SRI VENKATESWARA COLLEGE OF ENGINEERING

COURSE DELIVERY PLAN - THEORY

Department of Automobile Engineering	LP: **AE22403**
B.E/~~B.Tech~~/M.E/~~M.Tech~~ : Automobile Engineering Regulation: 2022	Rev. No: 00
PG Specialisation : NA	Date: 22.01.2024
Sub. Code / Sub. Name : **AE22403 THERMAL ENGINEERING AND HEAT TRANSFER**	
Unit : I	

Unit Syllabus: **UNIT I GAS POWER CYCLES AND AIR COMPRESSORS**

Air standard cycles: Otto, Diesel, Dual - Work output, Efficiency and MEP calculations. Comparison of the cycles for same compression ratio and heat addition, same compression ratio and heat rejection, same peak pressure, peak temperature and heat rejection, same peak pressure and heat input, same peak pressure and work output, Simple Brayton cycle.
Single acting and double acting air compressors, work required, effect of clearance volume, volumetric efficiency, isothermal efficiency, free air delivery. Rotary compressors (Descriptive only).

Objective: To know the application of thermodynamics and its use in analysis of gas power cycles

Session No *	Topics to be covered	Ref	Teaching Aids
1	Introduction	1 to 8	PPT, BB
2	Assumptions in Air Standard cycles. Otto Cycle - analysis, efficiency & Mean Effective Pressure.	3, 8	PPT, BB
3	Tutorial - Problems on Otto cycle	3, 8	PPT, BB
4	Diesel Cycle - analysis, efficiency & Mean Effective Pressure.	3, 8	PPT, BB
5	Dual Cycle - analysis, efficiency & Mean Effective Pressure, Brayton cycle.	3, 8	PPT, BB
6	Tutorial - Problems on Diesel and Dual cycles	3, 8	PPT, BB
7	Problems on Diesel and Dual cycles	3, 8	PPT, BB
8	Comparison of various cycles, Simple problems on Brayton cycle.	3, 8	PPT, BB
9	Air Compressors - reciprocating and rotary - working principles	3, 8	PPT, BB
10	Analysis of single and double acting Air Compressors, Work, Volumetric and Isothermal efficiencies, FAD.	3, 8	PPT, BB
11	Tutorial - Problems on Reciprocating Air Compressors	3, 8	PPT, BB
12	Problems on Reciprocating Air Compressors	3, 8	PPT, BB

Content beyond syllabus covered (if any):

- Modern automotive air compressors

* Session duration: 50 minutes

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Unit : II

Unit Syllabus : **UNIT II PSYCHROMETRY AND AIR CONDITIONING**

Psychrometric properties and chart. Property calculations of air vapour mixtures by using chart and expressions. Psychrometric processes - adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing. Air conditioning system - Processes, Types and Working Principles - Concept of RSHF, GSHF, ESHF - Cooling load estimation (Descriptive only).

Objective: To understand different types of air compressors and estimate the power required to run the compressor.

Session No *	Topics to be covered	Ref	Teaching Aids
13	Introduction to Psychrometry, property of moist air.	3, 8	PPT, BB
14	Psychrometry chart, Psychrometric processes -adiabatic saturation, sensible heating and cooling.	3, 8	PPT, BB
15	Psychrometric processes - humidification, dehumidification, evaporative cooling and adiabatic mixing.	3, 8	PPT, BB
16	Tutorial - Problems on Property	3, 8	PPT, BB
17	Problems on Processes	3, 8	PPT, BB
18	Tutorial - Problems on Processes using Psychrometric Chart	3, 8	PPT, BB
19	Air Conditioning system - summer, winter and year-round.	3, 7, 8	PPT, BB
20	SHF, RSHF, GSHF, ESHF	3, 7, 8	PPT, BB
21	Problems on SHF, RSHF, GSHF, ESHF	3, 7, 8	PPT, BB
22	Problems on Air Conditioning	3, 7, 8	PPT, BB
23	Tutorial - Problems on Air Conditioning	3, 7, 8	PPT, BB
24	Cooling load estimation	3, 7, 8	PPT, BB

Content beyond syllabus covered (if any):

- Application of Psychrometry in automotive applications

* Session duration: 50 mins

Sub. Code / Sub. Name: AE22403 THERMAL ENGINEERING AND HEAT TRANSFER

Unit : III

Unit Syllabus : **UNIT III CONDUCTION**

Basic concepts of engine simulation - Governing equations, Classification of engine models Thermodynamic models for Intake and exhaust flow process - Quasi steady flow - Filling and emptying - Gas dynamic Models. Thermodynamic based in cylinder models for SI engine and CI engines.

