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BIME-006

B.Tech. – VIEP – MECHANICAL ENGINEERING (BTMEVI)

00158

Term-End Examination

June, 2016

BIME-006 : THERMOFLUID ENGINEERING

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **seven** questions. All questions carry equal marks. Use of calculator is allowed.*

1. Define the terms 'fluid' and 'flow'. Explain the classification of the fluid flow on the basis of the fluid properties and the flow phenomena. *10*

2. If for a two-dimensional potential flow, the velocity potential is given by

$$\phi = x(2y - 1)$$

determine the velocity at the point P(4, 5). Also determine the value of stream function ψ at the point P. *10*

3. Oil of viscosity 0·1 Pa.s and specific gravity 0·90, flows through a horizontal pipe of 25 mm diameter. If the pressure drop per metre length of the pipe is 12 kPa, determine

(a) the rate of flow in N/min,

(b) the shear stress at the pipe wall,

(c) Reynolds number of the flow, and

(d) the power required per 50 m length of pipe to maintain the flow. *10*

4. Find an expression for the power transmission through pipes. What is the condition for maximum transmission of power and corresponding efficiency of transmission ? *10*

5. A pipe of diameter 300 mm and length 3500 m is used for the transmission of power by water. The total head at the inlet of the pipe is 500 m. Find the maximum power available at the outlet of the pipe, if the value of f = 0·006, where f is the coefficient of friction. *10*

6. What is a boundary layer ? Describe the phenomena of boundary layer separation when the flow takes place over a curved surface. *10*

7. Experiments were conducted in a wind tunnel with a wind speed of 50 km/hour on a flat plate of size 2 m long and 1 m wide. The density of air is 1·15 kg/m^3. The coefficients of lift and drag are 0·75 and 0·15, respectively.

Determine

(a) the lift force,

(b) the drag force,

(c) the resultant force,

(d) the direction of the resultant force, and

(e) the power exerted by air on the plate. *10*

8. (a) How is sonic velocity defined in terms of pressure and density of the fluid ? *5*

(b) Show that the sonic velocity in an ideal gas depends on the temperature and nature of the gas. *5*

9. What is a shock ? Where does it occur in a nozzle ? *10*

10. Show that, for an ideal gas, the fractional change in pressure across a small pressure pulse is given by

$$\frac{dp}{p} = \gamma \frac{dV}{c},$$

and that the fractional change in absolute temperature is given by

$$\frac{dT}{T} = (\gamma - 1)\frac{dV}{c}.$$ *10*
