# KUMARAGURU
### college of technology
character is life

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

(Regulation 2018)

Third Semester

**AERONAUTICAL ENGINEERING**

U18AEI3201: Fluid Mechanics

## COURSE OUTCOMES

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|---|---|
| **CO1:** | Apply the basic equation of fluid statics to determine forces on planar and curved surfaces that are submerged in a static fluid. |
| **CO2:** | Apply conservation laws to determine velocities, pressures, and accelerations for incompressible and inviscid fluids. |
| **CO3:** | Apply principles of dimensional analysis to identify non dimensional parameters. |
| **CO4:** | Explain the concepts of viscous boundary layers. |
| **CO5:** | Apply principles of impacts of jets in fluid machineries. |
| **CO6:** | Measure coefficient of discharge of fluid flows. |

**Time: Three Hours**          **Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 2 = 20 Marks)**
**(Answer not more than 40 words)**

| | | | |
|---|---|---|---|
| 1. | List out various properties of real fluid. | CO1 | [K$_4$] |
| 2. | Define surface tension. | CO1 | [K$_1$] |
| 3. | Compare steady and unsteady flow. | CO2 | [K$_2$] |
| 4. | Define flow net | CO6 | [K$_1$] |
| 5. | Define Froude's number. | CO3 | [K$_1$] |
| 6. | Derive the dimensions for velocity. | CO3 | [K$_3$] |
| 7. | Define boundary layer thickness. | CO4 | [K$_1$] |
| 8. | Define momentum correction factor. | CO4 | [K$_1$] |
| 9. | List out various cases of force exerted by jet on a plate. | CO5 | [K$_4$] |
| 10. | How is jet reaction calculated? | CO5 | [K$_1$] |

**Answer any FIVE Questions:-**
**PART B (5 x 16 = 80 Marks)**
**(Answer not more than 400 words)**

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|---|---|---|---|---|---|
| 11. | a) | A differential manometer is connected at the two points A and B of two pipes as shown in below figure-1. The pipe A contains a liquid of specific gravity 1.5 | 10 | CO1 | [K$_5$] |

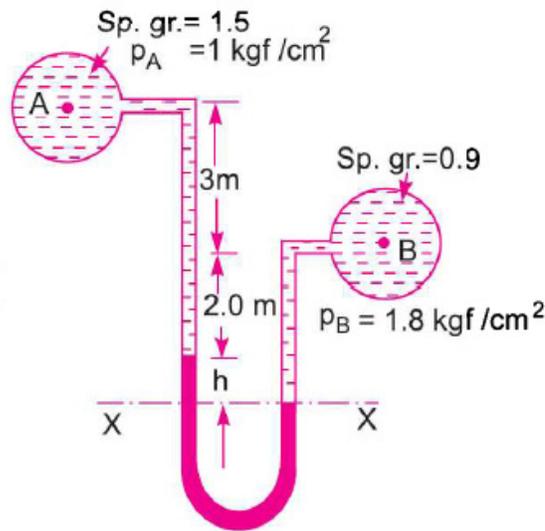| | | while pipe B contains a liquid of specific gravity 0.9. The pressures at A and B are 1 kgf/cm$^2$ and 1.80 kgf/cm$^2$ respectively. Find the difference in mercury level in the differential manometer. | | | |
|---|---|---|---|---|---|



Figure -1

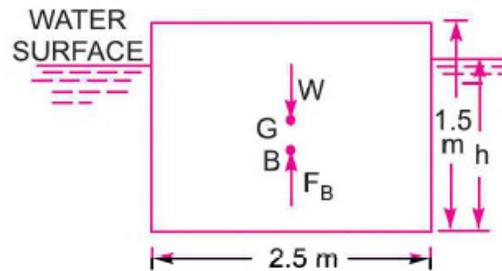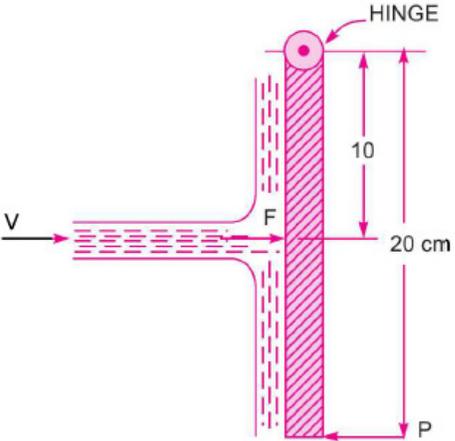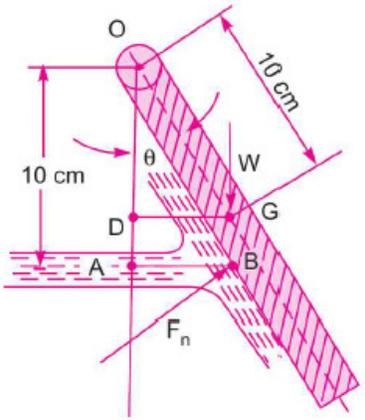| | | | | | |
|---|---|---|---|---|---|
| | b) | Find the volume of the water displaced and position of centre of buoyancy for a wooden block of width 2.5 m and of depth 1.5 m, when it floats horizontally in water as shown in figure-2. The density of wooden block is 650 kg/m$^3$ and its length 6.0 m. | 06 | CO1 | [K$_5$] |



Figure-2

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| 12. | | 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. Find the volume rate of flow in AB, the velocity in BC, the velocity in CD and the diameter of CE. | 16 | CO6 | [K$_6$] |
| | | | | | |
| 13. | | Derive the Bernoulli's equation from Euler's Equation. | 16 | CO2 | [K$_3$] |
| | | | | | |

| 14. | Derive on the basis of dimensional analysis suitable parameters to present the thrust developed by a propeller. Assume that the thrust T depends upon the angular velocity $\omega$, speed of advance V, diameter D, dynamic viscosity $\mu$, mass density $\rho$, elasticity of the fluid medium which can be denoted by the speed of sound in the medium C. | 16 | CO3 | [K$_6$] |
|---|---|---|---|---|
| | | | | |
| 15. | Oil with a free-stream velocity of 2 m/s flows over a thin plate 2 m wide and 2 m long. Calculate the boundary layer thickness and the shear stress at the trailing end point and determine the total surface resistance of the plate. Take specific gravity as 0.86 and kinematic viscosity as $10^{-5}$ m$^2$/s. | 16 | CO4 | [K$_4$] |
| | | | | |
| 16. | A jet of water of diameter 25 mm strikes a 20 cm X 20 cm square plate of uniform thickness with a velocity of 10 m/s at the centre of the plate which is suspended vertically by a hinge on its top horizontal edge as shown in figure-3. The weight of the plate is 98.1 N. The jet strikes normal to the plate. What force must be applied at the lower edge of the plate so that plate is kept vertical? <br><br>  <br> Figure-3　　　　　Figure -4 <br><br> If the plate is allowed to deflect freely as shown in figure-4, what will be the inclination of the plate with vertical due to the force exerted by the jet of water? | 16 | CO5 | [K$_5$] |

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