| Reg. No. | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| Question Paper Code | 13998 |
|---|---|

**B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 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. | The Property of fluid by virtue of which is offers resistance to shear is called<br>(a) Surface Tension (b) Adhesion (c) Cohesion (d) Viscosity | 1 | K1 | CO1 |
| 2. | Manometer is used to measure<br>(a) Pressure in pipes, Channels etc (b) atmospheric Pressure<br>(c) velocity (d) None of the above | 1 | K1 | CO1 |
| 3. | Bernoulli's theorem deals with the conservation of<br>(a) Mass (b) Force (c) Energy (d) Momentum | 1 | K1 | CO2 |
| 4. | Pitot tube is used for measurement of<br>(a) Pressure (b) Flow (c) Velocity (d) Discharge | 1 | K1 | CO2 |
| 5. | In a centrifugal pump, the function of the impeller is to<br>(a) Direct the flow of water (b) Convert mechanical energy into kinetic energy<br>(c) Prevent cavitation (d) Reduce friction | 1 | K1 | CO3 |
| 6. | In a reciprocating pump, the working principle relies on<br>(a) Continuous flow<br>(b) Displacement of a fixed volume by a piston<br>(c) Acceleration of fluid by a rotating impeller<br>(d) Creating a vacuum in the casing | 1 | K1 | CO3 |
| 7. | Impulse turbine is used for<br>(a) Low Head (b) High Head (c) Medium Head (d) None of the above | 1 | K1 | CO4 |
| 8. | What type of turbine is a Pelton wheel?<br>(a) Axial flow turbine (b) Radial flow turbine<br>(c) Impulse turbine (d) Mixed flow turbine | 1 | K1 | CO4 |
| 9. | For pipes Laminar flow occurs when Reynolds number is<br>(a) Less than 2000 (b) between 2000 and 4000<br>(c) More than 4000 (d) None of the above | 1 | K1 | CO5 |
| 10. | Which among the following is not a criteria to achieve similitude?<br>(a) Geometric similarity (b) Kinematic similarity<br>(c) Dynamic similarity (d) Conditional similarity | 1 | K1 | CO6 |

**PART - B (12 × 2 = 24 Marks)**

Answer ALL Questions

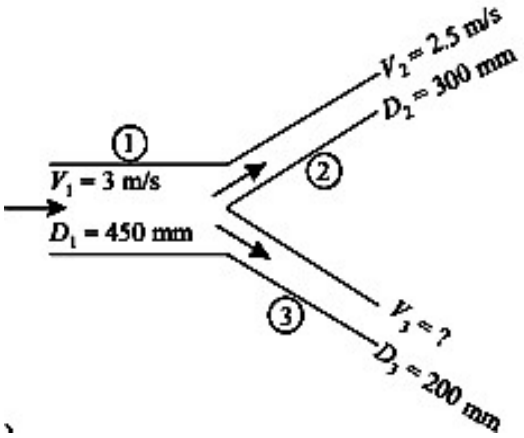
| | | Marks | K – Level | CO |
|---|---|---|---|---|
| 11. | State Newton's law of Viscosity. | 2 | K2 | CO1 |
| 12. | What is a manometer? How are they classified? | 2 | K1 | CO1 |
| 13. | Write the Euler's equation of motion. | 2 | K1 | CO2 |
| 14. | What do you understand by Continuity Equation? | 2 | K1 | CO2 |
| 15. | Define "Slip" of reciprocating pump. When does the negative slip occur? | 2 | K1 | CO3 |
| 16. | Outline the function of an impeller in a centrifugal pump. | 2 | K2 | CO3 |
| 17. | Outline the working principle of a Pelton wheel turbine. | 2 | K2 | CO4 |
| 18. | Define the term 'specific speed' of a turbine. | 2 | K1 | CO4 |
| 19. | Mention the general characteristics of a laminar flow. | 2 | K1 | CO5 |

| | | | | | |
|---|---|---|---|---|---|
| 20. | Give an expression for loss of head due to sudden contraction. | | 2 | K1 | CO5 |
| 21. | State and apply the significance Buckingham's -π - theorem. | | 2 | K1 | CO6 |
| 22. | State three demerits of a distorted model. | | 2 | K1 | CO6 |

