B. Tech.

(Semester-III) Theory Examination, 2011-12

THERMAL AND HYDRAULIC MACHINES

Time : 3 Hours]   *[Total Marks : 100*

Note : Attempt questions from each Section as per directions..

Section-A

Answer *all* questions.   2×10=20

1. Define Enthalpy. Why does the enthalpy of an ideal gas depend only on temperature ?

2. When is reheating of steam is recommended in a steam power plant ?

3. Explain 'reheat factor'. Why is its magnitude always greater than unity ?

4. Why flywheel is not used in gas turbine ?

5. What are the advantages of multistage compressor ?

6. What is scavenging in 2 stroke engine ?

7. Define velocity of flow and velocity of whirl and explain their significance.

8. On what factors does the number of jets depend in case of Pelton wheel ?

9. Explain the function of spiral casing for a centrifugal pump.

10. Why a reciprocating pump is called a positive displacement pump ?

Section-B

Answer any *three* questions.   10×3=30

1. With the help of a neat sketch explain Regenerative Rankine cycle.

2. Explain the methods of steam turbine governing and control.

3. Give the differences between centrifugal and axial compressor.

4. Derive an equation for the power developed by a Reaction turbine.

5. Explain the differences between a single stage and a multistage centrifugal pump.

Section-C

Answer *all* questions.   10×5=50

1. With the help of graphical representation explain stages of formation of steam.

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Or

In a Rankine cycle the steam at inlet to turbine is saturated at a pressure of 30 bar and the exhaust pressure is 0.25 bar. Determine the turbine work, pump work, specific work output, Rankine efficiency and dryness fraction at the end of expansion.

2. In an impulse turbine the mean diameter of the blades is 1.05 m and speed is 3000 rpm. The nozzle angle is 18°, the ratio of the blade speed to steam speed is 0.42 and the ratio of the relative velocity at outlet from the blades to that at inlet is 0.84. The outlet angle of the blade is to be made 3° less than the inlet angle. The steam flow rate is 10kg/s. Draw the velocity diagram for the blades and find :

(i) Tangential thrust

(ii) Axial thrust

(iii) Resultant thrust

(iv) Power

(v) Blade efficiency.

Or

Explain intercooling method for gas turbine and represent the process on T-S diagram.

3. Derive the work done equation for multistage compressor.

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Or

In a Diesel cycle the compression ratio is 15.
Compression begins at 0.1 MPa 40° C. The heat added
is 1.675 MJ/kg. Find :

(i) Maximum temperature of the cycle
(ii) Temperature at the end of expansion
(iii) Work done/kg of air
(iv) Cycle efficiency.

4. What do you understand by the term 'jet of water' ?
Derive an expression for the force of jet on an inclined
fixed plate.

Or

A Pelton wheel, working under a head of 500 metres,
produces 13,000kW at 430 rpm. If, the efficiency of
the wheel is 85%, determine (a) discharge of the
turbine (b) diameter of the wheel, and (c) diameter of
the nozzle. Assume coefficient of velocity as 0.98 and
tangential velocity of the wheel as 0.46.

5. Explain the indicator diagram of a Reciprocating
pump. Show the effect of acceleration of piston on the
indicator diagram.

Or

Calculate vane angle at the inlet of a Centrifugal pump
impeller having 200mm diameter at inlet and 400 mm
diameter at outlet. The impeller vanes are set back at an
angle of 45° to the outer rim, and the entry of the pump is
radial. The pump runs at 1000 rpm and the velocity of
flow through the impeller is constant at 3m/sec. Also
calculate the work done per kN of water and the velocity
as well as directions of the water at outlet.

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