**Roll No……..** **Total No. of Printed Pages: 1**
**Total No. of Questions: [09]**

**B. Tech. (Mechanical Engg.) (Semester – 3rd)**
**APPLIED THERMODYNAMICS-I**
**Subject Code: BMEE1304**
**Paper ID: [112304]**

**Time: 03 Hours** **Maximum Marks: 60**

**Instruction for candidates:**

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

**Section – A** **(2 marks each)**

Q1. Attempt the following:
a) How I.C. engines are classified?
b) What do you understand by the degree of reaction?
c) How are the steam turbines classified?
d) Define nozzle efficiency.
e) What are the advantages of Rankine cycle over Carnot cycle?
f) Explain the concept of Multistaging in turbines.
g) Discuss the effect of knocking on engine performance.
h) Explain the Dalton's law of partial pressures.
i) What is Pure substance?
j) What is adiabatic flame temperature?

**Section – B** **(5 marks each)**

Q2. Lay down the procedure for determination of minimum air required for complete combustion of coal.

Q3. Calculate the mass flow rate of steam in a nozzle having inlet pressure = 10 bar, inlet temperature = 200°C, exit pressure = 0.5 bar and throat diameter = 12 mm.

Q4. The velocity of steam at inlet to a simple impulse turbine is 1000 m/s and the nozzle angle is 20°.The mean blade speed is 400 m/s and the blades are symmetrical. The mass flow rate of steam is 0.75 kg/s. The friction effects on the blades are negligible. Estimate: (a) the blade angles; (b) the tangential force on the blades; (c) the axial thrust; (d) the diagram power; and (e) the diagram efficiency.

Q5. Explain the working of Stirling boiler with the help of neat diagram.

Q6. Explain the working of Carnot cycle and its limitations.

**Section – C** **(10 marks each)**

Q7. In a thermal power plant operating on an ideal Rankine cycle, steam at 15 bar and 250°C enters a turbine which generates 40kW indicated power. If the steam consumption is 300 kg/hr and condenser is maintained at 0.15 bar, determine the final condition of steam, Rankine efficiency and relative efficiency. Neglect pump work. Also determine the fuel to be supplied per hour if its calorific value is 41850 kJ/kg.

Q8. The pressure under air baffle of a surface condenser is 52 mm of Hg. Temperature of the mixture leaving the cooler suction is 25°C. Assuming available water at 15.5°C and external water might lower the temperature further to 20°C. Explain the effect of this on the quality of vapor accompanying the air to the air pump suction.

Q9. Write short notes on the following:
(a) Cooling Towers
(b) Compounding of Steam Turbines.