Reg. No. : | | | | | | | | | | | | |

Question Paper Code: 1013186

B.E. / B.Tech. DEGREE EXAMINATIONS, NOV/ DEC 2024
Third Semester
Aeronautical Engineering
U20AE301– AERO ENGINEERING THERMODYNAMICS
(Regulation 2020)
(Common to Aerospace Engineering)

Time: Three Hours Maximum: 100 Marks

Answer ALL questions

PART – A (10 x 2 = 20 Marks)

1. Explain about concept of continuum.
2. Explain about Quasi-static process.
3. Explain about Kelvin plank statement of second law of thermodynamics.
4. Explain about Clausius inequality.
5. Explain about the phase rule of a pure substance.
6. Explain about specific steam consumption.
7. Define air standard efficiency.
8. Outline the P-v and T-s diagram of brayton cycle.
9. List out the psychrometric processes.
10. List out the important refrigerants used in refrigeration system.

PART – B (5 x 16 = 80 Marks)

11. (a) 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 systems complete 100 cycles per min. Complete the following table showing the method for each item, and determine the net rate of work output in kW. (16)

Process	Q (kJ/min)	W (kJ/min)	ΔE (kJ/min)
a-b	0	2170	---
b-c	21,000	0	---
c-d	- 2,100	---	- 36,600
d-a	---	---	---

(OR)

(b) Air flows steadily at the rate of 0.5 kg/s through an air compressor, entering at 7m/s velocity, 100 kPa pressure, and 0.95 m^3/kg volume, and leaving at 5 m/s, 700 kPa, and 0.19 m^3/kg. The internal energy of the air leaving is 90 kJ/kg greater than that of the air entering. Cooling water in the compressor jackets absorbs heat from the air at the rate of 58 kW. (a) Determine the rate of shaft work input to the air in kW. (b) Determine the ratio of the inlet pipe diameter to outlet pipe diameter. (16)

12. (a) A reversible heat engine operates between two reservoirs at temperatures of 600°C and 40°C. The engine drives a reversible refrigerator which operates between reservoirs at temperatures of 40°C and - 20°C. The heat transfer to the heat engine is 2000 kJ and the network output of the combined engine refrigerator plant is 360 kJ. Solve the heat transfer to the refrigerant and the net heat transfer to the reservoir at 40°C. (16)

(OR)

(b) Air in a closed vessel of fixed volume 0.15m^3 exerts pressure of 12 bar at 250^{0}C.if the vessel is cooled so that the pressure falls to 3.5 bar, solve the final temperature heat transfer and change of entropy (16)

13. (a) Utilize the following details: a closed vessel of 0.2 m^3 contains steam at 1Mpa and temperature 205^{0}C, if the vessel is cooled so that pressure falls to 300kpa.find the final temperature, heat transfer and change in entropy during this process. (16)

(OR)

(b) Steam at 20 bar, 360°C is expanded in a steam turbine to 0.08 bar. It then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. Assuming ideal processes, Estimate per kg of steam the network and the cycle efficiency. (16)

14. (a) Compare between Otto, Diesel and Dual cycles based on their same compression ratio, same maximum pressure and temperature. (16)

(OR)

(b) Compare two stroke and four stroke internal combustion engines. (16)

15. (a) Atmospheric air at 1.0132 bar has a DBT of 32°C and a WBT of 26°C. Solve (i) the partial pressure of water vapour, (ii) the specific humidity, (iii) the dew point temperature, (iv) the relative humidity, (v) the degree of saturation, (vi) the density of the air in the mixture. (16)

(OR)

(b) Construct a vapour compression refrigeration system with neat sketches. (16)

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