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BIME-006

01245

B.Tech. MECHANICAL ENGINEERING (BTMEVI)

Term-End Examination

June, 2012

BIME-006 : THERMOFLUID ENGINEERING

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt **any seven** questions. All questions carry **equal** marks. Question No. **10** is compulsory. Use of calculator is allowed.*

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1. What do you understand by Continuity Equation ? Derive a continuity equation for unsteady three dimensional and compressible flow in rectangular coordinates and cylindrical coordinates. **10**

2. The fluid flow is described by the velocity field as given below : **10**

$$V = (5x^3)\ i - (15\ y)\ j + (t)\ k$$

Find the velocity and acceleration components at point (1, 2, 3) in the field and at t = 1 and total acceleration also.

3. The momentum equation of the fluid flow is obtained by using Newton's second law of motion then prove that : **10**

$$\Sigma F_x = PQ\ (V_{2x} - V_{1x})$$
$$\Sigma F_y = PQ\ (V_{2y} - V_{1y})$$

4. Derive an expression for average velocity for laminar flow through a pipe and further prove that $f = 64/Re$. **10**

5. Shear stress between two fixed parallel plates containing oil and flowing is given by : **10**

$$T = \frac{1}{2}\left(-\frac{dp}{dx}\right)(\delta - 2y)$$

If the plates are inclined, than prove that

$$(P_1 + wz_1) - (P_2 + wz_2) = \frac{12\,\mu V_a L}{\delta^2}.$$

6. Explain the characteristics of laminar and turbulent boundary layers. And also describe which factors affect the thickness of boundary layer. **10**

7. Differentiate between gross head and net head. Define hydraulic efficiency, Mechanical efficiency and overall efficiency concerning the Pelton wheel. **10**

8. Why a draft tube is used with reaction turbine ? Explain how the net head on the reaction turbine is increased with use of the draft tube. **10**

9. A Pelton wheel develops 5520 kW B.P. when running at 180 rpm and head available is 250 m and overall efficiency is 80%. The speed ratio is 0.46. Find the speed, discharge and power developed when available head is reduced to 200 m. **10**

10. Write the short notes at ***any two*** of the following. **5x2=10**

(a) Governing of turbines

(b) Darcy resistance equation

(c) Adiabatic flow (Fanno line)

(d) Major losses in pipes