**PART - C (6 × 11 = 66 Marks)**

Answer ALL Questions

| | | | | | |
|---|---|---|---|---|---|
| 23. | a) | Calculate the capillary rise 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 that for mercury 130$^o$. Take density of water at 20°C as equal to 998 kg/m$^3$. | 11 | K3 | CO1 |
| | | **OR** | | | |
| | b) | A U - Tube manometer is used to measure the pressure of water in a pipe line, which is in excess of atmospheric pressure. The right limb of the manometer contains mercury and it is open to atmosphere. The contact between water and mercury is in the left limb. Determine the pressure of water in the main line, if the difference in level of mercury in the limbs of U-tube is 10 cm and the free surface of mercury is in level with the centre of the pipe. If the pressure of water in pipe line is reduced to 9810 N/m$^2$, Calculate the new difference in the level of mercury. Sketch the arrangement in both cases. | 11 | K3 | CO1 |
| 24. | a) | A pipe (1) 450 mm in diameter branches into two pipes (2 and 3) of diameters 300 mm and 200 mm respectively as shown in Fig. If the average velocity in 450 mm diameter pipe is 3 m/s find: (i) Discharge through 450 mm diameter pipe; (ii) Velocity in 200 mm diameter pipe if the average velocity in 300 mm pipe is 2.5 m/s. | 11 | K3 | CO2 |




**OR**

| | | | | | |
|---|---|---|---|---|---|
| | b) | A 30 cm x 15 cm venturimeter is provided in a vertical pipe line carrying oil of specific gravity 0.9, the flow being upwards. The difference in elevation of the throat section and entrance section of the venturimeter is 30 cm. The differential U-tube mercury manometer shows a gauge deflection of 25 cm. Calculate: (a) the discharge of oil. (b) The pressure difference between the entrance section and the throat section. Take co-efficient of discharge as 0.98 and specific gravity of mercury as 13.6. | 11 | K3 | CO2 |
| 25. | a) | Explain about the construction and working principle of centrifugal pump with neat sketch. | 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* | *K3* | *CO4* |
| | | **OR** | | | |
| | b) | As inward flow reaction turbine has external and internal diameters as 1.0 m and 0.6 m respectively. The hydraulic efficiency of the turbine is 90% when the head on the turbine is 36 m. The velocity of flow at outlet is 2.5 m/s and discharge at outlet is radial. If the vane angle at outlet is 15° and width of the wheel is 100 mm at inlet and outlet, determine: (i) the guide blade angle, (ii) speed of the turbine, (iii) vane angle of the runner at inlet, (iv) volume flow rate of turbine and (v) power developed. | *11* | *K3* | *CO4* |
| 27. | a) | An oil of specific gravity 0.9 and viscosity 0.06 poise is flowing through a pipe of diameter 200 mm at the rate of 60 litres/sec. Calculate the head lost due to friction for a 500 m length of 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 $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$. | *11* | *K3* | *CO5* |
| 28. | a) | Using Buckingham's pi theorem, show that the velocity through a circular pipe orifice is given by, $V = \sqrt{2gH}\ .\phi\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$<br>Where H = Head causing flow, D=diameter of orifice, μ=coefficient of viscosity, ρ= mass density, g=acceleration due to gravity. | *11* | *K3* | *CO6* |
| | | **OR** | | | |
| | b) | A Ship 300m long moves in sea water, whose density is 1030 kg/m³, A1:100 model of ship is to be tested in a wind tunnel. The velocity of air in the wind tunnel around the model is 30m/s and the resistance of model is 60N. 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 $kg/m^3$. Take the kinematic viscosity of sea -water and air as 0.012 stokes and 0.018 respectively. | *11* | *K3* | *CO6* |