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BIME-006

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

Term-End Examination

June, 2015

00036

BIME-006 : THERMOFLUID ENGINEERING

Time : 3 hours *Maximum Marks : 70*

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

1. Differentiate between the Eulerian and Lagrangian methods of representing fluid flow. *10*

2. For a three-dimensional flow, the velocity distribution is given by $u = -x$, $v = 3 - y$ and $w = 3 - z$. What is the equation of a streamline passing through (1, 2, 2) ? *10*

3. Derive an expression for the power transmission through the pipes. Also find the conditions for maximum transmission of power and corresponding efficiency of transmission. *10*

4. Explain the term boundary layer and define displacement and momentum thickness. *10*

5. The velocity distribution in the boundary layer is given by

$$\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2.$$

'δ' is boundary layer thickeness.

Calculate the following :

(a) Displacement thickness

(b) Momentum thickness *10*

6. Briefly explain the construction and working of a Pelton turbine and derive an expression for maximum hydraulic efficiency. *10*

7. A reaction turbine works at 450 rpm under a head of 120 m. Its diameter at inlet is 1·2 m and flow area is 0·4 m^2. The angles made by absolute and relative velocities at inlet are 20° and 60° respectively, with the tangential velocity. Determine : *10*

(a) The volume flow rate

(b) The power developed

(c) The hydraulic efficiency

8. Discuss the functions of convergent portion, the throat and the divergent portion of a convergent-divergent nozzle with reference to flow of steam. *10*

9. A water turbine delivering 10 MW power is to be tested with the help of a geometrically similar 1 : 8 model, which runs at the same speed as the prototype.

   (a) Find the power developed by the model assuming the efficiencies of the model and the prototype are equal.

   (b) Find the ratio of the heads and the ratio of mass flow rates between the prototype and the model. *10*

10. Write short notes on any ***four*** of the following : *10*

   (a) Mach Number and Mach Angle

   (b) Specific Speed

   (c) Cavitation

   (d) Minor losses in pipe

   (e) Drag and Lift