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Total No. of Questions : 09]

[Total No. of Pages : 02

**B.Tech. (Sem. - 3<sup>rd</sup>)**  
**APPLIED THERMODYNAMICS - I**  
**SUBJECT CODE : ME - 209**  
**Paper ID : [A0805]**

[Note : Please fill subject code and paper ID on OMR]

**Time : 03 Hours**

**Maximum Marks : 60**

**Instruction to Candidates:**

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

**Section - A**

**Q1)**

**(10 × 2 = 20)**

- a) Classify air compressor & enlist its applications in industry.
- b) Define heat rejection ratio.
- c) Define superheated steam. Discuss the advantages of the same.
- d) What is meant by saturation temperature and saturation pressure?
- e) Differentiate the features of a water tube and a fire tube boiler.
- f) What is the function of super heater in a boiler?
- g) Explain clearly the equivalent evaporation from and at 100°C.
- h) What do you mean by the stage efficiency and overall efficiency of impulse turbine?
- i) What are the functions of the condenser in a steam plant?
- j) Discuss briefly the factors affecting the condenser capacity.

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**P.T.O.**

### Section - B

(4 × 5 = 20)

- Q2)** A fuel has the following percentage composition by mass: CO<sub>2</sub> 13.3%, CO 0.95%, O<sub>2</sub> 8.35% and N<sub>2</sub> 77.4%. Convert this into volumetric analysis.
- Q3)** Give the constructional and working detail of Lancashire boiler with the help of suitable sketch.
- Q4)** Give the chemical reactions and numeric values for estimating the air requirement for complete combustion of coal.
- Q5)** Define discharge. Derive the condition for maximum discharge through a nozzle. Also derive the equation for maximum discharge.
- Q6)** With the help of combined velocity triangle for moving blades, derive the equation for power produced by an impulse turbine.

### Section - C

(2 × 10 = 20)

- Q7)** (a) Steam enters an engine at a pressure of 12 bar with a 70°C of superheat. It is exhausted at a pressure of 0.15 bar and 0.92 dry. Find the drop in enthalpy of the steam if  $h_f$  and  $h_{fg}$  at 12 bar are 798.4 kJ/kg and 1984.3 kJ/kg. The values of  $h_f$  and  $h_{fg}$  at 0.15 bar are 226 kJ/kg and 2373.2 kJ/kg, respectively.
- (b) Define isentropic process. Derive the equations for change in internal energy, heat absorbed and work done during the isentropic process.
- Q8)** (a) Discuss the various processes of Rankine cycle. Derive the equation of work done and efficiency of the cycle.
- (b) What do you understand by the term 'height of blades' as applied to a reaction turbine?
- Q9)** (a) What are the methods of governing a steam turbine? Describe any one method of governing steam turbines.
- (b) Derive the equation for work per kg of air compressed by reciprocating air compressor with and without clearance.

