



B.E/B.TECH DEGREE EXAMINATIONS: NOV/DEC 2022

(Regulation 2018)

Third Semester

CIVIL ENGINEERING

U18CET3104 : FLUID MECHANICS

COURSE OUTCOMES

- CO1:** Measure the pressure of a fluid flow and fluid pressure on a plane and curved surface.
CO2: Analyse the stability of floating and submerged bodies.
CO3: Apply the working concepts of various devices used to measure the velocity and discharge of fluid.
CO4: Analyse a pipe network.
CO5: Understand the kinematics that exists in the fluid flow and draw flow net.
CO6: Formulate the functional relationships that exist between dependent and independent variables of fluid flow.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

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|---|-----|-------------------|
| 1. Recall the meaning of surface tension. | CO1 | [K ₁] |
| 2. State Pascal's law. | CO1 | [K ₁] |
| 3. Differentiate between buoyant force and centre of buoyancy. | CO2 | [K ₂] |
| 4. State the advantages of Orifice meter. | CO3 | [K ₁] |
| 5. Write the impulse-momentum principle. | CO3 | [K ₁] |
| 6. What is the relationship between friction factor and Reynolds number? | CO4 | [K ₂] |
| 7. Infer the conditions of loss of head when the pipes are connected in parallel. | CO4 | [K ₃] |
| 8. Distinguish between path line and streak line. | CO5 | [K ₂] |
| 9. Define forced vortex flow. | CO5 | [K ₁] |
| 10. What is scale effect in model analysis? | CO6 | [K ₂] |

Answer any FIVE Questions:-

PART B (5 x 16 = 80 Marks)

(Answer not more than 400 words)

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|---|---|-----|-------------------|
| 11. a) An oil of viscosity 5 poise is used for lubrication between a shaft and sleeve. The diameter of the shaft is 0.5 m and it rotates at 200 r.p.m. Calculate the power lost in oil for a sleeve of 100 mm. The thickness of oil film is 1.0 mm. | 8 | CO1 | [K ₃] |
|---|---|-----|-------------------|

- b) Determine the total pressure and centre of pressure on an isosceles triangular plate of base 4 m and altitude 4 m when it is immersed vertically in an oil of specific gravity 0.9. The base of the plate coincides with the free surface of oil. 8 CO1 [K₃]
12. a) A solid cylinder of diameter 4.0 m has a height of 3.0 m. Find the meta-centric height of the cylinder when it is floating in water with its axis vertical. The specific gravity of the cylinder is 0.6 8 CO2 [K₃]
- b) A hydraulic press has a ram of diameter 0.3 m and a plunger of 0.05 m diameter. Find the weight lifted by the hydraulic press when the force applied at the plunger is 400 N. 8 CO1 [K₃]
13. The inlet and throat diameters of a horizontal venturimeter are 30 cm and 10 cm respectively. The liquid flowing through the meter is water. The pressure intensity at inlet is $13.734 \times 10^4 \text{ N/m}^2$ while the vacuum pressure head at the throat is 37 cm of mercury. Find the rate of flow. Assume that 4 % of the differential head is lost between inlet and throat. Find also the value of coefficient of discharge for the venturimeter. 16 CO3 [K₃]
14. Derive Hagen-Poiseuille equation and state the assumptions made in the derivation. 16 CO4 [K₂]
15. a) The velocity potential for a two-dimensional flow is given by $\phi = x^2 - y^2$. Check whether the velocity components satisfy the condition of flow continuity. 8 CO5 [K₃]
- b) A two-dimensional flow field is defined by the stream function $\Psi = 2xy$. Find the corresponding expression for velocity potential. 8 CO5 [K₃]
16. Using Rayleigh method of dimensional analysis, develop a functional relationship for the resistance to motion of a partially submerged body when towed in water. The variables involved are the velocity of the body, length of the body, acceleration due to gravity and density and viscosity of water. 16 CO6 [K₃]
