

GUJARAT TECHNOLOGICAL UNIVERSITY**PDDC - SEMESTER-I • EXAMINATION – SUMMER • 2014****Subject Code: X11902****Date: 17-06-2014****Subject Name: Engineering Thermodynamics****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)** Define Thermodynamic system. **07**
Also explain different thermodynamic systems with suitable examples.
- (b)** What is thermodynamic equilibrium? **07**
Explain types of thermodynamic equilibrium with suitable examples.
- Q.2 (a)** Explain zeroth law of thermodynamics. **07**
How zeroth law can apply to compare different types of thermometers.
- (b)** Explain different types of work transfer with suitable examples. **07**
- OR**
- (b)** Give broad classification of energy. Explain each types in brief. **07**
- Q.3 (a)** Derive the energy balance equation for any steady flow process. **07**
- (b)** In a steam power station, steam flows steadily through a 0.2 m diameter pipeline from the boiler to turbine. At the boiler end, the steam pressure 4 MPa, temperature 400°C, enthalpy 3213.6 kJ/kg and specific volume is 0.073 m³/kg. At the turbine end, the steam pressure 3.5 MPa, temperature 392°C, enthalpy 3202.6 kJ/kg and specific volume is 0.084 m³/kg. There is a heat loss of 8.5 kJ/kg from the pipeline. Calculate the steam flow rate. **07**
- OR**
- Q.3 (a)** State and explain equivalence of Kelvin-Planck and Clausius statements **07**
- (b)** Which is the more effective way to increase the efficiency of Carnot engine: to increase T₁ by keeping T₂ constant; or to decrease T₂ by keeping T₁ constant? Prove it. Take T₁ > T₂. **07**
- Q.4 (a)** With usual notation prove that $\frac{dQ}{T} \leq ds$ for any process undergone by system **07**
- (b)** A fluid undergoes a reversible adiabatic compression from 0.5 MPa, 0.2 m³ to 0.05 m³ according to law $pv^{1.3} = \text{constant}$. Determine the change in enthalpy, internal energy, entropy, heat transfer and work transfer during the process. **07**
- OR**
- Q.4 (a)** Explain actual vapour power cycle with T-S diagram. **07**
Explain different losses in actual vapour power cycle.
- (b)** Explain ideal regenerative cycle with schematic and T-S diagram. **07**
- Q.5 (a)** Give name of different gas power cycle with P-V and T-S diagram of each. **07**
- (b)** In an air standard diesel cycle, the compression ratio is 16, and at the beginning of isentropic compression, the temperature is 15°C and the pressure is 0.1 MPa. Heat is added until the temperature at the end of the constant pressure process is 1480°C. Calculate (a) cut-off ratio, (b) the heat supplied per kg of air, (c) cycle efficiency and (d) m.e.p. **07**
Take $c_p = 1.005 \text{ kJ/kgK}$, $c_v = 0.718 \text{ kJ/kgK}$
- OR**
- Q.5 (a)** Explain concept of available Energy, unavailable Energy and lost work. **07**
- (b)** What is reduced properties and compressibility factor? **07**
Draw and explain Generalized compressibility chart.
