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**CODE NO:- Z-81**

**FACULTY OF ENGINEERING & TECHNOLOGY**

**T.E (Mech) - Year Examination June– 2015**

**Fluid Mechanics**

**(Revised)**

[Time: Three Hours]

[Max. Marks: 80]

“Please check whether you have got the right question paper.”

- i) Attempt any Three questions from each section (section A and B)
- ii) Figures to right indicates full marks
- iii) Draw diagrams or graphs wherever required
- iv) Assume suitable data, if necessary

**SECTION A**

- Q.1 a) Explain variation of viscosity with temperature 05  
b) A rectangular 10m long, 7m broad and 2.5m deep weighs 686.7kN. It carries on its upper deck an empty boiler of 5m diameter weighing 588.6kN. The center of gravity of the boiler and the pontoon are at their respective center along a vertical line. Find the meta-centric height. Weight density of water is  $10.104\text{kN/m}^3$  08
- Q.2 a) Explain pressure variation in a fluid at rest (hydrostatic law) 08  
b) Explain different types of fluid flow 05
- Q.3 a) The following cases represent the two velocity components, determine the third component of velocity such that they satisfy the continuity equation: 08  
i)  $u = x^2 + y^2 + z^2; v = xy^2 - yz^2 + xy$   
ii)  $v = 2y^2; w = 2xyz$   
b) A jet of water from a 25mm diameter nozzle is directed vertically upwards. Assuming that the jet remains circular and neglecting any loss of energy, that will be the diameter at a point 4.5m above the nozzle, if the velocity with which the jet leaves the nozzle is 12m/s. 05
- Q.4 a) The water is flowing through a taper pipe of length 100m having diameters 60cm at the upper end and 30cm at the lower end, at the rate of  $0.05\text{m}^3/\text{s}$ . The pipe has a slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher level is  $196200\text{N/m}^2$  08  
b) An orifice meter with orifice diameter 15cm is inserted in a pipe of 30cm diameter. The pressure difference measured by a mercury oil differential manometer on the two sides of the orifice meter gives readings of 50cm of hg. Find the rate of flow of oil of sp. Gravity 0.9 when the Cd of orifice meter = 0.64 05
- Q.5 Write short notes on (any two) 14  
a. Equilibrium of floating body and meta centric height  
b. Pitot – tube  
c. Momentum and energy correction factors

**SECTION B**

- Q.6 a) Explain the phenomenon of momentum and energy thickness 05  
b) Air is flowing over a flat plate 500mm long and 600mm wide with a velocity of 4m/s. the kinematic viscosity of air is given as  $0.15 \times 10^{-4}\text{m}^2/\text{s}$ . find(i) the boundary layer thickness at the end of the plate, ii) shear stress at 200mm from the leading edge, and iii) drag force on one side of the plate. Take the velocity Profile over the plate as  $\frac{u}{U} = \sin\left(\frac{\pi}{2} \cdot \frac{y}{\delta}\right)$  and density of air  $1.24\text{kg/m}^3$  08

- Q.7 Find the velocity profile for laminar boundary layer given as:  $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$  and find an expression for boundary layer thickness ( $\delta$ ), shear stress ( $\tau_0$ ), and co-efficient of drag ( $C_D$ ) in terms of Reynolds number 13
- Q.8 a) Find the head loss due to friction in a pipe of diameter 300mm and length 50m, through which water is flowing at a velocity of 3m/s using (i) Darcy formula and (ii) Chezy's formula for which  $C = 60$ . Take  $\nu$  of water = 0.01 stoke 05
- b) Determine the rate of flow of water through a pipe of diameter 20cm and length 50m when one end of the pipe is connected to a tank and other end of the pipe is open to the atmosphere. The pipe is horizontal and the height of the water in the tank is 4m above the center of the pipe. Consider all minor losses and take coefficient of friction  $f = 0.009$  08
- Q.9 a) The pressure difference  $\Delta p$  in a pipe of diameter  $D$  and length  $l$  due to turbulent flow depends on the velocity  $V$ , viscosity  $\mu$ , density  $\rho$  and roughness  $k$ . using Buckingham's  $\pi$  - Theorem, obtain an expression for  $\Delta p$  10
- b) Explain Euler's model law 03
- Q.10 Write short notes on (any two) 14
- Laminar and turbulent boundary layer
  - Turbulent flow in pipe
  - Similitude – types of similarities