

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC- SEMESTER I- • EXAMINATION –WINTER- 2016

Subject Code: X11902**Date:09/01/2017****Subject Name: Engineering Thermodynamics****Time: 10:30 AM to 1:00 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) Engine working on otto cycle. The pressure and temperature at the beginning of compression stroke are 10^5 N/m^2 and 273°C and the temperature at the end of compression stroke is 590 K . If the temperature at the end of constant volume heat addition process is 1800 K , calculate the air standard efficiency, heat addition per kg of air and rejected per kg of air, assume $\gamma = 1.4$, $C_v = 0.75 \text{ kJ/kg K}$. **07**
- (b) In a gas turbine unit, the gas flows through the turbine is 14 kg/s and the power developed by the turbine is 11500 kW . The enthalpy of gas at inlet and outlet are 1250 kJ/kg and 400 kJ/kg respectively and the gas at inlet and outlet are 52 m/s and 107 m/s respectively. Calculate the rate at which heat is rejected from the turbine. **07**
- Q.2** (a) A reversible heat engine operating between two thermal reservoirs at 800°C and 30°C respectively. It drives a reversible refrigerator operating between -15°C and 30°C . The heat input to the heat engine is 1900 kJ and the net work output from the combined plant is 290 kJ . Find the heat absorbed by the refrigerant and the total heat transferred to 30°C reservoir. **07**
- (b) Simple rankine cycle works between pressure of 30 bar and 0.07 bar , the initial condition of steam is dry. Calculate the cycle efficiency and work ratio. **07**
- OR**
- (b) Show that the two reversible adiabatic processes cannot intersect each other **07**
- Q.3** (a) Discuss first law of thermodynamics and derive steady flow energy equation for open system **07**
- (b) State and prove carnot theorem **07**
- OR**
- Q.3** (a) Derive steady flow energy equation for boiler, turbine and nozzle. **07**
- (b) Explain different statement of second law of thermodynamics **07**
- Q.4** (a) Define clausius inequality and prove it **07**
- (b) Explain available and un-available energy. Derive an expression for availability of a non flow process **07**
- OR**
- Q.4** (a) Explain principle of increase of entropy. **07**
- (b) What are the limitations of carnot cycle? Give comparison of carnot and rankine cycle. **07**
- Q.5** (a) Derive expression of thermal efficiency for rankine cycle. **07**
- (b) Derive equation of air standard efficiency of otto cycle **07**
- OR**
- Q.5** (a) Derive equation of air standard efficiency of diesel cycle **07**
- (b) Explain bomb calorimeter with sketch. **07**