OR

A crude oil of viscosity 0.9 poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 120 mm and length 12 m. Calculate the difference of pressure at the two ends of the pipe. If 785 N of the oil is collected in a tank in 25 seconds.

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Total No. of Questions :5]

Roll No .....

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

B.E. IV Semester

Examination, June 2015

Fluid Mechanics

Time : Three Hours

Maximum Marks : 70

Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.
ii) All parts of each question are to be attempted at one place.
iii) All questions carry equal marks, out of which part A and B (Max. 50 words) carry 2 marks, part C (Max. 100 words) carry 3 marks, part D (Max. 400 words) carry 7 marks.
iv) Except numericals, Derivation, Design and Drawing etc.

1. a) State and explain the Newton's law of viscosity.
   b) What is the centre of Buoyancy?
   c) Define Atmospheric, Gauge, Vacuum and Absolute pressure.
   d) A differential manometer connected at the two points P and Q in a pipe containing an oil of specific gravity of 0.9, shows a difference in mercury levels as 150 mm. Find the difference in pressures at the two points.

OR

Calculate the capillary effect in millimeters in a glass tube of 4 mm diameter, when immersed in mercury. The temperature of the liquid is 20°C and the value of surface tension of mercury at 20°C in contact with air is 0.51 N/m. Take contact angle is 130° and specific weight 133 kN/m³.

2. a) Explain steady, unsteady, uniform and non-uniform flow.
   b) What is a 'Flow-net'?
   c) Define and explain velocity potential and stream function.
   d) Derive the continuity equation in Cartesian co-ordinates.

OR

A pipe of 450 mm diameter has two branches of pipe having diameter 300 mm and 200 mm respectively. The average velocity in 450 mm diameter pipe is 3 m/s Calculate, the discharge through 450 mm diameter pipe and velocity in 200 mm diameter pipe if the average velocity in 300 mm diameter pipe is 2.5 m/s.

3. a) What are the limitations of the Bernoulli's equation?
   b) What is the moment of momentum equation?
   c) What is the pitot tube? How is it used to measure velocity of flow at any point in a pipe?
   d) The water is flowing through a tapering pipe having diameters 300 mm and 150 mm at section 1 and 2 respectively. The discharge through the pipe is 40 liters/sec. The section 1 is 10 m above datum and section 2 is 6 m above datum. Find the intensity of pressure at section 2 if that at section 1 is 400 kN/m^2.

OR

A horizontal venturimeter with inlet and throat diameters 300 mm and 100 mm respectively is used to measure the flow of water. The pressure intensity at inlet is 130 kN/m^2 while the vacuum pressure head at the throat is 350 mm of mercury. Assuming that 3% of head is lost in between the inlet and throat, find the co-efficient of discharge for venturimeter, and rate of flow.

4. a) What are the uses of dimensional analysis?
   b) Explain the term dimensional homogeneity.
   c) What are applications of model testing?
   d) Describe Buckingham's method to formulate a dimensionally homogeneous equation between the various physical quantities effecting a certain phenomenon.

OR

A 7.2 m high and 15 m long spillway discharge 94 m^3/s discharge under a head of 2.03 m. If 1:9 scale model of this spillway is to be constructed, determine model dimensions, head over spillway model and the model discharge. If model experience a force of 7500 N, determine force on the prototype.

5. a) What are the characteristics of a laminar flow?
   b) Explain the lubrication principles.
   c) Derive the relationship between shear stress and pressure gradient.
   d) A fluid of density 1200 kg/m^3 and viscosity 0.5 poise is flowing at a rate of 5m^3/min in a circular pipe of cross-section of 1 m^2. Is the flow laminar or turbulent? Can you predict the maximum velocity of the fluid in the pipe?