Q. Code: 842178

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

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

First Semester

MR22201 – THERMAL ENGINEERING FOR MARINE ENGINEERS

(Marine Engineering)

(Regulation 2022)

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

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Students should be able to understand the first law of thermodynamics along with engineering applications.	**3**
CO 2	Students should be able to recognize heat engines, heat pumps and refrigerators and applications of the second law of thermodynamics.	**3**
CO 3	Students should be able to comprehend the steam formation process, properties of steam and its application to Rankine cycle.	**3**
CO 4	Students should be able to analyze various air standard cycles and their applications.	**3**
CO 5	Students should be able to know the vapor compression refrigeration cycle and its analysis.	**3**

PART- A (20 x 2 = 40 Marks)

(Answer all Questions)

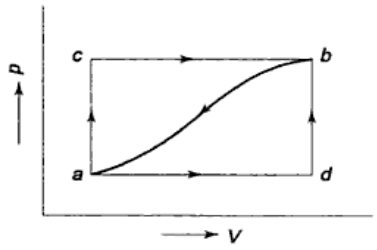
		CO	RBT LEVEL
1.	Illustrate the Zeroth law of Thermodynamics.	**1**	**2**
2.	Differentiate an open and closed system.	**1**	**2**
3.	Differentiate between a reversible and irreversible process.	**1**	**2**
4.	How will you find out the enthalpy of a system?	**1**	**2**
1			
5.	Define Kelvin-Planck statement.	**2**	**2**
6.	Derive the mathematical expression for the thermal efficiency of a heat engine.	**2**	**2**
7.	Differentiate between a heat pump and a refrigerator.	**2**	**2**
8.	What are the assumptions made for a Carnot cycle?	**2**	**2**
9.	Show the triple point in a p-T diagram.	**3**	**2**

10.	Give the mathematical expression for dryness fraction of steam using the basic notations.	**3**	**2**
11.	What are the various methods of improving the Rankine cycle efficiency?	**3**	**2**
12.	Name the advantages of regenerative cycle over normal Rankine cycle.	**3**	**2**
13.	Give the mathematical expression for the air standard efficiency for Otto cycle.	**4**	**2**
14.	Name the various processes taking place in a gas turbine working on Joule cycle.	**4**	**2**
15.	Define cut off ratio for a diesel cycle showing the parameters in pV diagram.	**4**	**2**
16.	Differentiate between indicated and brake thermal efficiency.	**4**	**2**
17.	Enumerate the different methods of refrigeration.	**5**	**2**
18.	Represent the vapor compression type of refrigeration in p-H chart.	**5**	**2**
19.	How does the thermostatic expansion valve play an important role in the refrigeration system?	**5**	**2**
20.	What do you understand by the term “Coefficient of performance”?	**5**	**2**

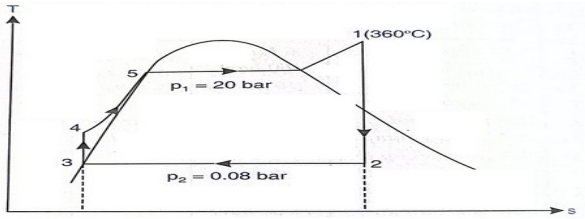
PART- B (5 x 10 = 50 Marks)

		Marks	CO	RBT LEVEL
21. (a)	Derive an expression for mass balance and energy balance in a simple steady flow process.	**(10)**	**1**	**3**
	(OR)			
(b)	When a system is taken from state *a* to state *b* shown in fig along path *acb*, 84kJ of heat flow into the system, and the system does 32kJ of work. (i) How much does the heat flow into the system along path *adb* if the work done is 10.5kJ? (ii)When the system is returned from *b* to *a* along the curved path, the work done on the system is 21kJ. Does the system absorb or liberate heat	**(10)**	**1**	**3**

and how much of the heat is absorbed or liberated? (iii) If $U_a=0$ and U_d = 42kJ, find the heat absorbed in the processes *ad* and *db*.



22. (a)	A reversible Heat Engine operates between two reservoirs at temperatures of 600 ºC and 40 ºC. The Engine drives a reversible Refrigerator which operates between reservoirs of 40 ºC and -20 ºC. Heat transfer to the Engine is 2000 kJ and the net Work output of the combined Engine is 360 kJ. Evaluate the Heat transfer to the refrigerant and the net Heat Transfer to the reservoir at 40 ºC.	**(10)**	**2**	**3**
	(OR)			
(b)	With the help of a neat sketch explain the various processes in a Carnot cycle. Discuss in detail why the Carnot cycle cannot be performed in practice.	**(10)**	**2**	**3**
23. (a)	In a steam turbine at 20 bar, 360 ºC is expanded to 0.08bar. It then enters a condenser, where it is considered to saturated liquid water. The pump feeds back the water into boiler. Assume ideal processes, find per kg of steam that the neat work and cycle efficiency.	**(10)**	**3**	**3**



	(OR)			
(b)	Discuss in detail with appropriate diagram of regenerative cycle and reheat cycle.	**(10)**	**3**	**3**
24. (a)	Derive the expression for the work done, efficiency and mean effective pressure of an Otto cycle using usual notations.	**(10)**	**4**	**3**
	(OR)			

(b)	With a neat diagram explain the Brayton cycle. Show the cycle on pV and Ts diagrams with usual notations.	**(10)**	**4**	**3**

25. (a)	**(i)**	Sketch and describe a vapor compression refrigeration system showing the important components.	**(7)**	**5**	**3**
	(ii)	List out the desirable properties of marine refrigerants.	**(3)**	**5**	**3**

(OR)

(b)		Explain the following with respect to refrigeration system: (i) ODP (ii) GWP (iii) refrigeration capacity (iv) CoP	**(10)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)

(Q.No.26 is compulsory)

		Marks	CO	RBT LEVEL
26.	With the help of a neat sketch explain the Otto cycle, Diesel cycle, dual cycle and suggest which cycle would provide more efficiency by comparing it with each other.	**(10)**	**4**	**3**

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