



Code No. : 5416/N

FACULTY OF ENGINEERING

B.E. 2/4 (Civil) II Semester (New) (Main) Examination, May/June 2012

FLUID MECHANICS – I

Time : 3 Hours]

[Max. Marks : 75

Note : Answer *all* questions from Part A, answer *any five* questions from Part B.

PART – A

(25 Marks)

1. Define Newton's law of viscosity. 2
2. Define surface tension. Prove the relationship between surface tension and pressure inside drop let of liquid is given by $p = \frac{4\sigma}{d}$. 2
3. Explain the terms path line and streak line. 2
4. Differentiate between forced vortex and free vortex flow. 2
5. The stream function for a two-dimensional flow is given $\psi = 2xy$. Calculate the velocity at the point P(2, 3). Find the velocity potential function ϕ . 3
6. What is difference between momentum equation and impulse equations ? 2
7. Prove that the error in discharge due to the error in the measurement of head over a rectangular notch is given by $\frac{dQ}{Q} = \frac{3dH}{2H}$. 3
when Q = discharge through rectangular notch and H = head over the rectangular notch.
8. State the Bernoulli's theorem for compressible flow. 3
9. Define Mach number. What is significance of mach number in compressible fluid flow ? 3
10. Define the term momentum correction factor. 3



PART – B

(50 Marks)

11. a) Define the continuity equation and obtain an expression for a three dimensional flow. 6
b) The velocity potential function ϕ is given by $\phi = x^2 - y^2$. Find the velocity components in x and y direction. Also show that ϕ represents a possible case of fluid flow. 4
12. a) Starting with Euler's equation of motion along a stream line, obtain Bernoulli's equation by its integration. List all the assumptions made. 5
b) Water is flowing through a pipe having diameters 30 cm and 15 cm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 14.715 N/cm^2 . Determine the difference in datum head if the rate of flow through pipe is 50 liters/sec. 5
13. a) A rectangular channel is 15 m wide has a discharge of 200 liters per second which is measured by a right angled V-notch Weir. Find the position of the apex of the notch from the bed of the channel with maximum depth of water not to exceed 1 m. Take $C_d = 0.62$. 6
b) Explain the principle of venturimeter with a neat sketch. Prove the expression for the rate of flow of fluid through it. 4
14. a) What do you understand by stagnation pressure ? Obtain an expression for stagnation pressure of a compressible fluid in terms of approaching mach number and pressure. 6
b) Find the mach number when an aeroplane is flying at 1000 km/hour through still air having pressure of 7 N/cm^2 and temperature of -5°C . Take $R = 287.14 \text{ J/kg K}$. Calculate the pressure and temperature of air at stagnation point. Take $K = 14$. 4
15. a) What for Hagen Poiseuille's formula is helpful ? Derive an expression for Hagen Poiseuille's formula. 6
b) A liquid is pumped through a 15 cm diameter and 300 m long pipe at the rate of 20 tonnes per hour the density of liquid is 910 kg/m^3 and Kinematic viscosity = $0.002 \text{ m}^2/\text{s}$. Determine Reynold's number. 4
16. a) State the significance of Mody's diagram in flow through pressure conduits. 5
b) Derive an expression for Bernoulli's equations when process is adiabatic. 5
17. Write the short notes of following :
a) Elbowmeter. 3
b) Mach cone 3
c) Reynolds experiment. 4