b) An orifice-meter with orifice diameter 15 cm is inserted in a pipe of 30 cm diameter. The pressure difference measured by a mercury oil differential manometer on the two sides of the orifice meter gives a reading of 50 cm of mercury. Find the rate of flow of oil of sp. gravity 0.9 when the co-efficient of discharge of the orifice-meter = 0.64. *13 K4 CO5*

PART - C (1 × 15 = 15 Marks)

16. a) The efficiency η of a fan depends on density ρ, dynamic viscosity μ, angular velocity ω, diameter D of the rotor and the discharge Q. Express η in terms of dimensionless parameters. *15 K3 CO6*

OR

b) 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. *15 K3 CO6*

$$R = \left(\rho L^2 V^2\right)\phi\left[\frac{\mu}{\rho VL}, \frac{K}{V^2\rho}\right]$$