SRI VENKATESWARA COLLEGE OF ENGINEERING

COURSE DELIVERY PLAN - THEORY

Department of Automobile Engineering		
B.E/~~B.Tech/M.E/M.Tech~~ : **Automobile Engineering**	Regulation: **R2022**	LP: AE22301
PG Specialisation : **NA**		Rev. No: 00
Sub. Code / Sub. Name : **AE22301 Basic and Applied Thermodynamics**		Date: 25.07.2023
Unit : I		

Unit Syllabus: BASIC CONCEPTS AND FIRST LAW

Basic concepts - concept of continuum, comparison of microscopic and macroscopic approach. Path and point functions. Intensive and extensive properties, total and specific quantities. System and their types. Thermodynamic Equilibrium State, path and process. Quasi-static, reversible and irreversible processes. Heat and work transfer, definition and comparison, sign convention. Displacement work and other modes of work. Zeroth law of thermodynamics. First law of thermodynamics - application to non-flow and steady flow systems. Unsteady flow processes (Descriptive only).

Objective: To understand basic concepts, Zeorth and First laws of Thermodynamics and applications.

Session No*	Topics to be covered	Ref	Teaching Aids
1	Introduction, continuum principle, microscopic and macroscopic approaches.	1-12	PPT
2	Path and Point functions, Thermodynamic properties.	1, 3, 4	PPT, BB
3	Thermodynamic systems and Equilibrium, State, Process, Path, Cycle, Quasi-static process.	1, 3, 4	PPT, BB
4	Heat and work transfer, Different modes of work, sign convention.	1, 3, 4	PPT, BB
5	Zeroth law and application, Design of Glass Thermometer using Zeroth Law concept, First Law for process and cycle.	1, 3, 4	PPT, BB
6	Application of I law for non-flow processes.	1, 3, 4	PPT, BB
7	Tutorial - Problems on Non-flow processes.	1, 3, 4	PPT, BB
8	Tutorial - Problems on Non-flow processes.	1, 3, 4	PPT, BB
9	Application of First Law for flow processes, SFEE.	1, 3, 4	PPT, BB
10	Problems on Non-flow processes.	1, 3, 4	PPT, BB
11	Tutorial - Problems on Non-flow processes.	1, 3, 4	PPT, BB
12	Problems on Non-flow processes , Unsteady flow processes.	1, 3, 4	PPT, BB
Content beyond syllabus covered (if any): Design of Glass Thermometer using Zeroth Law concept.			

* Session duration: 50 minutes

Sub. Code / Sub. Name: **AE22301 Basic and Applied Thermodynamics**

Unit : **II**

Unit Syllabus : SECOND LAW AND AVAILABILITY ANALYSIS

Heat reservoirs - source and sink. Heat Engine, Refrigerator, Heat pump. Statements of second law and its corollaries. Carnot and reversed Carnot cycles. Concept of entropy, T-s diagram, Entropy change for ideal gases - different processes. Available and unavailable energy. Exergy and Irreversibility (Descriptive Only). I and II law Efficiency.

Objective: To understand the Second Law of thermodynamics, Carnot cycle and entropy, and to impart knowledge in available energy and irreversibility.

Session No*	Topics to be covered	Ref	Teaching Aids
13	Limitations to I law of Thermodynamics, Heat reservoirs, Heat engine.	1,2, 3, 5	PPT, BB
14	Reversed heat engines - Heat pump and Refrigerator. Kelvin and Clausius statements.	1,2, 3, 5	PPT, BB
15	Efficiency of heat engine and COP of reversed heat engines, Carnot cycle.	1,2, 3, 5	PPT, BB
16	Reversed Carnot cycle, Entropy, derivation of expressions change of entropy during non-flow processes.	1,2, 3, 5	PPT, BB
17	Tutorial - Problems on Carnot cycle and heat engines.	1,2, 3, 5	PPT, BB
18	Tutorial - Problems on combination of Heat and Reversed heat engines.	1,2, 3, 5	PPT, BB
19	Problems on entropy change.	1,2, 3, 5	PPT, BB
20	Available and Unavailable energies.	1,2, 3, 5	PPT, BB
21	Exergy and Irreversibility.	1,2, 3, 5	PPT, BB
22	Problems on Availability.	1,2, 3, 5	PPT, BB
23	I and II law efficiencies, III Law of Thermodynamics.	1,2, 3, 5	PPT, BB
24	Tutorial - Problems on I and II law efficiencies.	1,2, 3, 5	PPT, BB
Content beyond syllabus covered (if any): III Law of Thermodynamics			

* Session duration: 50 mins

Sub. Code / Sub. Name: **AE22301 Basic and Applied Thermodynamics**

Unit : **III**

Unit Syllabus : GAS MIXTURES AND THERMODYNAMIC RELATIONS

Ideal and real gas - properties and comparison - Equations of state for ideal and real gases - Reduced properties - Compressibility factor - Simple Calculations using Generalised Compressibility Chart. Properties of gas mixture - Molar mass, gas constant, density, change in internal energy, enthalpy, entropy. Maxwell relations, T ds Equations, Difference and ratio of heat capacities, Energy equation, Joule-Thomson Coefficient, Clausius Clapeyron equation.

Objective: To impart knowledge in gas mixtures and Thermodynamic Relations.

