

Roll No

AU/CE/IP/IEM/PR/ME-405

B.E. IV Semester

Examination, December 2016

Fluid Mechanics

Time : Three Hours

Maximum Marks : 70

Note: Attempt any five questions. All questions carry equal marks.

1. a) Define compressibility. How it is related to bulk modulus of elasticity.
b) A steel shaft 25mm diameter and 30cm long falls of its own weight inside a vertical open tube 25.2 mm diameter. The clearance, assumed uniform is filled with glycerin of viscosity 1.5 Pas. Calculate how fast will the cylinder fall at terminal conditions. Take density of steel as 7850 kg/m^3 .
2. a) Explain the term total pressure acting on a plane surface immersed in a fluid at any angle. Obtain an expression for this and also the corresponding depth of center of pressure.
b) Show that if 'B' is the center of buoyancy and 'm' is the metacentre of a partially immersed floating body then $BM = I/V$ where I is the second moment of area of the surface of floatation about the longitudinal axis and 'V' is the immersed volume.
3. a) Define and distinguish between :
 - i) Rotational and Irrotational flow
 - ii) Uniform and Non Uniform flow
 - iii) Steady and unsteady flow

- b) Describe the different types of displacement and deformation a fluid particle may undergo in course of its motion.
4. a) Derive Eulers equation of motion along a streamline, and hence derive Bernoulli's theorem.
b) Water enters a reducing pipe horizontally and curves out vertically in the down ward direction. If the inlet velocity is 5m/sec and pressure is 80 kPa gauge and the diameter as the entrance and exit sections are 30m and 20m respectively calculate the components of reaction acting on the pipe.
5. a) Sketch a venturimeter and manometer arrangement, apply the steady flow energy equation and derive an expression for actual flow rate.
b) Define Vena contracta. Why is so much importance attached to it. Also explain the utility of a mouthpiece.
6. a) Explain the Buckingham - π theorem.
b) The flow rate over a 'V' notch of included angle ' θ ' takes place due to gravity and the flow rate depends upon the head of liquid 'H' density ' ρ ' and viscosity ' μ '. Derive the expression for non-dimensional parameters that relates the flow rate 'Q' to the independent variables.
7. a) State the reasons for constructing distorted models of rivers and discuss the various types of distortion in models
b) Explain the different dimensionless numbers and their physical significance.
8. a) Prove that for a steady laminar flow between two fixed parallel plates the velocity distribution across a section is parabolic and that the average velocity is $2/3^{\text{rd}}$ of maximum velocity.
b) Derive the Hagen-Poiseuille's equation and state the assumptions made.
