

- b. The humidification process, on the psychrometric chart is shown by 1 1 5 1
 (A) Horizontal line (B) Vertical line
 (C) Inclined line (D) Curved line
- c. Removal of moisture in the air is called 1 1 5 1
 (A) Humidification (B) Dehumidification
 (C) Sensible cooling (D) Sensible heating

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Reg. No.

B.Tech. DEGREE EXAMINATION, MAY 2023

OPEN BOOK EXAMINATION

Fourth Semester

18AUC203T – APPLIED THERMAL ENGINEERING FOR AUTOMOTIVE ENGINEERS

(For the candidates admitted from the academic year 2018-2019 to 2019-2020)

(Standard heat and mass transfer book and psychrometric chart should be provided)

- Specific approved THREE text books (Printed or photocopy) recommended for the course
- Handwritten class notes (certified by the faculty handling the course / head of the department)

Time: 3 Hours

Max. Marks: 100

Answer FIVE questions

(Question No 1 is compulsory)

- | | Marks | BL | CO | PO |
|---|-------|----|----|----|
| 1.a.i. An engine working on otto cycle has the following conditions: pressure at the beginning of compression is 3 bar and pressure at the end of compression is 13 bar. Calculate the air standard efficiency of the engine. Assume $\gamma=1.3$. | 3 | 2 | 1 | 1 |
| ii. A compression ignition engine works on dual combustion cycle. The pressure and temperature at the beginning of compression are 1 bar and 28°C, respectively and the pressure at the end of compression is 28 bar. If 430 kJ of heat is supplied per kg of air during constant volume heating and the pressure at the end of adiabatic expansion is found to be 3 bar, find the thermal efficiency. Assume $C_p = 1.005 \text{ kJ/kg K}$ and $C_v = 0.717 \text{ kJ/kg K}$. | 15 | 4 | 1 | 1 |
| b. The maximum temperature in the IC engine cylinder will be of the order of
(A) 500 - 1000°C (B) 1000 - 1500°C
(C) 1500°C - 2000°C (D) 2000 - 2500°C | 1 | 1 | 1 | 1 |
| c. For the same compression ratio, the efficiency of the diesel cycle is _____ otto cycle.
(A) Greater than (B) Less than
(C) Equal to (D) Not as comparable to | 1 | 1 | 1 | 1 |
| 2.a.i. A engine using at 1500 rpm develops a torque of 6 N-m. The indicated power of the engine is 1.4 kW. Find the loss due to friction power as the percentage of BP. | 3 | 3 | 2 | 2 |
| ii. A test was conducted in a single cylinder 4 stroke diesel engine having cylinder diameter of 25 cm and stroke length of 40 cm. The following observations were made.
Duration of the trial (or) test = 50 min
Total fuel used = 6.5 lit
Calorific value = $42500 \times 10^3 \text{ kJ/kg}$
Total no. of revolution = 12624
Gross Imep = 7.5 bar
Pumping Imep = 0.45 bar | 15 | 4 | 2 | 2 |

<p>Net load on the brake = 160 kg Diameter of the brake wheel drum = 1.78 m Diameter of the rope = 5 cm Cooling water circulated = 500 lit Cooling water temperature rise = 50°C Specific heat of water = 4.18 kJ/kg K Specific gravity of oil = 0.8 Find the mechanical efficiency and also the unaccounted losses.</p>				
b. In a petrol engine, the mixture has the highest pressure at the	1	1	2	1
(A) Beginning of suction stroke (B) End of suction stroke (C) End of compression stroke (D) End of exhaust stroke				
c. The mean effective pressure of a diesel engine having fixed compression ratio will _____ if the cut off ratio decreases.	1	1	2	1
(A) Increase (B) Decrease (C) Become zero (D) Become negative				
3.a.i. A hollow cylinder 6 cm inner radius and 12 cm outer radius has inner surface temperature of 300°C and outer surface temperature of 150°C. If the thermal conductivity is 75 W/mK, find the heat transfer per unit length.	3	3	3	2
ii. A hollow cylinder 6 cm inner diameter and 11 cm outer diameter has inner surface temperature of 250°C and outer surface temperature of 125°C. Determine the heat flow through the cylinder per meter length. Also determine the temperature of the point half way between the inner and outer surfaces. Take K = 1 W/mK.	15	4	3	2
b. The amount of conductive heat transfer through a solid body is	1	1	3	1
(A) Indirectly proportional to surface area (B) Directly proportional to surface area (C) Directly proportional to Reynolds number (D) Directly proportional to Prandtl number				
c. The thermal conductivity of solids with rise in temperature normally	1	1	3	1
(A) Increases (B) Decreases (C) Increase first then decrease (D) Decreases first then increases				
4.a.i. A two stage single acting reciprocating air compressor draws in air of a pressure of 2 bar and 18°C and compresses it to a pressure of 60 bar. After compression in the lower pressure cylinder, the air is cooled at constant pressure of 8 bar to a temperature of 39°C. The low pressure cylinder has a diameter of 160 mm and both the cylinders have 200 mm stroke. If the law of compression is $PV^{1.35} = C$, find the power of the compressor, when it runs at 300 rpm. Take R = 287 J/kg K.	18	4	4	2
b. In vapor compression cycle, the refrigerant immediately after expansion valve is	1	1	4	1
(A) Liquid (B) Sub cooling system (C) Saturated liquid (D) Wet vapor				
c. The ratio of shaft power to brake power in a compressor is known as	1	1	4	1
(A) Mechanical efficiency (B) Volumetric efficiency (C) Isothermal efficiency (D) Adiabatic efficiency				
5.a.i. A two stage air compressor compresses air from 1.5 bar and 30°C to 45 bar. If the law of compression is $PV^{1.35} = C$ and intercooling is complete to 25°C, find per kg of air.	18	4	4	2
(i) The work done is compressing (ii) The mass of water necessary for abstracting the heat in the inter cooler,				
If the temperature rise of the cooling water is 30°C. take R = 287 J/kg K, $C_p = 1.005$ kJ/kg K.				
b. The domestic refrigerator commonly uses which type of compressor.	1	1	4	1
(A) Centrifugal (B) Axial (C) Miniature sealed unit (D) Piston type reciprocating				
c. Volumetric efficiency is	1	1	4	1
(A) The ratio stroke volume to clearance volume (B) The ratio of the air actually delivered to the amount of piston displacement (C) Reciprocal of compression ratio (D) Index of compressor performance				
6.a.i. Following data refers to an air conditioning system to be designed for an industrial process for hot and wet climate	18	4	5	2
Outside conditions = 35°C DBT and 70% RH Required inside conditions = 25°C DBT and 65% RH The required condition is to be achieved first by cooling and dehumidifying and then by heating. If 26 m ³ of air is observed by the plant every minute, find				
(i) Capacity of the cooling coil in tonne of refrigeration (ii) Capacity of the heating coil is kW and (iii) Amount of water removed per hour				
b. Refrigerator works on	1	1	5	1
(A) Carnot cycle (B) Rankine cycle (C) Reversed Carnot cycle (D) Otto cycle				
c. The vapour compression refrigerator employs the following cycle	1	1	5	1
(A) Rankine (B) Carnot (C) Reversed Rankine (D) Reversed Carnot				
7.a.i. An air conditioning plant is required to supply 50 m ³ of air minute at a DBT of 21°C and 55% RH the outside air at DBT of 25°C and 65% RH. Determine the mass of water drained and capacity of the cooling coil. Assume the air conditioning plant first to dehumidify and then to cool the air.	18	4	5	2