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BIME-006

B.Tech. MECHANICAL ENGINEERING (BTMEVI)

01571

Term-End Examination

December, 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**.*

1. Define velocity potential function and list out its properties. What is relationship between stream function and velocity potential function ? 10

2. A pipe 25 cm. in diameter carrying water branches into two pipes of 10 cm and 20 cm in diameters. The water velocity in 25 cm pipe is 2 m/sec. Find the quantity of water flowing through this pipe. Also find out the velocity of water in 10 cm pipe if the velocity in 20 cm pipe is 1.5 m/s. 10

3. Define linear momentum and angular momentum and list out practical applications of each. 10

4. What do you understand by Reynold's number ? Derive the relationship between shear stress and pressure gradient. 10

5. Name the minor and major losses during the flow of liquid through a pipe. And also deduce Chezy's formula for the velocity of flow through a pipe. **10**

6. Explain the characteristics of laminar and turbulent boundary layers. Which factors affect the thickness of boundary layer ? **10**

7. A pipe of 25 cm in diameter and 400 m long is carrying oil whose specific gravity is 0.82 and μ is 0.0075 Poise. The oil flow rate is 100 l/sec. Find the heat lost in pipe and power required to maintain the flow. **10**

8. Prove that the maximum hydraulic efficiency of Kelton wheel is given by : **10**

$$(\eta_h)_{max} = \frac{1}{2} C_v^2 \left[1 + k \cos \beta_2\right] \text{ where } k = \frac{Vr_2}{Vr_1}$$

(known as blade friction coefficient and C_v is coefficiency of velocity.)

9. For a draft tube, prove that the pressure head at the inlet of turbine is given by : **10**

$$\frac{P_2}{w} = \left(\frac{P_a}{w} - H_d\right) - \left(\frac{V_2^2 - V_3^2}{2g} - h_f\right)$$

Where ;

h_f = friction head loss.

H_d = Height of the draft tube.

P_a = Atmospheric pressure

V_2 and V_3 = Velocities at inlet and outlet.

P_2 = Pressure head at inlet.

10. Write short notes on *any two* : **5x2=10**

(a) Cavitation in turbines

(b) Momentum Equation

(c) Propagation of shock wave

(d) Isentropic flow through nozzle