



Department of Marine Engineering		LP: MR22201
B.E/B.Tech/M.E/M.Tech : Marine Engineering		Rev. No: 00
PG Specialisation : NA	Regulation: 2022	Date: 27.03.22
Sub. Code / Sub. Name : MR22201 Thermal Engineering for Marine Engineers		
Unit : I		

Basic concepts and First law of Thermodynamics

Thermodynamic concepts – concepts of continuum, Thermodynamic properties, equilibrium processes, Thermodynamic cycle, work, heat, temperature and Zeroth law of Thermodynamics. First law of Thermodynamics– applications to closed and open systems, internal energy, specific heats, enthalpy – applications to steady flow devices in Marine Engineering. simple problems

Objective: At the end of this Topic, Students should be able to apply the first law of Thermodynamics to Engineering applications

Session No *	Topics to be covered	Ref	Teaching Aids
1.	Thermodynamic concepts – concepts of continuum,	Ch.1-1.3	PPT/BB
2.	Thermodynamic properties, equilibrium processes	Ch.4-4.1	PPT/BB
3.	Thermodynamic cycle, work, heat, temperature	Ch.5-5.1	PPT/BB
4.	Zeroth law of thermodynamics..	Ch.9-9.1	PPT/BB
5.	First law of thermodynamics – applications to closed and open systems..	Ch.10-10.1	PPT/BB
6.	Internal energy, specific heats, enthalpy	Ch.6-6.1	PPT/BB
7.	Internal energy, specific heats, enthalpy	Ch.6-6.1	PPT/BB
8.	Applications to steady flow devices in Marine Engineering	Ch.12-12.1	PPT/BB
9.	Applications to steady flow devices in Marine Engineering	Ch.12-12.1	PPT/BB

Content beyond syllabus covered (if any):



Sub. Code / Sub. Name: MR22201 Thermal Engineering for Marine Engineers

Unit : II

Second law of Thermodynamics

Thermodynamic systems – Second law of thermodynamics, Statements, T-s diagrams, Reversibility, causes of irreversibility, Carnot theorem, Carnot cycle, reversed Carnot cycle, difference between heat engine, refrigerator, and heat pump, Applications to Marine Engineering. Clausius inequality, entropy, available energy. Simple problems

Objective: At the end of this Topic, Students will be able to to analyze heat engine, heat pump and refrigerator using the second law of thermodynamics

Session No *	Topics to be covered	Ref	Teaching Aids
10.	Thermodynamic systems	Ch.14-14.1	PPT/BB
11.	Second law of thermodynamics, Statements	Ch.14-14.1	PPT/BB
12.	T-s diagrams, Reversibility, causes of irreversibility	Ch.14-14.12	PPT/BB
13.	T-s diagrams, Reversibility, causes of irreversibility	Ch.14-14.12	PPT/BB
14.	Carnot theorem, Carnot cycle, reversed Carnot cycle,	Ch.14-14.10	PPT/BB
15.	Carnot theorem, Carnot cycle, reversed Carnot cycle,	Ch.14-14.10	PPT/BB
16.	difference between heat engine, refrigerator, and heat pump, Applications	Ch.14-14.3	PPT/BB
17.	Clausius inequality, entropy, available energy. Simple problems	Ch.15-15.8	PPT/BB
18.	Clausius inequality, entropy, available energy. Simple problems	Ch.18-18.3	PPT/BB
Content beyond syllabus covered (if any):			



Code / Sub. Name: MR22201 Thermal Engineering for Marine Engineers

Steam formation and Rankine cycle

Thermodynamic properties of pure substances, property diagram, PVT surface of water, calculation of properties. Introduction – Rankine cycle, Analysis of Rankine cycle, Rankine efficiency, Methods of improving Rankine efficiency, Reheat cycle, Regenerative cycle, applications to marine steam turbine plant. Simple problems.

Objective: At the end of this Topic, Students should be able to understand steam formation, properties of steam and apply it to the Rankine cycle.

