Total No. of Questions : 8] SEAT No. :

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[4860]-1048

M.E. (Civil) (Water Resources and Environmental Engg.)

FLUID MECHANICS

(2013 Credit Pattern)

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) Derive Euler's equation of motion. **[5]**

b) Define nominal thickness, momentum thickness, displacement thickness, energy thickness of boundary layer and laminar sublayer. **[5]**

Q2) a) Bernoulli's theorem is based on which principle? Give its statement. Name three devices where Bernoulli's equation is applied. **[4]**

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

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

b) Water flows between two horizontal plates kept 4 m apart. The lower plate is stationary while the upper plate moves with a velocity of 0.5 m/s to the right. Find the pressure gradient such that the flow rate is zero. Viscosity of water 20°C is 0.001 N-s/m^2. **[5]**

Q4) a) Derive equation for stream function and velocity potential for superposition of a source and a sink. Draw stream lines and potential lines. **[5]**

b) Derive equation for velocity distribution for laminar flow between a circular pipe starting with Navier-Stokes equations. **[5]**

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Q5) a) What is boundary layer separation? What are its effects and how to control it? **[5]**

b) What are types of turbulent flow? Explain in detail with the help of sketches. **[5]**

Q6) a) Derive boundary layer equations starting with Navier-Stoke equations. **[6]**

b) Write a short note on Reynolds rules of averages. **[4]**

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

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

Q8) a) Derive equation for celerity of elastic wave due to compression of fluid. **[5]**

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