1514

Code : 15ME42T

Register Number | | | | | | | | | | |

IV Semester Diploma Examination, April/May-2019

BASIC THERMAL ENGINEERING

Time : 3 Hours] **[Max. Marks : 100**

Note : (i) Answer any **six** questions from PART – **A**.

(ii) Answer any **seven** full questions from PART – **B**.

(iii) Assume any missing data suitably.

PART – A

1. State two statements of second law of thermodynamics. **5**

2. A closed system undergoes a reversible constant pressure process of 3.5 bar and its volume changes from 0.14 m^3 to 0.07 m^3. During the process 40 kJ of heat is rejected. Find the change in internal energy of the system. **5**

3. List out the different thermodynamic processes on gases. **5**

4. Derive an expression for work done during isothermal process. **5**

5. List the assumptions made in thermodynamic air standard cycle. **5**

6. A Carnot engine working between 650 K and 340 K, produces 160 kJ of work. Determine thermal efficiency and heat added during the process. **5**

7. Define : Indicated power, Brake power and mechanical efficiency. **5**

8. Explain Black body. **5**

9. State the applications of gas turbine. **5**

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PART – B

10. (a) Explain Open system with examples. 5

(b) One litre of hydrogen at 0 °C is suddenly compressed to one-half its volume. Determine the change in temperature of the gas if the ratio of two specific heats for hydrogen is 1.4. 5

11. (a) 0.2 m^3 of air at a pressure of 2 bar is expanded isothermally to 0.8 m^3. Calculate the final pressure of the gas and heat supplied during the process. 5

(b) 2 kg of air is allowed to expand adiabatically. Its temperature during the process falls from 515 K to 390 K and the work done by air is 180 kJ. Calculate Cp and Cv for air. 5

12. A gas has a molecular mass of 26.7. The gas is compressed through a ratio of 12 according to the law $PV^{1.25} = C$, from initial conditions of 0.9 bar and 333K. Assuming specific heat at constant volume Cv = 0.79 kJ/kg K, find per kg of mass, work done and heat flow across the cylinder walls, gas constant and ratio of specific heat. 10

13. (a) Compare Otto cycle with diesel cycle. 5

(b) In an Otto cycle, the beginning and end temperatures of an isentropic compression are 314 K and 604 K respectively. Determine the air standard efficiency and the compression ratio. Take $\gamma = 1.4$. 5

14. With the help of P-V and T-S diagrams, derive an expression for the air standard efficiency of diesel cycle. 10

15. (a) Draw a neat diagram of an I.C. engine indicating the component parts. 5

(b) A heat engine has a piston diameter of 225 mm, length of stroke 600 mm and mean effective pressure 5 bar. The engine makes 100 explosions per minute. Determine the mechanical efficiency of the engine, if the engine BP is 14 kW. 5

(a) Explain with diagram Rope brake dynamometer. 5

(b) A diesel engine uses 6 kg of oil per hour of calorific value 42,000 kJ/kg. If the BP of the engine is 32 kW and mechanical efficiency 85%, Calculate :

(1) Indicated thermal efficiency

(2) Brake thermal efficiency

(3) Specific fuel consumption in kg/BP/hr. 5

17. A test on a single cylinder 4 stroke oil engine having bore 180 mm and stroke 360 mm yielded the following results :

Brake torque 0.44 kN-m, MEP 7.2 bar, fuel consumption 3.5 kg/min, cooling water flow 4.5 kg/min, water temperature rise 36 °C, A/F ratio 25, exhaust gas temperature 415 °C, Room temperature 21 °C, Specific heat of exhaust gases 1.05 kJ/kg K, Calorific value 45,200 kJ/kg, Speed = 286 rpm. Construct up a heat balance sheet on kJ/min. basis. 10

18. A furnace wall is made up of bricks of 200 mm thick. The inner and outer surfaces of the wall have temperature of 1000 °C and 300 °C. Find the heat loss. If the outside temperature becomes 50 °C, after the furnace wall is covered with insulator of 100 mm thick, find the reduction in heat loss. Take K_{brick} = 5W/mK, $K_{insulator}$ = 0.6 W/mK. 10

19. (a) Explain briefly the working principle of rocket engine with line diagram. 7

(b) The net work output of a cyclic process is 40 kN-m. If the input is 110 kJ, determine the efficiency of the cycle. 3
