B.Tech. / M.Tech. (Integrated) DEGREE EXAMINATION, DECEMBER 2023
OPEN BOOK EXAMINATION
Third Semester

21AUC201T – APPLIED THERMAL ENGINEERING
(For the candidates admitted during the academic year 2022 - 2023)

- 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: 75

INSTRUCTIONS
Answer **ANY FIVE** questions from Question No.1 to 7
Question No. 8 is Compulsory

		Marks	BL	CO	PO
1.	The compression ratio of an ideal air standard diesel cycle is 15, the heat transfer is 1465 kJ/kg of air. Find the pressure and temperature at the end of each process and determine the cycle efficiency. What is the mean effective pressure of the cycle, if the inlet conditions are 300 K and 1 bar.	10	4	4	2
2.	Determine the size of the cylinder for a double acting air compressor of 40 kW indicated power, in which air is drawn in at 1.5 bar and 17°C and compressed according to the law $pv^{1.3}$=constant, to 6 bar. The compressor runs at 150 rpm with an average piston speed of 152.5 m/min. Neglect clearance.	10	4	5	2
3.	Estimate the work done by a two stage reciprocating single acting air compressor to compress 2.8 m³ of air per min at 1.10 bar and 11°C to a final pressure of 35 bar the intermediate receiver cools the air to 30°C and 5.6 bar pressure for air, take n=1.4.	10	4	5	2
4.	The temperature limits of an ammonia refrigerating system are 25°C and −10°C. If the gas is dry at the end of compression. Calculate the coefficient of performance of the cycle assuming no under cooling of the liquid ammonia. Use the following table for properties of ammonia.	10	4	3	2

Temperature °C	Liquid heat (kJ/kg)	Latent heat (kJ/kg)	Liquid entropy (kJ/kg)
25	298.9	1166.94	1.1242
−10	135.37	1297.68	0.5443

		Marks	BL	CO	PO
5.	Atmospheric air with dry bulb temperature of 17°C is cooled to 15°C without changing its moisture content find (1) Original relative humidity (2) Final relative humidity and (3) Find wet bulb temperature.	10	4	5	2
6.	Atmospheric air at 760 mm of Hg barometric pressure has 23°C dry bulb temperature and 15°C web bulb temperature. By using psychometric chart, determine (1) relative humidity (2) humidity ratio and (3) dew point temperature.	10	4	5	2

7. In a compression ignition engine working on a dual combustion cycle, pressure and temperature at the start of compression are 1 bar and 300 K, respectively. At the end of compression, pressure reaches a value of 25 bar 420 kJ of heat is supplied per kg of air during constant volume heating and pressure becomes 2.8 bar at the end of isentropic expansion. Estimate the ideal thermal efficiency. Take C_p=1.005 kJ/kg K and C_V=0.712 kJ/kg K.

      10   4   5   2

8.a. Find the air standard efficiencies for the Otto and diesel cycle on the basis of equal compression ratio of 9 and equal heat rejection of 710 kJ/kg. the suction conditions are 1 bar and 318 K. Draw the PV and TS diagram for both cycles.

      25   4   4   2

(OR)

b. In a compression ignition engine working on a dual combustion cycle, pressure and temperature at the start of compression are 1 bar and 290 K, respectively. At the end of compression, pressure reaches a value of 26 bar. 410 KJ of heat is supplied per kg of air during constant volume heating and pressure becomes 2.8 bar at the end of isentropic expansion. Estimate the ideal thermal efficiency. Take C_p=1.005 kJ/kg K and C_v=0.712 kJ/kg K. Also determine (i) the cut of ratio if the expansion ratio is 5 (ii) the mean effective pressure if the hore and stroke of the cylinder are 200 mm and 300 mm, respectively.

      25   4   4   2

* * * * *