Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **M.Tech**
P2TFCC02

2nd Semester Regular Examination 2017-18
ADVANCED FLUID MECHANICS
BRANCH : THERMAL & FLUID ENGG
Time : 3 Hours
Max Marks : 100
Q.CODE : C750

Answer Question No.1 and 2 which is compulsory and any four from the rest.
The figures in the right hand margin indicate marks.
Answer all parts of a question at a place.

Q1 **Answer following questions :** **(2 x 10)**

a) Define concept of translation.

b) Define concept of rotation.

c) Define concept of deformation.

d) Differentiate between Newtonian and Non-Newtonian fluid.

e) What is Langragian method of description of fluid motion?

f) What are the factors affecting boundary layer thickness.

g) What is flow net?

h) Differentiate laminar flow and turbulent flow in pipe.

i) Differentiate hydraulic gradient and total energy lines.

j) Why are pipes connected in parallel?

Q2 **a)** State and derive the continuity equation of fluid flow for a three dimensional steady flow. **(10)**

b) Given two velocity components of flow, find the third component if flow satisfies the continuity equation. **(10)**

$$U = x^3 + y2 + 2z^2 \quad v = -x^2y - yz - xy$$

Q3 **a)** The velocity field in a fluid medium is given as in a vectorial field of **(10)**

$$V = 3xy^2 i + 2xy\, j + (2zy + 3t)\, k$$

Find the magnitude of translation velocity and rotational velocity at (1,2,1) at time t = 3.[10]

b) Define one dimensional, two dimensional and three dimensional fluid flows. **(10)**

Q4 **a)** Define kinematic similarity and dynamic similarity. Explain the representative magnitude of ration of forces for Reynolds number, Eulers number and Froude number. **(10)**

b) Explain Buckingham' Pi theorem. **(10)**

Q5 **a)** Does a velocity potential function $\varphi = 2(x^2 + 2y - y^2)$ describe the possible flow of an incompressible fluid? If so, find the equation of velocity vector V. Also find stream function. **(10)**

b) Water at 60 degree flows between two large parallel plates. The lower plate moves to left at a speed of 0.3 m/s. The plate spacing is 3 mm and flow is laminar. Determine pressure gradient required to produce zero net flow at cross section. $M\mu = 4.7 \times 10^{-4}$ Ns/m^2 at 60 degree. **(10)**

Q6 **a)** A. Water flows in a horizontal pipe 2 m long, which tapers from a diameter 0.2 m to 0.15 m in the length of 2 m. A constant discharge of 40 liters per second flows through the pipe. Determine the loss of head due to friction, f = 0.04. **(10)**

b) State and derive the Darcy-Weisbach equation to find head loss in pipe due to friction. **(10)**

Q7 **a)** What is boundary layer thickness? State displacement, momentum and energy thickness. **(10)**

b) For the velocity distribution $v/V = 2\eta - 2\eta^3 + \eta^4$ where $\eta = y/\delta$, obtain (δ^*/δ) and (θ/δ). **(10)**