BT MRE-II(R/S)-06-23-2323 Reg. No. | | | | | | | | |

A

B.Tech. Degree II Semester Regular/Supplementary Examination in Marine Engineering June 2023

19-208-0202 APPLIED THERMODYNAMICS

(*2019 Scheme*)

Time: 3 Hours Maximum Marks: 60

Course Outcome

On successful completion of the course, the students will be able to:

CO1: Understand basics of thermodynamics and find the work done and heat transferred in different thermodynamic process.
CO2: Understand the different types of boilers and vapour power cycles and calculate their efficiencies.
CO3: Gain knowledge on the working of steam nozzles and steam turbines and calculate the work output.
CO4: Identify the different ideal gas cycles used in IC engines and calculate their efficiencies.
CO5: Calculate the properties of gas mixtures as applied to air conditioning.

Bloom's Taxonomy Levels (BL): L1 – Remember, L2 – Understand, L3 – Apply, L4 –Analyze, L5 – Evaluate, L6 – Create

PI – Programme Indicators

(Answer ***ALL*** questions) (5 × 15 = 75)

			Marks	BL	CO	PI
I.	(a)	State and explain Kelving Plank and Clausius statement of second law of thermodynamics with suitable examples. Derive the expression for efficiency of heat engine and COP of refrigerator.	10	L2	1	1.4.1
	(b)	Determine whether the following cases represents the reversible, irreversible or impossible heat engine (i) 900 KW heat rejected (ii) 560 KW heat rejected (iii) 108 KW heat rejected In each case engine is supplied with 1120 KJ/S of heat. The source and sink temperature are maintained at 560 K and 280 K respectively.	5	L3	1	1.4.1
		OR				
II.	(a)	Define and explain entropy. Differentiate between entropy, enthalpy, internal energy and the relation between them.	10	L2	1	1.4.1
	(b)	The temperature in a domestic refrigerator is to be maintained at –10°C. The ambient air temperature is 30°C. If the heat leaving through the refrigerator is 3 KW, determine the least power required to pump out this heat continuously.	5	L3	1	1.4.1
III.	(a)	Explain classification of Boilers.	5	L1	2	1.4.1
	(b)	What are the differences between boiler mountings and accessories? Draw one boiler accessory and one mounting and explain its working its working.	10	L2	2	1.4.1
		OR				
IV.	(a)	Explain the formation of steam from –10C ice to superheated steam at 1 atmospheric pressure with the help of a diagram.	5	L1	2	1.4.1
	(b)	Steam at 10 Mpa and degree of superheat of 89°C is supplied to a Rankine cycle. The condenser pressure is 10 Kpa. For mass flow rate of 2 kg/s, determine the power output and efficiency.	10	L2	2	1.4.1

(P.T.O.)

			Marks	BL	CO	PI
V.	(a)	What are steam nozzles? Explain its uses.	5	L2	3	3.1.1
	(b)	What is the expression for critical pressure ratio? What is its significance? What is its value for dry and superheated steam?	5	L2	3	3.1.1
	(c)	Derive an expression for exit velocity of steam flow through nozzle in terms of enthalpy drop.	5	L2	3	3.1.1
		OR				
VI.	(a)	Explain the differences between impulse turbine and reaction turbine.	5	L2	3	3.2.1
	(b)	In a De Lavel turbine, steam issues from the nozzle with a velocity of 1200 m/sec. The nozzle angle is 20° and the blade velocity is 400 m/sec. The inlet and outlet angles of the blades are equal. Calculate the blade angles, relative velocity of steam entering blades, power developed by the turbine and blade efficiency for steam flow rate of 1200 kg/hour. Also calculate the axial thrust on bearings. Take blade velocity coefficient as 0.8.	10	L2	3	3.2.1
VII.	(a)	Compare the advantages and disadvantages of Otto cycle, Diesel cycle.	5	L2	4	3.1.1
	(b)	In an air standard Otto cycle, the pressure at the beginning and end of compression are 1 bar and 15 bar respectively. The maximum pressure is 30 bar. Determine (i) compression ratio (ii) Thermal efficiency.	10	L2	4	3.1.1
		OR				
VIII.	(a)	What is meant by compression ratio in an air standard cycle? For the same compression ratio Otto cycle or Diesel cycle which is more efficient and why?	6	L2	4	3.2.1
	(b)	In an air standard Otto cycle the condition of air at the beginning of compression is 1 bar 300 K. The temperature at the beginning and end of burning are 400°C and 1000°C respectively. Determine the compression ratio and the thermal efficiency.	9	L2	4	3.2.1
IX.	(a)	What are the laws governing properties of gas mixtures?	7	L2	5	4.1.1
	(b)	Determine the apparent molecular weight of dry air, which is a gas mixture consisting of nitrogen, oxygen and small amounts of Argon. Air contains Nitrogen 78%, Oxygen 21% and Argon 1%.	8	L2	5	4.1.1
		OR				
X.	(a)	What is a psychometric chart? Draw a typical chart and show the parameters.	7	L2	5	4.1.1
	(b)	Explain the principle of cooling towers.	4	L2	5	4.1.1
	(c)	What is air leakage problem in surface condenser?	4	L2	5	4.1.1

Bloom's Taxonomy Levels
L1 = 7%, L2 = 86%, L3 = 7.

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