

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-III (NEW) EXAMINATION – WINTER 2017

Subject Code: 2131905

Date: 21/11/2017

Subject Name: Engineering Thermodynamics

Time: 10:30 AM to 01:00 PM

Total Marks: 70

Instructions:

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

MARKS

- Q.1 (a) **Define:** Availability, Heat pump and Entropy. 03
- (b) Write the limitation of first law of thermodynamics. Explain the second law of thermodynamics by Clausius statement and Kelvin-Planck statement. 04
- (c) **Define the following terms:** (1) Critical point temperature, (2) thermodynamic equilibrium (3) Dead state of a given system, (4) Mole fraction (5) enthalpy, (6) Irreversibility, (7) Intensive properties. 07

- Q.2 (a) Explain path function and point function. 03
- (b) The gravimetric analysis of air and other data are as follow: 04

Constituent	Percentage %	Molecular weight
Oxygen	23.14	32
Nitrogen	75.53	28
Argon	1.28	40
Carbon Dioxide	0.05	44

Calculate: (i) gas constant for air, (ii) Apparent molecular weight.

- (c) With help of T-s diagram, explain the effects of variables on efficiency of the Rankine cycle 07

OR

- (c) List the Engineering Application of SFEE and explain any two. 07

- Q.3 (a) Explain Carnot theorem. 03
- (b) Explain briefly Dalton's law and Gibb's-Dalton law. 04
- (c) A domestic refrigerator maintains a temperature of -12°C. The ambient air temperature is 35°C. If heat leaks into freezer at the continuous rate of 2kJ/s determine the least power necessary to pump this heat out continuously. 07

OR

- Q.3 (a) Draw Bryton cycle and derive expression for optimum pressure ratio 03
- (b) With usual notations prove that $\Phi \delta Q/T \leq 0$. 04
- (c) A heat engine receives heat at the rate of 1500kJ/min and gives an output of 8.2 KW. Determine: (i) The thermal Efficiency (ii) The rate of heat rejection. 07

- Q.4 (a) Discuss limitations of Carnot cycle. 03
- (b) Compare the Otto, Diesel and Dual cycle for (1) same compression ratio and heat supplied (2) constant maximum pressure and heat supplied 04
- (c) A simple Rankine cycle works between pressures 28 bar and 0.06 bar, the initial condition of steam being dry saturated. Calculate the cycle efficiency, work ratio and specific steam consumption. (Use of Steam table is Permitted) 07

OR

- Q.4** (a) Define: Cycle, Air standard Efficiency, Compression ratio. **03**
(b) Sketch the Ideal Rankine cycle on p-V, T-s, and h-s diagram. **04**
(c) A steam power plant operates on a theoretical reheat cycle. Steam at boiler at 150 bar, 550°C expands through the high pressure turbine. It is reheated at a constant pressure of 40 bar to 550°C and expands through the low pressure turbine to a condenser at 0.1 bar. Draw T-S and h-s diagrams and find: (i) Quality of steam at turbine exhaust, (ii) Cycle efficiency, (ii) steam rate in kg/kWH. (**Mollier diagram is permitted**) **07**

- Q.5** (a) How can you improve the first law efficiency and second law efficiency? **03**
(b) Enlist the various components used in intercooling and reheating gas cycle based power plant **04**
(c) How actual Brayton cycle differs from the theoretical cycle? Explain with the help of T-S diagram. **07**

OR

- Q.5** (a) Draw the generalized compressibility chart. **03**
(b) Define a thermodynamic system. Differentiate between open system, closed system and an isolated system. **04**
(c) What is regeneration in gas turbine plant? How it improves thermal efficiency of simple open cycle Gas Turbine Plant. Explain it with the help of schematic diagram and T-S Diagram of the cycle. **07**
