Code No: R7210106 **R7**

II B.Tech I Semester(R07) Supplementary Examinations, May/June 2010
FLUID MECHANICS
(Civil Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) State and prove Pascal's law.
   (b) Calculate:
      i. The height of an oil column of specific gravity 0.9 equivalent to a gauge pressure of 22.4 KPa
      ii. Height of a water column equivalent to a pressure of 0.18 MPa. [10+6]

2. (a) A triangular plate of base width 2m and height 2.5m lies immersed in water with the apex downwards. The base of the plate is 1m below and parallel to the free water surface. Calculate the total pressure on the plate and the depth of centre of pressure.
   (b) A square plate 6m6m hangs in water from one of its corners and its centroid lies at a depth of 10m from the free water surface. Workout the total pressure on the plate and locate the position of centre of pressure with respect to the plate centroid. [8+8]

3. (a) Derive the equation of continuity for three dimensional flow.
   (b) Define stream function. Explain its significance. For a two dimensional potential flow, the velocity potential is given by $\phi = 3x(4y-7)$. Determine the velocity at point (5,11). Determine also the stream function and its value at a point (4,3). [8+8]

4. (a) A fireman holds a water hose ending into a nozzle that issues a 25mm diameter jet of water. If the pressure of water in the 60mm diameter hose is 750KPa, find the force experienced by the fireman.
   (b) Derive Euler's equation of motion along a stream line. [10+6]

5. A smooth flat plate of length 5.5 m and width 2.5 m is moving with a velocity of 4.2 m/s in stationary air of density as 1.25 kg/m^3 and kinematic viscosity 1.5×10^{-5} m^2 /s. Find the thickness of the boundary layer at the trailing edge of the smooth plate. Find the total drag on one side of the plate assuming that the boundary layer is turbulent from the very beginning. [16]

6. Lubricating oil of specific gravity 0.82 and dynamic viscosity 12.066×10^2 N.s/m^2 is pumped at a rate of 0.02 m^3/s through a 0.15 m diameter 300m long pipe. Calculate the pressure drop, average shear stress at the wall of the pipe and the power required to maintain flow if the pipe is inclined at 15 degree with the horizontal and the flow is in upward direction. [16]

7. (a) What is a compound pipe explain in detail.
   (b) Explain pipes in parallel. [8+8]

8. (a) A pitot-static tube placed in the centre of a 300 mm pipe line has one orifice pointing upstream and other perpendicular to it. The mean velocity in the pipe is 0.80 of the central velocity. Find the discharge through the pipe if the pressure difference between the two orifices is 60 mm of water. Take the co-efficient of pitot tube as $C_v = 0.98$.
   (b) Find the velocity of the flow of an oil through a pipe, when the difference of mercury level in a differential U-tube manometer connected to the two tappings of the pitot-tube is 100 mm. Take co-efficient of pitot-tube 0.98 and sp. gr. of oil = 0.8. [8+8]

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