Paper Code: CH-301	**Roll No.**									

B. Tech.
THIRD SEMESTER EXAMINATION, 2016-17
FLUID MECHANICS

[Time: 3 Hours] [Max. Marks: 100]

Note: Attempt ***ALL*** questions. Assume suitable data, if required. All question carry equal marks.

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

(a) What is the difference between dynamic viscosity and Kinematics viscosity? State their units of measurements.
(b) The quantities viscosity μ, velocity *V*, and surface tension *Y* may be combined into a dimensionless group. Find the combination which is proportional to μ.
(c) Obtain an expression for volume modulus of elasticity of atmosphere assuming the process to be isothermal.
(d) Differentiate between deformation drag, friction drag and form drag.
(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 *four* parts of following:- **(5x4=20)**

(a) Define and give significance of following dimensionless numbers. Develop mathematical expression for these.
(i) Mach's number (ii) Euler's number
(b) An oil of viscosity 5 poise flows between two parallel fixed plates which are kept at a distance of 60 mm apart. Find the rate of flow of oil between the plates, if the drop of pressure in a length of 1.2 m be 0.4 N/cm^2. The width of the plate is 200mm.
(c) If u=ax and v=-ay give velocity distribution for two dimensional flow, determine the equation of stream line passing through the point (3, 1). Is the flow irrotational or rotational? Identify the flow pattern.
(d) 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.
(e) 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.
(f) Convert dimensionally homogeneous equations $\Delta p = 32\mu U\, l / D^2$ into dimensionless parameter and verify Buckingham's π theorem.

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) Air at atmospheric pressure and 350 K flow through a pipe of internal diameter 25cm with an average velocity of 10 m/s. Calculate the pressure drop per 100m length of the pipeline and the power consumed. Take, $f = 0.079N_{Re}^{-0.25}$ in the turbulent region and $\mu = 10^{-5}$ kg/m.s.
(c) Derive Navier-strokes equation of motion and show how it can convert to Euler equation.

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

(a) Derive Bernoulli's equation with assumptions and suitable examples.

(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 $w = 0$. (i) Does this flow satisfy conservation of mass? (ii) Find the pressure field $p(x, y)$ if the pressure at point ($x = 0$, $y = 0$) is equal to pa.

(b) With the help of a neat diagram explain the operation of a reciprocating pump and differentiate between Simplex and Duplex type of pumps.

(c) Explain the following:
(i) Water hammering
(ii)Supersonic flow