

GUJARAT TECHNOLOGICAL UNIVERSITY**BE SEM-III Examination May 2012****Subject code: 133401****Subject Name: Thermodynamics and Thermal Engineering****Date: 08/05/2012****Time: 02.30 pm – 05.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Derive the expressions for “Dual combustion cycle.” **07**
(b) Explain “Clausius inequality” **07**
- Q.2** (a) What do you mean by the term ‘Entropy’? Prove that entropy is a property of a system. **07**
(b) An engine of 250 mm bore and 375 mm stroke works on Otto cycle. The clearance volume is 0.00263 m^3 . The initial pressure and temperature are 1 bar and 50°C . If the maximum pressure is limited to 25 bar, find the following **07**
(i) The air standard efficiency of the cycle.
(ii) The mean effective pressure for the cycle.
Assume the ideal conditions.
- OR**
- (b) Derive the expressions for “Brayton cycle.” **07**
- Q.3** (a) The stroke and cylinder diameter of a compression ignition engine are 250 mm and 150 mm respectively. If the clearance volume is 0.0004 m^3 and fuel injection takes place at constant pressure for 5 per cent of the stroke determine the efficiency of the engine. Assume the engine working on the diesel cycle. **07**
(b) Briefly explain the term “Steam Nozzles” **07**
- OR**
- Q.3** (a) Explain the working principle of “Turbo-prop” **07**
(b) Define the following: **07**
(i) Thrust power (ii) Propulsive power
(iii) Propulsive efficiency
- Q.4** (a) Explain briefly about air refrigerator working on a reversed Carnot cycle. Derive the expression for its C.O.P. **07**
(b) Give the comparison between a vapour compression system and a vapour absorption system. **07**
- OR**
- Q.4** (a) Describe briefly about the following processes : **07**
(i) Sensible heating (ii) Cooling and dehumidification
(b) Define the following terms : **07**
(i) Dew point temperature (ii) Relative humidity
(iii) Specific humidity.
- Q.5** (a) A reactor’s wall 320 mm thick, is made up of an inner layer of fire brick ($k = 0.84 \text{ W/m}^\circ\text{C}$) covered with a layer of insulation ($k = 0.16 \text{ W/m}^\circ\text{C}$). The reactor operates at a temperature of 1325°C and the ambient temperature is **07**

25°C. (i) Determine the thickness of fire brick and insulation which gives minimum heat loss. (ii) Calculate the heat loss presuming that the insulating material has a maximum temperature of 1200°C. If the calculated heat loss is not acceptable, then state whether addition of another layer of insulation would provide a satisfactory solution.

(b) Explain Fourier's Law of Heat Conduction and Explain Thermal Resistance. **07**

OR

Q.5 (a) Explain the various types of Heat Exchangers. **07**

(b) Define the following : **07**

(i) Emissivity

(ii) Stefan-Boltzmann Law

(iii) Wien's Displacement Law
