Total No. of Questions : 8]

SEAT No :

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M.E. (Civil) (Water Resources and Environmental Engg.)
FLUID MECHANICS
(2013 Course) (Semester-I) (501083)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answer any five questions.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicates full marks.***
4) ***Use of logarithms tables, slide rule, electronics pocket calculator is allowed.***
5) ***Assume suitable data if necessary.***

Q1) a) The velocity potential function for a two-dimensional flow is $\Phi = x(3y-1)$ at a point P(3,5) determine: the velocity, the value of stream function. **[6]**

b) Define nominal thickness, momentum thickness, energy thickness and laminar sub-layer of a boundary layer. **[4]**

Q2) a) Derive Bernoulli's equation along a streamline. **[4]**

b) For the following velocity profiles in the boundary layer on a flat plate, calculate the displacement thickness in terms of the nominal boundary layer thickness δ' a) $u/U = n$ b) $u/U = 2n - n^2$ Where $n = y/$ [illegible] **[6]**

Q3) a) Derive differential form of continuity equation in cylindrical polar coordinate system. **[5]**

b) A circular pipe of 25mm diameter and 2m long carried an oil of sp. gr. 0.9 and viscosity 0.15 N-s/m^2 at 1/10 of critical velocity for which Reynold's number is 2450. Find: a) Velocity of through pipe b) head in meters of oil to maintain flow. **[5]**

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Q4) a) Derive equation for stream function and velocity potential for a doublet. **[5]**

b) Derive equation for velocity distribution for flow between parallel plates with one plate moving and the other at rest starting with Navier-Stokes equations. **[5]**

Q5) a) Derive Karman Intergral momentum equation. **[5]**

b) Derive Reynolds equation of motion. **[5]**

Q6) a) Derive equation for boundary layer over a flat plate starting with boundary layer equations. **[6]**

b) What are the factors affecting the transition from laminar to turbulent flow. **[4]**

Q7) a) Drive equation for stagnation density. **[5]**

b) Discuss the analogy between the normal shock wave and the hydraulic jump. **[5]**

Q8) a) Derive equation for work done in adiabatic process. **[5]**

b) What is the effect of compressibility on drag. **[5]**