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B.Tech. DEGREE EXAMINATION, JANUARY 2024
Fourth Semester

18MEC107T – APPLIED THERMAL ENGINEERING
(For the candidates admitted from the academic year 2021 - 2022)

Note:

- (i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.
- (ii) **Part - B & Part - C** should be answered in answer booklet.

Time: 3 hours

Max. Marks: 100

PART – A (20 × 1 = 20 Marks)

Answer ALL Questions

PART – A (20 × 1 = 20 Marks)				
Answer ALL Questions				
1. The compression ratio in a diesel engine is of the order of (A) 5 to 8 (C) 15 to 25	(B) 10 to 15 (D) 25 to 30	Marks	BL	CO PO
2. The heat addition and heat rejection in Brayton cycle takes place at (A) Constant volume (C) Constant pressure	(B) Constant temperature (D) Constant entropy	1	1	1 2
3. For the same compression ratio, the efficiency of diesel cycle is _____ otto cycle. (A) Greater than (C) Equal to	(B) Less than (D) Cannot say	1	2	1 2
4. The thermal efficiency of dual cycle is equal to that of diesel cycle at _____ equal to unity. (A) Cut-off ratio (C) Expansion ratio	(B) Pressure ratio (D) Compression ratio	1	2	1 2
5. A chemical fuel is a substance which releases _____ on combustion. (A) Chemical energy (C) Sound energy	(B) Heat energy (D) Magnetic energy	1	1	2 2
6. Stoichiometric air-fuel ratio by mass for combustion of petrol is (A) 5 (C) 12	(B) 10 (D) 15.05	1	1	2 2
7. An analysis which includes the steam in the exhaust is called (A) Dry analysis (C) Dry and wet analysis	(B) Wet analysis (D) Water vapour analysis	1	2	2 2
8. Bomb calorimeter is used to find the calorific value of _____ fuels. (A) Solid (C) Solid and gaseous	(B) Gaseous (D) Dispersion	1	1	2 2

9. The ratio of indicated thermal efficiency to the corresponding air standard cycle efficiency is called
 (A) Net efficiency (B) Efficiency ratio
 (C) Relative efficiency (D) Overall efficiency
10. If the speed of the engine is increased, the indicated power will
 (A) Increase (B) Decrease
 (C) Remain same (D) None of the mentioned
11. The brake power of a diesel engine, keeping other parameters constant, can be increased by
 (A) Decreasing the density of intake air (B) Increasing the temperature of intake air
 (C) Increasing the pressure of intake air (D) Decreasing the pressure of intake air
12. A carburettor is used to supply _____
 (A) Petrol, air and lubricating oil (B) Air and diesel
 (C) Petrol and lubricating oil (D) Petrol and air
13. The intercooling in multistage compressors is done _____
 (A) To cool the air during compression (B) To cool the air at delivery
 (C) To enable compression in two stages (D) To minimize the work of compression
14. The compressor mostly used for supercharging of IC engine is _____
 (A) Radial flow compressor (B) Axial flow compressor
 (C) Roots blower (D) Reciprocating compressor
15. The rotary compressors are used for delivering _____
 (A) Small quantities of air at high pressure (B) Large quantities of air at high pressure
 (C) Small quantities of air at low pressures (D) Large quantities of air at low pressure
16. Separators in compressor installations are located _____
 (A) Before intercooler (B) After intercooler
 (C) After receiver (D) Between after cooler and air receiver
17. The condition of refrigerant after passing through the condenser in a vapour compression system is
 (A) Saturated liquid (B) Wet vapour
 (C) Dry saturated vapour (D) Super heated vapour
18. Domestic refrigerator working on vapour compression cycle uses the following type of expansion device
 (A) Electrically operated throttling valve (B) Manually operated valve
 (C) Thermostatic valve (D) Capillary tube

- b. Explain the following in detail with neat sketch 12 2 2 2
- (i) Exhaust gas analysis by Orsat's apparatus
 - (ii) Determination of calorific value using bomb calorimeter

30. a. A four cylinder four stroke petrol engine has a bore of 57 mm and a stroke of 90mm. Its rated speed is 2800 rpm, torque is 55.2 Nm. The fuel consumption is 6.74 litre/hour. The density of petrol is 735kg/m³ and petrol has a calorific value of 44200 kJ/kg. Calculate brake power, brake mean effective pressure, brake thermal efficiency and brake fuel consumption. 12 3 3 2

(OR)

- b. In a trial of a single cylinder oil engine working on dual cycle, the following observations were made: compression ratio =15, oil consumption = 10.2 kg/h, CV of fuel = 43890 kJ/kg, air consumption = 3.8 kg/min, speed =1900 rpm, torque on brake drum = 186 Nm, quantity of cooling water used = 15.5 kg/min, temperature rise = 36°C, exhaust gas temperature = 410°C, room temperature =20°C, C_p for exhaust gasses = 1.17kJ/kg. Calculate brake power, brake specific fuel consumption, brake thermal efficiency. Draw the heat balance sheet on minute basis. 12 3 3 2

31. a.i. Derive an expression for the minimum work required for a two-stage reciprocating air compressor. 6 2 4 2

- ii. Explain the concept of multi-stage air compression with intercooling with neat sketches. 6 2 4 2

(OR)

- b. A single stage double acting air compressor operating at a delivery pressure of 7.5 bar delivers 5m³ of free air per minute at 1 atm and 20°C. Speed = 300 RPM, mechanical efficiency = 0.9, pressure loss in passing through intake valve= 0.04 bar, temperature rise of air during suction stroke=12°C, clearance volume = 5% of stroke volume, index of compression and expansion, $n = 1.3$, length of the stroke = 1.3 times of the cylinder diameter. Calculate: 12 3 4 2

- (i) Power input to the shaft
- (ii) Volumetric efficiency and
- (iii) The cylinder diameter

32. a. Explain the following in detail with neat sketch 12 2 5 2
- (i) Vapor compression refrigeration system
 - (ii) Vapour absorption refrigeration system

(OR)

- b. A psychrometer reads 40°C DBT, and 36°C WBT. Find the humidity ratio, relative humidity, dew point temperature, specific volume of air, density of air, density of water vapour and enthalpy of air. 12 3 5 2

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