Code No. 2067

FACULTY OF ENGINEERING

B.E. 2/4 (M/P) II-Semester **(Main)** Examination, April / May 2013

Subject : **Fluid Dynamics**

Time : 3 Hours Max. Marks: 75

Note: Answer all questions of Part - A and answer any five questions from Part-B.

PART – A (25 Marks)

1. If the volume of liquid decreases by 0.2 % for an increase of pressure form 70 kg/cm^2 to 160 kg/cm^2, the value of the bulk modulus of the liquid is _____ (3)
2. A flow is called irrotational if (2)
   (a) Force is not required
   (b) External force is required
   (c) Velocity is maximum
   (d) Rotational components of the velocity are zero
3. What is the principle of manometers, while measuring the pressure? (3)
4. Define Reynold's number, what is its use in the case of pipe flow. (3)
5. Velocity distribution in a boundary layer remains uniform. Is this statement Time or False? Explain. (3)
6. Explain the concept of Mach number. (2)
7. Explain how the different terms in Beronoulli's equation have dimensions of length only though they represent flow energy. (3)
8. Define the following terms: (2)
   (a) Aspect Ratio
   (b) Stall Condition of aero foil
   (c) Angle of attack
9. By equating Darcy's equation and Hagen Poiseuille's equation prove that f=16/Re where 'f' is friction factor and Re, the Raynold's number. (2)
10. The value of 'ψ' (stream function) along a stream line is _____ (2)
    (a) Increases
    (b) Decreases
    (c) Is zero
    (d) Is constant

PART – B (5x10=50 Marks)

11.(a) Prove that the shear stress of a fluid is the product of velocity gradient and coefficient of viscosity. (5)

(b) The 'x' and 'y' components of velocity in a 2-D flow field are $u = \frac{y^3}{3} + 2x - x^2 y$ and $v = xy^2 - 2y - \frac{x^3}{3}$, show that the is steady and irrotational. (5)

12.(a) Define Bernoulli's energy equation by integrating Euler's equation of motion. (5)

(b) A 45^o reducing bend is connected in a Pipeline, the diameters at the inlet and outlet of the bend being 400 mm and 200 mm respectively. Find the force exerted by water on the bend if the intensity of Pressure at inlet of the bend is 215.8 kN/m^2. The rate of flow of water is 0.5 m^3/sec. (5)

13.(a) Derive and explain the Hagen Poiseuille's Law. (5)

(b) The rate of drop of pressure of water through a pipe of diameter 50 mm is 200N/m^2 per mt length. If the maximum velocity of flow is not to exceed0.8m/sec. What is the power required to maintain the flow over a length of 1 km? (5)

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14.(a) With the aid of neat sketches, explain the concept of boundary layer theory across a flat plate. (5)

(b) A small pipe line 10 cm in diameter and 1000 mt long carries water at the rate of 7.5 lts/sec. If the kinematic viscosity of water is 0.02 stokes, calculate the head lost wall shearing stress, center line velocity, shear stress and velocity at 4 cm from centerline and thickness of the laminar sublayer. (5)

15.(a) Prove that celerity 'C' of a sound wave in a fluid is given by $C^2 = \frac{dp}{d\rho}$. Also prove that for a perfect gas C = $\sqrt{kRT}$ where 'k' is the adiabatic index, R is gas constant and T is absolute temperature. (5)

(b) Find the Mach number when a aeroplane is flaying at 1100 km/hr through still air having a pressure of 7 N/cm^2 and temperature of -5^{o}C. Wind velocity may be taken as zero. Take k=1.4, R=287 J/kg ^{o}k. Also calculate the pressure temperature and density of air at stagnation point on the nose of the plane. (5)

16.(a) Derive an expression to find out the discharge through a ventrimeter. (5)

(b) A hydraulic lift consists of a 25 cm diameter ram which slide in a 25.015 cm diameter cylinder, the annular space being filled with oil having a specific gravity of 0.85. If the rate of travel of ram is 9.15 mts/min, find the frictional resistance when 3.05 mts of ram is engaged in the cylinder. (5)

17. (a) Explain the working principle of manometers and mechanical gauges. Briefly explain the working of micromanometer. (5)

(b) The velocity in a fluid flow is given by

C = $4x^3i + 10x^2yj + 2tk$

Find the velocity and acceleration of a fluid particle at (2, 1, 3) at time t = 1. (5)

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