

# MEMA1 - Applied Thermodynamics

236

REG. NO

OCTOBER 2021

Time: Three hours

Maximum Marks: 75

- Note:
1. Answer ALL the questions in PART-A (1 mark each)
  2. Answer any ONE question from each unit in PART-B (3 marks each)
  3. Answer any ONE question from each unit in PART-C (10 marks each)
  4. The question paper contains TWO Pages

## PART-A (1x10=10)

1. State Boyle's law.
2. Name any two extensive properties.
3. Define : Air standard efficiency.
4. What is meant by control volume?
5. What is clearance volume?
6. State any two applications of rocket.
7. Define the term calorific value.
8. List any four term major components of I.C. engine.
9. Define : Friction power.
10. Define : Convection.

## PART-B (3x5=15)

### UNIT-I

11. Write about S.T.P. and N.T.P. conditions.
12. Derive : General gas equation.

### UNIT-II

13. An ideal carnot cycle engine takes in air at  $27^{\circ}\text{C}$ . The adiabatic expansion ratio for this engine is found to be 6. Find the air standard efficiency?
14. Write SFEE for gas turbine.

### UNIT-III

15. What are the classification of air compressor?
16. What is the principle of Jet propulsion.

### UNIT-IV

17. What are the requirements of a good fuel?
18. Compare four stroke and two stroke engines.

### UNIT-V

19. Define : (a) Indicated thermal efficiency. (b) Brake thermal efficiency.
20. Define : (i) black body, (ii) white body.

## UNIT-I

21. A mass of gas at a pressure of 10 bar and a volume of 24 litres at a temperature of 23°C. Find the mass of the gas if the pressure of the gas drops to 5 bar isothermally. Find also the work done, heat transferred, change in enthalpy and change in entropy.
22. 0.5 kg of a certain gas occupies 0.3m<sup>3</sup> at 20°C and 140 KN/m<sup>2</sup> and after adiabatic compression to 0.15m<sup>3</sup> the pressure is 370 KN/m<sup>2</sup>. Find the value of gas constant and the two specific heats.

## UNIT-II

23. In an oil engine working on the diesel cycle, the compression ratio is 14 and fuel cut off occurs at 6% of the stroke. If the fuel cut off is delayed to 9% of stroke, Calculate the change in the efficiency. Take  $\gamma = 1.4$  for air.
24. In a gas turbine, air flows at the rate of 5 kg/s. The velocity and the enthalpy of air at the entrance are 200m/s and 7000 KJ/KG. The exit velocity is 160 m/s and the enthalpy is 5000 KJ/KG. As the air passes through the turbine, a heat loss of 40 KJ/KG occurs. Find the power developed by the turbine.

## UNIT-III

25. A single stage single acting reciprocating air compressor has a bore of 200 mm and a stroke of 300 mm. It receives air at 1 bar and 20°C and delivers it at 5.5 bar. If the compression follows the law  $PV^{1.3}=C$  and clearance volume is 5 percent of the stroke volume, determine the power required to drive the compressor, If it runs at 500 rpm.
26. Explain the construction and working of a ram jet engine with a neat sketch.

## UNIT-IV

27. A fuel contains 92% carbon, 4% hydrogen, 2% sulphur, 1.5% Oxygen and Ash 0.5%. Find stoichiometric mass of air required to completely burn the fuel and also determine the products of combustion of mass as a percentage.
28. Explain the working of four stroke petrol engine with neat sketch.

## UNIT-V

29. In a test with a four cylinder four stroke petrol engine the following results were obtained B.P. with all cylinder working 23.54 KW B.P. with no.1 cylinder cut off 15.88 KW, B.P. with no.2 cylinder cut off 16.4 KW, B.P. with no.3 cut off 16.55 KW, B.P. with no.4 cylinder cut off 16.92 KW. Estimate the indicated power of the engine and its mechanical efficiency.
30. Explain with neat sketch the parallel flow and counter flow heat exchanger.

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