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BIME-006

B.Tech. MECHANICAL ENGINEERING (BTMEVI)

Term-End Examination

June, 2013

BIME-006 : THERMOFLUID ENGINEERING

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt **any five** questions. All questions carry **equal** marks.*

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1. (a) Explain the types of flow : 7

(i) Steady and Unsteady flow

(ii) Stream line and Streak line flow

(iii) Uniform and non-uniform

(b) A 30 cm diameter pipe, conveying water, branches into two pipes of diameter 20 cm and 15 cm respectively. If the average velocity in 30 cm pipe is 2.5 m/sec, find the discharge in this pipe. Also determine the velocity in 15 cm pipe if the average velocity in 20 cm diameter pipe is 2 m/sec. 7

2. (a) What is Mach number ? Find the sonic velocity for crude oil of specific gravity 0.8 and bulk modulus 153036 N/cm^2. 7

(b) What is momentum equation ? Derive the expression for the velocity of sound wave in a fluid. 7

3. (a) Derive the Darcy-Weisbach equation used for finding loss of head due to friction in pipes. 7

(b) Explain the main components of KAPLAN turbine. Briefly explain its working. 7

4. (a) Derive Euler's equation of motion. What are the assumptions made in the derivation of Bernoulli's equation ? 7

(b) Experiments were conducted in a wind tunnel with a wind speed of 50 km/hour on a flat plate of size 2m long and 1m wide. The density of air is 1.15 kg/m^3. The co-efficient of lift and drag are 0.75 and 0.15. Determine : 7

(i) the lift force
(ii) the drag force
(iii) the resultant force
(iv) the direction of resultant force

5. (a) Explain the boundary layer theory along with boundary layer thickness and displacement thickness. 7

(b) A Pelton wheel is to be designed for a head of 60 m when running at 200 rpm. The pelton wheel develops 95.6475 kw shaft power. The velocity of bucket =0.45 times the velocity of the jet, overall efficiency = 0.85 and co-efficient of velocity is equal to 0.98. Find diameter of jet, diameter, width and depth of bucket on the wheel. 7

6. (a) Explain the choked flow occurring in a nozzle. 7

(b) The hub diameter of a kaplan turbine, working under a head of 12m, is 0.35 times the diameter of the runner. The turbine is running at 100 r.p.m. If the vane angle of the extreme edge of the runner at outlet is 15° and flow ratio is 0.6. Find 7

(i) Diameter of the runner.

(ii) Diameter of the boss.

(iii) Discharge through the runner.

The velocity of whirl at outlet is given as zero.

7. Write a short note on *any three* : 14

(a) Cavitation

(b) Fanno line Flow

(c) Lagrangian and Eulerian Method

(d) Governing of Turbine