Q. Code:613653

Reg. No. | | | | | | | | | | | | | |

B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2024

Fourth Semester

ME22403 – THERMAL ENGINEERING

(Mechanical Engineering)

(Regulation 2022)

(Use of Approved Steam Table is permitted)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Students will be able to compare the various system & components of IC engine and to analyze their performance of air standard cycles.	**4**
CO 2	Students will be able to understand the various system used in IC engine and to analyze their performance.	**4**
CO 3	Students will be able to distinguish the different types of nozzles and turbine, and to analyze their performance.	**4**
CO 4	Students will be able to distinguish the different types of air compressor and to analyze their performance.	**4**
CO 5	Students will be able to analyze the performance of different air conditioning and Refrigeration system.	**4**

PART- A (20 x 2 = 40 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Draw the P-v and T-s diagram for limited pressure cycle.	**1**	**2**
2.	How is SI engine differed from CI engine?	**1**	**2**
3.	State the characteristics of air standard cycles.	**1**	**2**
4.	Mention the use of Gudgeon pin in IC engine.	**1**	**2**
5.	Lubricants must have low cloud and pour point. Justify	**2**	**3**
6.	State the significance of octane and cetane numbers.	**2**	**3**
7.	State the significance of Morse test.	**2**	**3**

8.	Compare Battery ignition system with magneto ignition system.	**2**	**2**
9.	Define Degree of freedom. State its value in percentage for impulse turbine.	**3**	**3**
10.	What do you mean by governing in steam turbine?	**3**	**2**
11.	Define critical pressure ratio of Nozzle.	**3**	**2**
12.	What is super saturated flow in steam nozzle?	**3**	**2**
13.	When an intercooling will be perfect intercooling in multi stage reciprocating air compressor?	**4**	**3**
14.	At what condition, work input for multistage reciprocating air compressor will be minimum?	**4**	**3**
15.	Define clearance ratio of reciprocating air compressor.	**4**	**2**
16.	State the necessity of multi stage compression in reciprocating air compressor.	**4**	**2**
17.	Define sub cooling .State its effects.	**5**	**2**
18.	Refrigerants must have low boiling point. Justify	**5**	**3**
19.	How the capacity of the refrigerator is expressed?	**5**	**2**
20.	Draw T-s Diagram of vapor compression refrigeration cycle with refrigerant is dry at the beginning of compression.	**5**	**2**

PART- B (5 x 10 = 50 Marks)

		Marks	CO	RBT LEVEL
21. (a)	In an constant volume cycle, air enters at 25°C and 0.95 bar and compressed with a compression ratio is 8. If the maximum temperature of cycle is 1000K, determine the cycle efficiency and its mean effective pressure.	**(10)**	**1**	**3**

(OR)

(b)	**(i)**	In a p-v diagram show Otto and diesel for (i) Same compression ratio (ii) Same peak pressure. Which cycle will have more efficient at these conditions? Justify.	**(5)**	**1**	**3**
	(ii)	Compare actual valve timing diagram with theoretical valve timing diagram.	**(5)**	**1**	**3**
22. (a)		What are the limitations of conventional fuel injection system of CI engine? With an Illustration explain, how these limitations are overcome with Common Rail Direct Injection (CRDI) system.	**(10)**	**2**	**3**
		(OR)			
(b)		A four cylinder four stroke petrol engine has a size 65 mm diameter and 95 mm stroke. On test, it developed a torque of 64 Nm when running at 3000 rpm. If clearance volume in each cylinder is 63 cm^3, the brake efficiency ratio based on air standard efficiency is 0.5 and calorific value of petrol is 42000 kJ/kg, determine the fuel consumption in kg/h and brake mean effective pressure.	**(10)**	**2**	**3**
23. (a)		Discuss the importance of reducing rotor speed in impulse turbine. Illustrate the variation of pressure and velocity during different methods of reducing the speed. Explain any one in detail.	**(10)**	**3**	**3**
		(OR)			
(b)		A single stage steam turbine is supplied with steam at 10 bar, 350°C at the rate of 40kg/min. It expands into a condenser at a pressure of 0.5 bar. The blade speed is 400m/sec. The nozzles are inclined at an angle of 20° to the wheel and the out let blade angle is 30°. Neglecting friction losses, determine the power developed by the turbine.	**(10)**	**3**	**3**
24. (a)	**(i)**	In a four stage single acting reciprocating air compressor, pressure, temperature and volume flow rate of air at inlet are 1 bar, 25^0 C and 5 m^3/min. The air is to be compressed to a final pressure of 70 bar. The index of compression in each cylinder is 1.25. If the Inter cooling between the stages is perfect, determine (1) Pressure ratio in each stage of compression (2) minimum power input to the compressor.	**(10)**	**4**	**3**
		(OR)			

(ii)	How rotary compressors are differed from reciprocating compressors with respect to their working principle, capacity and application? With schematic diagram explain the working of any one type of rotary compressor.	**(10)**	**4**	**3**
25. (a)	A simple vapour compression plant produces 6 tonnes of refrigeration. The enthalpy values at inlet to compressor, at exit from the compressor and at exit from the condenser are 183.19,209.41 and 74.59 kJ/kg respectively. Estimate the refrigerant flow rate, power required to drive the compressor and COP.	**(10)**	**5**	**3**
	(OR)			
(b)	Compare vapour Absorption Refrigeration System with vapour compression Refrigeration System. With schematic diagram explain any one type of vapor absorption system with its merits and demerits.	**(10)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)

(Q.No.26 is compulsory)

		Marks	CO	RBT LEVEL
26.	Air has to be compressed in a single stage single acting reciprocating air compressor. Assuming suitable numerical data, investigate a reversible compression process which requires minimum work input. Justify your selection. Neglect clearance volume.	**(10)**	**4**	**4**

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