CH-301 **Roll No.** | | | | | | | | | | |

B. Tech.
(SEM. III) EXAMINATION, 2015-16
FLUID MECHANICS

Time: 3Hours] **[Total Marks: 100**

Note: (1) Attempt all questions
(2) All questions carry equal marks.
(3) In case of numerical problems assume data wherever not provided

1. Attempt any four parts of the following: **5x4=20**

(a) Explain how changes in enthalpy and changes in internal energy can be determined?
(b) Determine the compressibility of a liquid which gives 0.2% volume decrease with increase in pressure from 5M*Pa* to 10M*Pa*.
(c) Obtain an expression for volume modulus of elasticity of atmosphere assuming the process to be isothermal.
(d) Calculate water height in an atmospheric tank if the mercury manometer attached at the tank bottom shows 20*cm* height difference in its two legs.
(e) Discuss the Eularian and Lagrangian view point.
(f) A pipe of inner diameter 5m is bifurcated into two small pipes of diameter 2.5m each. If the average flows velocity through the main pipe is 4m/s. Find the average velocity through the bifurcated pipes.

2. Attempt any two parts of following: **10x2=20**

(a) Define the following dimensionless numbers and develop mathematical expressions for these.
(i) Reynolds number *(ii) Mach's number*
(iii) Froude number *(iv) Euler's number*

(b) Calculate the flow rate through a filter 70mm outside diameter and 40mm inside diameter and 100 mm long given that the pressure on the outside is 20 kPa greater than on the inside. The mean particle diameter d is 0.04 mm and void fraction is 0.3. The dynamic viscosity is 0.06 N s/m^2.

(c) Differentiate between circulation and vorticity? If the velocity field is given by u=y, v=-x, find the circulation around the closed curve defined by x= ±1 and y= ±2.

3. Attempt any two parts of the following: **10x2=20**

(a) Derive the velocity profile equation for a non-Newtonian fluid in laminar flow in a circular pipe.

(b) If the volumetric flow rate of a shear thinning liquid (pseudo plastics), flowing in a pipeline is doubled in a laminar flow, find the variation of the pressure difference.

(c) Derive Navier-stokes equation of motion and show how it can be converted to Euler equation.

4. Attempt any two parts of the following: **10x2=20**

(a) What is the orifice size required to give a pressure difference of 30 cm water column for the flow of liquid styrene of specific gravity 0.9 at 0.065 m^3/s in a 300 mm diameter pipe, assuming orifice meter coefficient as 0.6.

(b) A horizontal pipeline of diameter 30cm carrying oil of specific gravity 0.9 flowing through it, has a venturimeter of throat diameter 0.15 cm installed. Calculate the oil discharge when the manometer shows 20 cm of mercury difference. Assume meter coefficient as 0.98 and mercury specific gravity 13.55.

(c) Air at room temperature is passed through a rotameter at atmospheric pressure. It gives reading at the flow rate of $50cm^3/sec$. if helium of molecular weight 4 passed through the same rotameter shows the same reading, find the helium flow rate. Assume density is proportional to molecular weight.

5. Attempt any two parts of the following: **10x2=20**

(a) Consider a steady, two-dimensional, incompressible flow of a newtonian fluid with the velocity field $u = -2xy$, $v = y^2 - x^2$, and $w = 0$. (a) Does this flow satisfy conservation of mass? (b) Find the pressure field $p(x, y)$ if the pressure at point ($x = 0$, $y = 0$) is equal to p_a.

(b) A centrifugal pump delivering 0.004 m^3/s of water at a head of 14m is to be replaced with a double capacity pump. Find the head developed by the new pump and the percent increase in power requirements.

(c) Explain the following:
   (i) Cavitation and Water hammering
   (ii) Subcritical and supercritical flows