Session No. *	Topics to be covered	Ref	Teaching Aids
19.	Thermodynamic properties of pure substances	Ch.21-21.1	PPT/BB
20.	Property diagram, PVT surface of water, calculation of properties	Ch.21-21.8	PPT/BB
21.	Property diagram, PVT surface of water, calculation of properties	Ch.21-21.8	PPT/BB
22.	Introduction – Rankine cycle, Analysis of Rankine cycle, Rankine efficiency,	Ch.22-22.3	PPT/BB
23.	Introduction – Rankine cycle, Analysis of Rankine cycle, Rankine efficiency,	Ch.22-22.9	PPT/BB
24.	Methods of improving Rankine efficiency, Reheat cycle,	Ch.22-22.15	PPT/BB
25.	Methods of improving Rankine efficiency, Reheat cycle,	Ch.22-22.17	PPT/BB
26.	Regenerative cycle, Applications, Simple problems.	Ch.22-22.44	PPT/BB
27.	Regenerative cycle, Simple problems.	Ch.22-22.44	PPT/BB

Content beyond syllabus covered (if any):



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Unit : IV

Air Standard Cycles

Properties of ideal gases, gas laws. Air standard cycles for Marine Engines – Elementary principles and cycles of operation – Otto cycle, Diesel cycle, Dual cycle – Work done, power developed – Indicated and brake thermal efficiency, mechanical efficiency, overall efficiency - Gas turbine cycle – Brayton /Joule cycle, Simple problems.

Objective: At the end of this topic, Students should be able To understand air standard cycles and analyze them.

Session No *	Topics to be covered	Ref	Teaching Aids
28.	Properties of ideal gases, gas laws.	Ch.23-23.1	PPT/BB
29.	Air standard cycles for Marine Engines	Ch-9-9.3	PPT/BB
30.	Elementary principles and cycles of operation – Otto cycle– Work done, power developed	Ch.9-9.5	PPT/BB
31.	Elementary principles and cycles of operation –Diesel cycle – Work done, power developed	Ch.9-9.6	PPT/BB
32.	Elementary principles and cycles of operation –Dual cycle – Work done, power developed	Ch.9-9.6	PPT/BB
33.	Indicated and brake thermal efficiency	Ch.9-9.5	PPT/BB
34.	Mechanical efficiency, overall efficiency	Ch.9-9.5	PPT/BB
35.	Gas turbine cycle – Brayton cycle, Simple problems.	Ch.9-9.8	PPT/BB
36.	Gas turbine cycle – Joule cycle, Simple problems.	Ch.9-9.11	PPT/BB
Content beyond syllabus covered (if any):			



Code / Sub. Name: MR22201 Thermal Engineering for Marine Engineers

Refrigeration

Vapour compression cycle -components and principle of operation, refrigerating effect, Co-efficient of Performance, Methods of improving C.O.P. Vapour absorption Refrigeration – Components and principle of operation, Marine Refrigerants and their desirable properties, ODP, GWP, use of Refrigerant tables and charts – Simple Problems.

Objective: At the end of this Topic, Students will have acquired Knowledge on Thermodynamic Relations and Combustion of fuels.

Session No.	Topics to be covered	Ref	Teaching Aids
37.	Vapour compression cycle -components and principle of operation	Ch.27-27.5	PPT/BB
38.	Refrigerating effect, Co-efficient of Performance	Ch.27-27.3	PPT/BB
39.	Methods of improving C.O.P.	Ch.27-27.20	PPT/BB
40.	Vapour absorption Refrigeration – Components and principle of operation	Ch.27-27.15	PPT/BB
41.	Marine Refrigerants and their desirable properties	Ch.27-27.12	PPT/BB
42.	ODP, GWP, use of Refrigerant tables and charts	Ch.15-15.2	PPT/BB
43.	Simple Problems	Ch.15-15.3	PPT/BB
44.	Simple Problems	Ch.15-15.4	PPT/BB
45.	Simple Problems	Ch.15-15.4	PPT/BB

Content beyond syllabus covered (if any):

* Session duration: 50 mins



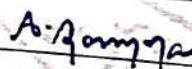

Sub Code / Sub Name: MR22201-Thermal Engineering for Marine Engineers

TEXT BOOKS:

1. Cengel. Y and M.Boles, "Thermodynamics - An Engineering Approach", 8th Edition, TataMcGraw Hill, 2016.
2. Natarajan E., "Engineering Thermodynamics: Fundamentals and Applications", 2nd Edition, Anuragam Publications, 2014.
3. Rathakrishnan. E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice-Hall of India Pvt. Ltd, 2015.

REFERENCES:

1. William Embleton OBE., "REEDS Applied Heat for Engineers", Thomas Reed Publication, 4th Edition, Reprint 2011.
2. K.K. Ramalingam, "Engineering Thermodynamics", 1st Edition, Scitech Publications (India) Pvt. Ltd., 2009
3. R.K. Rajput, "Thermal Engineering", 9th Edition, Laxmi Publications, 2014

	Prepared by	Approved by
Signature		
Name	Dr.A.Sankaran	S.Krishnan
Designation	Assistant Professor	Professor & HOD
Date	27.03.23	27.03.23
Remarks *:		

* If the same lesson plan is followed in the subsequent semester/year it should be mentioned and signed by the Faculty and the HOD