Total No. of Questions :8]

SEAT No. :

P4050

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M.E. (Civil) (Water Resources and Environment Engg.)
FLUID MACHANICS
(2013 Pattern) (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 indicate full marks.***
4) ***Use of logarithms tables, slide rule, electronics pocket calculator is allowed.***
5) ***Assume suitable data if necessary.***

Q1) a) Define circulation, stream function, velocity potential. **[6]**

b) Define hydrodynamically rough and smooth boundaries. **[4]**

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

b) The velocity distribution in the turbulent boundary layer over a flat plate is given as $\frac{u}{U_\infty}=\frac{3}{2}\frac{y}{\delta}-\frac{1}{2}\left(\frac{y}{\delta}\right)^3$. Obtain an expression for the displacement thickness, momentum thickness and energy thickness. **[6]**

Q3) a) Derive equation for stream function and potential function of a source and sink. **[4]**

b) Derive equation for velocity distribution for laminar flow between parallel plates with both plates fixed starting with Navier-Stokes equations. **[6]**

Q4) a) Given the complex potential, $W=\log_e Z^2$, evaluate the stream and velocity functions. Identify the flow pattern. **[4]**

b) Laminar flow takes place in a circular tube. At what distance from the boundary does the local velocity equal the average velocity. **[6]**

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Q5) a) Derive Karman Momentum Integral equation starting Navier Stokes equations. **[6]**

b) What are the characteristics of turbulent flow? **[4]**

Q6) a) What is boundary layer separation? What are its effects and methods to avoid separation? **[4]**

b) Derive Reynolds equation of motion. **[6]**

Q7) a) Find the stagnation temperature and pressure for carbon dioxide flowing at 150 m/s if the pressure and temperature in undisturbed flow are 500 kPa and 30ºC respectively. k = 1.28 and R = 188 J/kg K. **[5]**

b) Write in brief about Rayleigh and Fanno lines. **[5]**

Q8) a) Derive equation for stagnation density for a compressible fluid flow. **[6]**

b) Write a short note on compressible flow around submerged bodies. **[4]**