Reg. No															

B.Tech DEGREE EXAMINATION, DECEMBER 2023

Fourth Semester

18AUC203T - APPLIED THERMAL ENGINEERING FOR AUTOMOTIVE ENGINEERS

(For the candidates admitted during the academic year 2018-19 to 2021-22)

OPEN BOOK EXAMINATION

Note:

i. Specific approved THREE text books (Printed or photocopy) recommended for the course.
ii. 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
1	i.	An air standard dual cycle has a compression ratio of 9. The pressure and temperature at the starting of compression are 1 bar and 28°C. The maximum pressure reached is 44 bar and the maximum temperature is 1600°C. Determine (i) The temperature at the end of constant volume heat addition (ii) cut-off ratio (iii) work done per kg of air and (iv) the cycle efficiency. Assume Cp= 1.004 kJkg K and Cv =0.717kJ/kg K for air.	18	4	1
	ii.	The air standard Otto cycle comprises (A) Two constant pressure processes and two constant volume processes (B) Two constant pressure and two constant entropy processes (C) Two constant volume processes and two isotropic processes (D) Two constant volume processes and two isothermal processes	1	1	1
	iii.	Piston compression rings are made of which one of the following? (A) Cast iron (B) Bronze (C) Aluminum (D) White metal	1	1	1
2	i.	In a test of an oil engine, under full load condition, the following results were obtained. IP = 33kW, BP = 27 kW, Fuel used = 8 kg/hr, Rate of flow of water through gas calorimeter = 12 kg/min, Cooling water flow rate = 7 kg/min, Calorific value of fuel = 43 MJ/kg, Inlet temp of cooling water = 15°C, Outlet temp of cooling water = 75°C, Inlet temp of water to exhaust gas calorimeter = 15°C, Outlet temp of water to exhaust gas calorimeter = 55°C, Final temp of exhaust gas = 80°C, Room temp = 17°C, A/F ratio on mass basis = 20, mean specific heat of exhaust gas = 1 kJ/kg-K, Specific heat of water = 4.18 kJ/kg-K. Draw a heat balance sheet and estimate the thermal and mechanical efficiencies.	18	4	2
	ii.	The frictional power (F.P) is given by (A) F.P. = B.P.-I.P (B) F.P. = I.P.- B.P (C) F.P. = B.P./I.P (D) F.P. = I.P./B.P	1	1	2
	iii.	For low speed operation or for idling in petrol engines, the engine requirements are for (A) Lean mixture (B) Theoretically correct mixture (C) Rich mixture (D) Very lean mixture	1	1	2
3	i.	A wall of cold room composed of three layer. The outer layer is brick 35cm thick. The middle layer is cork 25 cm thick. The inside layer is cement 20cm thick. The temperature of the outside air is 35°C and on the inside air is -25°C. The film coefficient for outside air and brick is 55.4W/ m^2 K. Film coefficient for inside air and cement is 17W/ m^2 K. Find the heat flow rate.	18	4	3
	ii.	Heat transfer takes place from higher temperature to lower temperature according to (A) Zeroth law of thermodynamics (B) First law of thermodynamics (C) Second law of thermodynamics (D) Third law of thermodynamics	1	1	3
	iii.	Which one of the following represents Fourier equation? (A) Q=KA(dT/dX) (B) Q= - KA(dT/dX) (C) Q=K/A(dT/dX) (D) Q=-K/A(dT/dX)	1	1	3

4	i.	A single acting reciprocating air compressor has cylinder diameter and stroke of 300mm and 400mm respectively. The compressor sucks air at 1.5 bar 29°C and delivers at 9 bar while running at 200 rpm. Find 1. Indicated power of the compressor, 2.mass of air delivered by the compressor per minute and 3. Temperature of the air delivered by the compressor. The compression follows the law $PV^{1.25}=C$, Take R as 287J/kg K.	18	4	4
	ii.	Example of reversed heat engine is (A) Air compressor (B) Heat Pump (C) Diesel engine (D) Roots blower	1	1	4
	iii.	Ratio of shaft power to brake power in compressor is known as (A) Mechanical efficiency (B) Volumetric efficiency (C) Isothermal efficiency (D) Adiabatic efficiency	1	1	4
5	i.	A two stage single acting reciprocating air compressor draws in air at a pressure of 1 bar and 19 °C and compresses it to a pressure of 50 bar. After compression in LP cylinder. The air is cooled at constant pressure of 7 bar to a temperature of 35°C. The low pressure cylinder has a diameter of 140mm and both the cylinder have 190mm stroke. If the law of compression $PV^{1.35}=C$, find the power of the compressor, when it runs at 200 rpm. Take R=287J/kg K	18	4	4
	ii.	In a One ton refrigerator (A) One ton is the total mass of the machine (B) One ton of refrigerant is used (C) One ton of water can be converted into ice (D) The refrigeration effect produced is 210 kJ/min	1	1	4
	iii.	Reciprocating air compressor is best suited for (A) Large quantity of air at high pressure (B) Small quantity of air at high pressure (C) Small quantity of air at low pressure (D) Large quantity of air at low pressure	1	1	4
6	i.	An ideal diesel cycle operates on a pressure of 1 bar and a temperature of 29°C at the beginning of compression and a pressure of 3 bar at the end of adiabatic expansion. calculate the amount of heat required to be supplied per kg of air if the ideal thermal efficiency is taken as 70% Take Cv=0.717kJ/kg K	18	4	1
	ii.	If N is the rpm, number of power strokes per minute in a four stroke engine is (A) 2N (B) N/2 (C) 4N (D) N	1	1	1
	iii.	Volumetric efficiency is the measure of (A) Speed of the engine (B) Power of the engine (C) Breathing capacity of the engine (D) Pressure rise in the cylinder	1	1	1
7	i.	Atmospheric air at 760mm of Hg barometric pressure has 20°C dry bulb temperature and 10°C wet bulb temperature. By using psychrometric chart, determine 1. Relative humidity 2. Humidity ratio and 3. Dew point temperature.	18	4	5
	ii.	The horizontal line in psychrometric chart joining the change of state of air represents….. (A) Humidification (B) Sensible cooling or heating (C) Sensible cooling or heating with humidification (D) Sensible cooling or heating with dehumidification	1	1	5
	iii.	Example of Humidification process is (A) Air cooler (B) Water Cooler (C) Air conditioning (D) Refrigerator	1	1	5

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