Session No*	Topics to be covered	Ref	Teaching Aids
25	Introduction to real and ideal gases, assumptions.	1,2, 3, 5	PPT, BB
26	Equation of state, Reduced Properties.	1,2, 3, 5	PPT, BB
27	Compressibility factor and chart and use.	1,2, 3, 5	PPT, BB
28	Tutorial - Problems using compressibility chart.	1,2, 3, 5	PPT, BB
29	Gas mixtures, Molar mass, gas constant, density, change in internal energy, enthalpy, entropy.	1,2, 3, 5	PPT, BB
30	Tutorial - Problems on Gas mixtures.	1,2, 3, 5	PPT, BB
31	Maxwell equations.	1,2, 3, 5	PPT, BB
32	T ds equations.	1,2, 3, 5	PPT, BB
33	Tutorial - Obtaining expressions for Difference and ratio of heat capacities, Energy equation.	1,2, 3, 5	PPT, BB
34	Joule-Thomson Coefficient	1,2, 3, 5	PPT, BB
35	Clausius Clapeyron equation	1,2, 3, 5	PPT, BB
36	Revision.	1,2, 3, 5	PPT, BB
Content beyond syllabus covered (if any):			

* Session duration: 50 mins

Sub. Code / Sub. Name: **AE22301 Basic and Applied Thermodynamics**

Unit : **IV**

Unit Syllabus : STEAM, STEAM NOZZLES AND STEAM POWER CYCLE

Formation of steam and thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of Steam Table and Mollier Chart. Determination of dryness fraction. Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow. Ideal and actual Rankine cycles, Reheat and Regenerative cycles. Binary and Combined cycles (Description Only).

Objective: To understand the steam formation and properties and to analyse various steam power cycles.

Session No*	Topics to be covered	Ref	Teaching Aids
37	Pure substances, Steam generation from ice.	1,2, 3, 5	PPT, BB
38	Thermodynamic properties of steam.	1,2, 3, 5	PPT, BB
39	p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface.	1,2, 3, 5	PPT, BB
40	Use of Steam Table and Mollier Chart to find the properties of different types of steam.	1,2, 3, 5	PPT, BB
41	Tutorial - Problems on Steam properties.	1,2, 3, 5	PPT, BB
42	Steam nozzles, types, flow through steam nozzles.	1,2, 3, 5	PPT, BB
43	Effect of friction, critical pressure ratio, supersaturated flow though nozzle.	1,2, 3, 5	PPT, BB
44	Tutorial - Problems on flow through steam nozzles.	1,2, 3, 5	PPT, BB
45	Tutorial - Problems on flow through steam nozzles.	1,2, 3, 5	PPT, BB
46	Ideal and actual Rankine cycles, Reheat and Regenerative cycles. Binary and Combined cycles.	1,2, 3, 5	PPT, BB
47	Tutorial - Problems on steam power cycles.	1,2, 3, 5	PPT, BB
48	Binary and Combined cycles, Modern Steam power plant.	1,2, 3, 5	PPT, BB
Content beyond syllabus covered (if any): Modern Steam power plant.			

* Session duration: 50 mins

Sub. Code / Sub. Name: **AE22301 Basic and Applied Thermodynamics**
Unit : **V**

Unit Syllabus : REFRIGERATION AND REFRIGERATION CYCLES

Fundamentals of refrigeration, C.O.P., simple vapour compression refrigeration system, T-s, p-h diagrams, simple problems. Simple vapour absorption refrigeration system (Description Only), desirable properties of an ideal refrigerant.

Objective: To impart knowledge in refrigeration fundamentals and working of VCR and VAR systems.

Session No*	Topics to be covered	Ref	Teaching Aids
49	Introduction to refrigeration, capacity, COP.	1,2, 3, 5	PPT, BB
50	Simple vapour compression refrigeration system.	1,2, 3, 5	PPT, BB
51	Vapour compression refrigeration system with superheating and sub-cooling.	1,2, 3, 5	PPT, BB
52	Effect of superheating and sub-cooling on COP, Refrigeration effect and work of compression.	1,2, 3, 5	PPT, BB
53	Tutorial - Problems on VCR.	1,2, 3, 5	PPT, BB
54	Tutorial - Problems on VCR.	1,2, 3, 5	PPT, BB
55	Tutorial - Problems on VCR.	1,2, 3, 5	PPT, BB
56	Simple vapour absorption refrigeration system.	1,2, 3, 5	PPT, BB
57	Desirable properties of an ideal refrigerant.	1,2, 3, 5	PPT, BB
58	Refrigerants used in modern refrigerators and air conditioners.	1,2, 3, 5	PPT, BB
59	Revision	1-12	PPT, BB
60	Revision	1-12	PPT, BB

Content beyond syllabus covered (if any): Refrigerants used in modern refrigerators and air conditioners.

* Session duration: 50 mins

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REFERENCES:

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3. Rajput. R.K., "Thermal Engineering", Laxmi Publications, Tenth Edition, 2017.
4. Cengel. Y and M. Boles, "Thermodynamics - An Engineering Approach", 8th Edition, Tata McGraw Hill, 2014.
5. Holman.J.P., "Thermodynamics", 3rd Edition, McGraw-Hill, 1995.
6. Rathakrishnan. E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice- Hall of India Pvt. Ltd, 2006.
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8. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
9. Van Wylen and Sonntag, "Classical Thermodynamics", Wiley Eastern, 1987.
10. Venkatesh. A, "Basic Engineering Thermodynamics", Universities Press (India) Limited, 2007.
11. Kau-Fui Vincent Wong, "Thermodynamics for Engineers", CRC Press, Indian Reprint, 2010.
12. Prasanna Kumar: "Engineering Thermodynamics" Pearson Education, 2013.

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Designation	PROFESSOR	HoD/AUT
Date	25.07.2023	25.07.2023
Remarks *:		
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