# GUJARAT TECHNOLOGICAL  UNIVERSITY
### P.D.D.C. Sem- I Remedial Examination March / April  2010
**Subject code: X11902**        **Subject Name: Engineering Thermodynamics**
**Date:  09 / 04 / 2010**                        **Time: 12.00 noon – 02.30 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)** Define thermodynamic systems. Explain various types of thermodynamic   **07**
systems with neat sketch.

**(b)** Explain how first law of thermodynamics is applied to a closed system   **07**
undergoing a cycle.

**Q.2** **(a)** A heat engine operates between a source temperature of $800^{o}$C and sink   **07**
temperature of $27^{o}$C. The net output of engine is 1 kW. Calculate the efficiency
of engine and heat rejected by the engine

**(b)** "No heat engine operating between constant temperature, has a higher   **07**
efficiency than a reversible engine". Explain

**OR**

**(b)** Explain Clausius' theorem for entropy.   **07**

**Q.3** **(a)** Explain available energy for cyclic process   **07**

**(b)** Explain with neat sketch P-T diagram for pure substance   **07**

**OR**

**Q.3** **(a)** Discuss the concept of exergy balance for closed system   **07**

**(b)** Define adiabatic process. Derive the equation for workdone in adiabatic   **07**
process.

**Q.4** **(a)** Explain Dalton's law of partial pressure.   **07**

**(b)** An engine working on Otto cycle is supplied with air at    0.1 MPa , $35^{o}$C. The   **07**
compression ratio is 8. heat supplied is 2100 kJ/kg. Calculate the maximum
pressure and temperature of the cycle, the cycle efficiency and the mean
effective pressure.
Take $c_p$ = 1.005, $c_v$ = 0.718 and R = 0.287 kJ/kg K for air.

**OR**

**Q.4** **(a)** Explain Diesel Cycle with neat sketch and derive the equation for efficiency of   **07**
Diesel cycle

**(b)** 0.5 kg of air is compressed reversibly and adiabatically from 80 kPa , $60^{o}$C to   **07**
0.4 MPa. It is then expanded at constant pressure to the original volume.
Sketch these properties on p-v diagaram and compute the heat transfer and
work done for the whole path.

**Q.5** **(a)** Explain the effect of inter cooling on Brayton cycle.   **07**

**(b)** With neat sketch explain the construction and working of Bomb calorimeter   **07**

**OR**

**Q.5** **(a)** Explain Junker's gas calorimeter with neat sketch   **07**

**(b)** A sampele of coal supplied to a boiler has the following composition by mass :   **07**
Carbon = 88 %        Hydrogen = 5%
Oxygen = 3%          Nitrogen = 1%
Sulphur = 0.5%       Incombustible matter 2.5%
Calculate mass of air required for complete combustion of    1 kg of coal.
Molecular weights of Carbon, Hydrogen, Oxygen, Nitrogen and Sulphur are
12, 2, 32, 28 and 32.

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