AJEENKYA
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End Term Examination (December 2019)

School: School of Engineering **Program:** B-Tech- Mechatronics

Course: Strength of Materials and Fluid Mechanics **Course Code**: MTE206

Semester: III **Max Marks:** 40 **Duration (mins):** 90

Note:1) Answers to the questions to be written in answer sheet provided.
2) Figures to the right indicate full marks.
3) Neat diagrams must be drawn wherever necessary.
4) Assume suitable data, if necessary.
5) Q.1 & Q6 is compulsory, Solve Q2 or Q3; and Q4 or Q5.

Q1. Briefly explain the following:

1. List the critical assumption made during the Euler's Columns Theory.
2. Explain the different end conditions for Crippling stress for Long Columns
3. The Continuity equation for 3D and 2D flows.
4. Velocity Potential Function.
5. Pitot tube and its application. **[10]**

Q2.A) In a hollow circular shaft of outer diameter 50 mm and inner diameter 30 mm the shear stress is not to exceed 40 N/mm^2. How much torque can it transmit? If the hole in shaft is eliminated and the shaft is made solid, what is the percentage increase in torque capacity it can then transmit? **(6)**

Q 2.B) A solid round bar 3m long and 5cm in diameter is used as a strut with both ends hinged. Determine the Crippling load, take E= 2.1 x 105 N/mm^2. Also find out the crippling load if one end is fixed and the other end is hinged **(6)**

OR

Q3. A 15 cm x 15 cm Venturimeter is provided in a vertical pipe carrying crude oil (Sp.Gr =0.8). The flow is in upward direction. The difference in elevation between the entrance and throat Section of the Venturimeter is 25cm. The difference in level between the two limbs of U tube mercury manometer recorded is 20cm. Calculate (i) the flow rate of oil (ii) the pressure difference between the entrance and the throat section. Take C_d = 0.95 **(12)**

Q4. The following cases represent the 2 velocity components, determine the third component of velocity such that they satisfy the continuity function

(i) $u = x^2 + y^2 + z^2$; $v = xy^2 - yz^2 + xy$.

(ii) $v = 2y^2$, $w = 2xyz$ **(10)**

OR

Q5. Determine the Difference in the elevation between the water surfaces in the 2 tanks which are connected by a horizontal pipe of diameter 300mm and length of 400m. The rate of flow of water through the pipe is 300 liters/sec. Consider all the losses and take the value of f =0.008 **(10)**

Q6. Using Buckingham-Pi theorem, show that the velocity through a circular orifice in a pipe is given by:

$$V = \sqrt{2gH}\, f\left(\frac{d}{H}, \frac{\mu}{\rho VH}\right).$$

(8)

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