Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV EXAMINATION – WINTER 2015

Subject Code: 142501 **Date:22/12/2015**

Subject Name: Heat Power Engineering

Time: 02:30pm to 05:00pm **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 Cycle. Draw P-V and T-S diagram of following **07**

i) Dual cycle ii) Otto cycle iii) Diesel cycle

(b) Explain various modes of Heat transfer with suitable examples. **07**

Q.2 **(a)** (i) Give statement of Kelvin plank and Clausius for 2nd law of thermodynamics. **04**

(ii) Define following terms. **03**

1) Refrigerant 2) Refrigerant Effect 3) C.O.P

(b) Explain with neat sketch a "Psychrometric Chart" **07**

OR

(b) (i) A psychrometer reads 40^0C dbt and 36^0C wbt. Find the relative humidity, dew point temperature and enthalpy of air. **03**

(ii) Bell-Coleman cycle works between 1 bar and 6 bar. Compression follows $PV^{1.25}$=C and expansion follows $PV^{1.3}$=C. find out C.O.P of refrigeration if the air flow is 0.5 kg/s. Assume compression and expansion begin at 7^0C and 37^0C respectively. Neglect clearance. **04**

Q.3 **(a)** An oil engine working on Diesel cycle has cylinder bore of 190 mm and piston stroke of 230 mm. The clearance volume is 290 cm^3. The fuel injection takes place at constant pressure for 6% of the stroke. Determine the air standard efficiency. Also calculate the % of loss of efficiency if fuel cut off is delayed from 6% to 11% of the stroke with same compression ratio. **07**

(b) A single stage reciprocating air compressor has a swept volume of 2000 cm^3 and runs at 800 rpm. It operates on a pressure ratio of 8, with a clearance of 50% of the swept volume. Assume NTP room conditions and at inlet (P=101.3 kpa, T=15^0C) and polytropic compression and expansion follows $PV^{1.25}$=C. Calculate **07**

(i) Indicated Power

(ii) Volumetric efficiency

(iii) Mass flow rate

(iv) The actual power needed to drive the compressor, if mechanical efficiency is 0.85

OR

Q.3 **(a)** In an air standard Otto cycle, the pressure and temperature of the air at the start of compression are 1 bar and 330 K respectively. The compression ratio is 8. The energy added at constant volume is 1250 KJ/kg. Calculate **07**

(i) The maximum temperature and pressure of the cycle.
(ii) The air standard efficiency
(iii) Mean effective pressure. Take Cv = 0.718 KJ/kg.k and $\gamma = 1.4$ for air.

(b) A piston and cylinder machine contains a fluid system which passes through a complete cycle of four processes. During a cycle, the sum of all heat transfers is –170 KJ. The system completes 100 cycles per min. Complete the following table showing the method for each item, and computes the net rate of work output in KW. **07**

Process	Q (KJ/min)	W (KJ/min)	ΔE (KJ/min)
a-b	0	2170	-
b-c	21000	0	-
c-d	-2100	-	-36600
d-a	-	-	-

Q.4 **(a)** Derive the general expression for change of entropy of a perfect gas. **07**

(b) What is steam turbine? Why compounding of steam turbine is required? List out various methods of compounding and explain any one with neat sketch. **07**

OR

Q.4 **(a)** List methods of improving thermal efficiency of open cycle gas turbine and explain any one with neat sketch. **07**

(b) What is the function and application of compressor? Explain any one with neat sketch. **07**

Q.5 **(a)** Derive the expression for Joule cycle with P-V and T-S diagram. **07**

(b) (i) What is the difference between a Closed system and Open system? **04**

(ii) Distinguish between the terms ‘Change of state’, ‘Path’ and ‘process. **03**

OR

Q.5 **(a)** What is Steam nozzle? Explain the effect of friction on the steam flow through nozzle. **07**

(b) (i) A domestic food freezer maintains a temperature of -15^0C. The ambient air temperature is 30^0C. If the heat leaks in to the freezer at the continuous rate of 1.75 KJ/s. What is the least power necessary to pump this heat out continuously? **04**

(ii) Explain application of Steady flow energy equation for work developing system. **03**

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