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BIME-013

B.Tech. MECHANICAL ENGINEERING (BTMEVI)

Term-End Examination

December, 2013

BIME-013 : TURBO MACHINES

Time : 3 hours *Maximum Marks : 70*

Note : *Answer **any five** questions. Assume missing data suitable if any. All questions carry **equal** marks. Use of scientific calculator is **permitted**.*

1. (a) How the principle of dimensional analysis applied to turbomachines ? Explain. 7

   (b) The efficiency 'η' of a fan depends upon density 'ρ', dynamic viscosity 'μ' of the fluid, angular velocity 'ω', diameter 'D' of the rotor and discharge 'Q'. Express 'λ' in terms of dimensionless parameters. 7

2. (a) State the advantages and disadvantages of a Francis turbine over a pelton wheel. 7

   (b) Sketch the velocity triangles for francis turbine for the following three cases. 7
   (i) Low speed
   (ii) Medium speed.
   (iii) High speed.

3. (a) With the help of neat diagram explain the construction and working of Kaplan turbine. 7

(b) A pelton wheel has a mean bucket diameter of 1m and is running at 1000rpm. The net head on the pelton wheel is 700m. If the angle of deflection of jet is 165° and discharge through the nozzle is $0.1m^3/s$, coefficient of velocity $C_v = 0.98$, find : 7

(i) The hydraulic efficiency of the turbine.

(ii) The power available at the nozzle.

4. (a) With the neat sketch, explain the different types of centrifugal pump castings. 7

(b) Name the types of impeller and draw the corresponding velocity triangles at entry and exit. 7

5. (a) Derive the Euler's equation for turbine. 7

(b) The following data refers to a mixed flow pump, where the fluid absolute velocity at the inlet is axial while at the outlet, the relative velocity is radial. The inlet hub diameter is 9cm, impeller tip diameter = 30cm, speed 3000 rpm. Axial velocity at inlet is equal to the radial velocity at exit. Calculate. 7

(i) the degree of reaction.

(ii) the energy input to fluid, if the relative velocity at the exit equals the inlet tangential blade speed.

6. (a) Explain the velocity compounding of steam turbine with neat sketch. 7

(b) Air enters the compressor of a gas turbine plant operating on Brayton cycle at 1 bar and 27°C. The pressure ratio in the cycle is '6'. Calculate the maximum temperature in the cycle and the cycle efficiency. Assume the turbine work as 2.5 times the compressor work. Take $\gamma = 1.4$. 7

7. Write short notes on ***any four*** of the following : **14**

(a) Power input factor
(b) Manometric head
(c) Diagram efficiency
(d) Slip factor
(e) Cavitation