Sub Code: RMI501

Paper Id: **143503**   Roll No: ☐☐☐☐☐☐☐☐☐☐☐☐☐

BTECH
(SEM V) THEORY EXAMINATION 2019-20
THERMAL AND HYDRAULIC MACHINES

Time: 3 Hours   *Total Marks: 70*

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. **Attempt *all* questions in brief.**   **2 x 7 = 14**

a.	What is meant by reversible and irreversible process.?
b.	What is turbine blade windage loss.?
c.	What is the function of lacing wire.?
d.	Define the term compression ratio.
e.	Classify the reciprocating pump.
f.	Write down the function of draft tube.?
g.	What are the different efficiency associated with impulse turbine.?

SECTION B

2. **Attempt any *three* of the following:**   **7 x 3 = 21**

a.	In a gas turbine the gas enters at the rate of 5 Kg/s with a velocity of 50m/s and enthalpy of 900KJ/kg and leaves the turbine with a velocity of 150 m/s and enthalpy of 400 KJ/kg. The loss of heat from the gas to the surroundings is 25 KJ/kg. Assume for gas R = 287 KJ/kg K and Cp = 1.004 KJ/kg K and the inlet conditions to be at 100KPa and 27oC. Determine the power output of the turbine and the diameter of the inlet pipe
b.	In an stage of impulse turbine stage discharge 0.5kg/sec of steam from 20 bar 400^0c into the turbine casing where pressure is 0.5 bar. Friction loss in divergent part is 15% of the isentropic specific enthalpy drop in the part. The convergent part is frictionless neglecting velocity of approach determine throat and exit diameter of the nozzle and quality of stem at nozzle exit.
c.	An Engine-working on Otto cycle has a volume of 0.45 m3 , pressure 1 bar and temperature 30o,C at the beginning of compression stroke. At the end of compression stroke, the pressure is 11 bar and 210 KJ of heat is added at constant volume. Determine (i) Pressure, temperature and volumes at salient points in the cycle. (ii) Efficiency
d.	Derive the expression for force exerted by a jet on series of moving flat plates fixed on a wheel, find the maximum efficiency with usual notations.
e.	Derive an expression for minimum starting speed of a centrifugal pump.

SECTION C

3. **Attempt any *one* part of the following:**   **7 x 1 = 7**

(a)	Derive the general steady flow energy equation and deduce SFEE for (i) Boiler (ii) Condenser and evaporator (iii) Nozzle
(b)	Explain Brayton cycle with help of neat sketch.

4. **Attempt any *one* part of the following:**   **7 x 1 = 7**

(a)	Compare the Otto cycle and diesel cycle on the basis of heat input and compression ratio.
(b)	Explain the working of four stroke petrol engine with help of P-V and t-s diagram.

5. **Attempt any _one_ part of the following:**   **7 x 1 = 7**

| (a) | Describe the working principle of closed gas turbine wit P-v and T-s diagram. |
| (b) | Derive an expression for degree of reaction in axial flow gas turbine with help of velocity traingles. |

6. **Attempt any _one_ part of the following:**   **7 x 1 = 7**

| (a) | Derive the expression for force on the curve plate and also work done by the jet on the plate / sec when the plate is moving in direction of jet |
| (b) | A Pelton wheel has a mean bucket speed of 10 m/sec. with a jet of water flowing at a rate of 700 Liter/sec under a head of 30 m. the bucket deflects the jet through an angle of 160^0. Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume coefficient of velocity as 0.98. |

7. **Attempt any _one_ part of the following:**   **7 x 1 = 7**

| (a) | With help of neat sketch explain the characteristic curves for centrifugal pump. |
| (b) | For a single acting reciprocating pump piston diameter is 150 mm stroke length is 300 mm, rotational speed is 50 rpm and the water is raised through 18m. determine theoretical discharge. If the actual discharge is 400 Liter/ sec. determine the volumetric efficiency, slip and actual power required. Take mechanical efficiency as 80%. |