

FACULTY OF ENGINEERING
B.E. 2/4 (M/P) II Sem. (New) (Main) Examination, May/June 2012
FLUID DYNAMICS

Time: 3 Hours]

[Max. Marks:75

Note: 1) Answer **all** questions from Part A.
 2) Answer **five** questions from Part B.

PART – A**(10×2.5=25 Marks)**Answer **all** the questions :

1. Is there is any analogy of Hooke's law in fluids ? If so, state the parallel law in fluids.
2. Differentiate between dynamic viscosity and kinematic viscosity.
3. Define stream line, path line and streak line. When they coincide ?
4. Define nominal thickness of boundary layer.
5. Define :
 i) Circulation and ii) Vorticity
6. What is Prandtl tube ? State its practical use.
7. Why is coefficient of discharge of an orifice meter much smaller than that of venturimeter ?
8. What are the advantages of triangular notch when compared to rectangular notch ?
9. What is Laminar sub layer ? Define it.
10. Define adiabatic flow.

PART – B**50 Marks**

11. a) Define and distinguish between steady flow and unsteady flow and show that the flow rate per unit width between stream lines in two dimensional flow is equal to the difference between the values of the stream function corresponding to these stream lines. 5
- b) Two velocity components in a two dimensional flow field for an incompressible fluid are expressed as $u = 2y$ and $v = 2x$. Show that these functions represent a possible case of an irrotational flow and obtain an expression for stream function. 5



12. a) Deduce the Euler's equation for three dimensional flow. 5
- b) A 120° bend cum reducer has 300 mm diameter at inlet and 200 mm diameter at the other end. When the bend-cum-reducer carries 0.30 m³/s of water, pressure at section – 1 is 210 kN/m². Assume no energy loss in the bend and determine the components of force exerted by the bend on the flow. Assume the weight of bend plus water in it to be 1500 N. Assume section – 2 be 0.40 m above section – 1. 5
13. a) Explain Venturimeter with a neat sketch and its advantages with respect to discharge measurement. Also explain why diverging cone is longer than the converging cone. 5
- b) What is Broad crested weir ? Find an expression for the discharge over a broad crested weir. 5
14. a) What is boundary layer ? Give any example in everyday life where formation of boundary layer is important. 5
- b) A smooth plate 2 m wide and 2.5 m long is towed in oil (RD = 0.8) at a velocity of 1.5 m/s along its length. Find the thickness of the boundary layer and shear stress at i) the centre and ii) the trailing edge of the plate. Also find the power required for towing plate, $\nu = 10^{-4}$ m²/s. 5
15. a) Obtain expression for Darcy-Weisbach friction factor f for the laminar flow in a pipe. 5
- b) Determine the optimum diameter of the pipe required to carry 100 l/s of crude oil (mass density = 950 kg/m³, dynamic viscosity = 8×10^{-2} kg/ms) and still maintaining laminar flow. Also determine the power required for its transport over one kilometer. 5
16. a) Explain velocity of sound in compressible and incompressible fluids and derive the expression for velocity of sound in adiabatic process. 6
- b) Define temperature, pressure and density ratios as functions of Mach number. 4
17. Write short note on the following : (4×2.5=10 Marks)
- Free vortex and forced vortex.
 - Growth of Laminar boundary over a flat plate.
 - Adiabatic and isothermal expansion.
 - Energy correction factor.