1336

Code: 15ME42T

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IV Semester Diploma Examination, April/May-2018

## BASIC THERMAL ENGINEERING

Tim	ne: 3 Hours	ax. Marks . 100		
Note	(i) Answer any six from Part – A and seven from Part – B.  (ii) Missing Data may be suitably assumed.			
	PART - A	CONSOLE		
1.	Define:	5		
	(a) Intensive property	iploma - [All Branches		
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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 the thermal efficiency of the cycle.	p, determine Papers [2015-		
4.	Define:  (a) Throttling process  (b) Free expansion process	5. weiti (a): (b)		
5.	Derive an expression for work done during an adiabatic process.	5		
6.	What are the conditions of reversibility?	197 (8) Misself (8) 5		
7.	In a Carnot cycle, the temperature of the source and sink are 700 °C and the theoretical efficiency of the engine.	CVI STRUCTURE TILS		
	in characteristics which is the state of the			
8.	Define Brake power and Swept volume.	5		
9.	Derive an expression for heat transfer through a slab.	5		
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## 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.
  - (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.
- 11. A volume of 0.5 m<sup>3</sup> of gas at a pressure of 10 bar and 200 °C is expanded in a cylinder to 1.2 m<sup>3</sup> at a constant pressure.

Calculate:

- (a) work done
- (b) increase in internal energy

$$C_p = 1.005 \text{ kJ/kg K}$$

$$C_v = 0.712 \text{ kJ/kg K}$$





- 12. An ideal gas at 30 °C and 1 bar is compressed adiabatically from 5 m<sup>3</sup> to 1 m<sup>3</sup>. Find the final temp., work done and final pressure. Take γ = 1
- 13. (a) Draw P-V and T-S diagram for Carnot cycle. Show that efficiency of Carnot cycle.

$$=1-\frac{\mathrm{T}_3}{\mathrm{T}_1}$$

- (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  $1.25 \times 10^{-3}$  m<sup>3</sup>.

Find

- (a) Compression ratio
- (b) Air standard efficiency

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

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

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Indicated power = 30 kW

Brake power = 26 kW

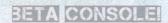
Engine speed = 1800 rpm

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



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

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. =  $65 \, ^{\circ}\text{C}$ 

Calculate:

- (a) Heat equivalent of BP
- (b) Heat carried by cooling water
- (c) Heat supplied by fuel

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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

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(b) The glass windows of a room have a total area of 10 m<sup>2</sup> 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.

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

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

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