1336

Code : 15ME42T

Register Number | | | | | | | |

IV Semester Diploma Examination, April/May-2018

BASIC THERMAL ENGINEERING

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

Note : (i) Answer any **six** from Part – **A** and **seven** from Part – **B**.
(ii) Missing Data may be suitably assumed.

PART – A

1. Define : **5**
   (a) Intensive property
   (b) Open system

2. Prove that $C_p - C_v = R$ with usual notations. **5**

3. The network output of a cyclic process is 45 kJ. If the heat input is 125 kJ, determine the thermal efficiency of the cycle. **5**

4. Define : **5**
   (a) Throttling process
   (b) Free expansion process

5. Derive an expression for work done during an adiabatic process. **5**

6. What are the conditions of reversibility ? **5**

7. In a Carnot cycle, the temperature of the source and sink are 700 °C and 50 °C. Find the theoretical efficiency of the engine. **5**

8. Define Brake power and Swept volume. **5**

9. Derive an expression for heat transfer through a slab. **5**

[Turn over

PART – B

10. (a) An engine works between limits of 1775 K and 375 K. The heat supply is 84 kJ/s, find the power developed by the engine. **5**

(b) A domestic food refrigerator is to be maintained at temperature of –15 °C. The ambient air temp. is 30 °C. If the heat leaks into the freezer at the rate of 1.75 kJ/s. Find the power required to pump this heat. **5**

11. A volume of 0.5 m^3 of gas at a pressure of 10 bar and 200 °C is expanded in a cylinder to 1.2 m^3 at a constant pressure. **10**

Calculate :

(a) work done

(b) increase in internal energy

$C_p = 1.005$ kJ/kg K

$C_v = 0.712$ kJ/kg K

12. An ideal gas at 30 °C and 1 bar is compressed adiabatically from 5 m^3 to 1 m^3. Find the final temp., work done and final pressure. Take $\gamma = 1.4$. **10**

13. (a) Draw P-V and T-S diagram for Carnot cycle. Show that efficiency of Carnot cycle. **5**

$$= 1 - \frac{T_3}{T_1}$$

(b) The efficiency of an Otto cycle is 50% and $\gamma = 1.5$. Find the compression ratio. **5**

14. An engine working on the Otto cycle has a cylinder diameter of 150 mm and a stroke of 225 mm. The clearance volume is 1.25×10^{-3} m^3. **10**

Find

(a) Compression ratio

(b) Air standard efficiency

15. Explain with neat diagram the working of four stroke diesel engine. **10**

16. The following data refer to a test on a petrol engine : **10**

Indicated power = 30 kW

Brake power = 26 kW

Engine speed = 1800 rpm

Fuel consumption = 9.1 kg/hr

Calorific value of the fuel = 44100 kJ/kg.

Calculate :

(a) Mechanical efficiency

(b) Indicated thermal efficiency

(c) Brake thermal efficiency

17. The following particulars refer to the full load test of a single cylinder petrol engine working on 4-stroke cycle : **10**

Speed = 2500 rpm

Brake power = 118 kW

Cylinder bore = 110 mm

Stroke length = 120 mm

Calorific value of fuel = 41150 kJ/kg

Petrol consumption = 40 kg/hr

Cooling water used = 2800 kg/hr

Jacket water inlet temp. = 20 °C

Jacket water outlet temp. = 65 °C

Calculate :

(a) Heat equivalent of BP

(b) Heat carried by cooling water

(c) Heat supplied by fuel

[Turn over

18. (a) A tube has internal radius 20 mm and external radius 25 mm. The inside of the tube is maintained at 100 °C and the outside at 20 °C. Calculate the quantity of heat conducted through the tube per sec.

Take length of tube = 1 m

K = 380 W/mK **5**

(b) The glass windows of a room have a total area of 10 m^2 and the glass is 4 mm thick. Temp. at inside surface of window 25 °C and at outside surface 10 °C. The value of K for glass 0.84 W/mK. Using Fourier conduction equation, calculate the quantity at heat that escapes from the room per second. **5**

19. (a) List the classification at Gas turbine and state two applications of gas turbines. **5**

(b) Explain closed cycle gas turbine with schematic diagram. **5**