Session No *	Topics to be covered	Ref	Teaching Aids
25	Introduction to Heat Transfer- Basic concept	2, 5	PPT, BB
26	Mechanism of Heat Transfer - Conduction, Convection and Radiation	2, 5	PPT, BB
27	General Differential equation of Heat Conduction – Fourier Law of Conduction	2, 5	PPT, BB
28	Conduction- Cartesian Coordinates	2, 5	PPT, BB
29	One Dimensional Steady State Heat Conduction – Conduction through Plane Wall- Problems	2, 5	PPT, BB
30	Cylinders and Spherical systems, Composite Systems. Conduction with Internal Heat Generation.	2, 5	PPT, BB
31	Tutorial - Problems on Conduction - Simple and Composite.	2, 5	PPT, BB
32	Problems on Conduction with Heat Generation	2, 5	PPT, BB
33	Extended Surfaces and Unsteady Heat Conduction -Lumped Analysis	2, 5	PPT, BB
34	Tutorial - Problems on Extended Surfaces and Lumped Analysis.	2, 5	PPT, BB
35	Tutorial - Problems on Extended Surfaces and Lumped Analysis.	2, 5	PPT, BB
36	Use of Heislers Chart	2, 5	PPT, BB

Content beyond syllabus covered (if any): NIL

* Session duration: 50 mins

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Unit : IV

Unit Syllabus : **UNIT IV CONVECTION**

Basic Concepts, Convective Heat Transfer Coefficients, Boundary Layer Concept. Forced Convection: Flow over Plates, Cylinders and Spheres and Bank of tubes. Laminar and Turbulent Flow through tubes. Free Convection: Flow over Vertical Plate.

Objective: To understand various modes of heat transfer and the estimation of rate of heat transfer.

Session No *	Topics to be covered	Ref	Teaching Aids
37	Convection heat transfer- Basic Concepts	2, 5	PPT, BB
38	Convective Heat Transfer Coefficients – Boundary Layer Concept	2, 5	PPT, BB
39	Forced Convection - Flow over Plates, Cylinders and Spheres	2, 5	PPT, BB
40	Forced Convection – Flow over Bank of tubes	2, 5	PPT, BB
41	Problems on Forced Convection	2, 5	PPT, BB
42	Tutorial - Problems on Forced Convection	2, 5	PPT, BB
43	Problems on Flow over Bank of tubes	2, 5	PPT, BB
44	Internal Flow – Laminar and Turbulent Flow- Combined Laminar and Turbulent	2, 5	PPT, BB
45	Tutorial - Problems on Internal Flow	2, 5	PPT, BB
46	Free Convection - Flow over Vertical Plate	2, 5	PPT, BB
47	Problems on Free Convection	2, 5	PPT, BB
48	Tutorial - Problems on Free Convection	2, 5	PPT, BB

Content beyond syllabus covered (if any): NIL

* Session duration: 50 mins

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Unit : V

Unit Syllabus : **UNIT V RADIATION AND HEAT EXCHANGERS**

Basic Concepts, Laws of Radiation: Stefan Boltzman Law, Kirchoff Law. Black Body Radiation, Grey body radiation, Shape Factor, Electrical Analogy, Radiation Shields, Introduction to Gas Radiation. Heat Exchangers: Parallel, Counter and Cross flow, LMTD, simple problems. Heat exchangers in automotive applications. Introduction to NTU concept.

Objective: To gain the knowledge about basic types of heat exchangers and their applications in automobiles.

Session No *	Topics to be covered	Ref	Teaching Aids
49	Radiation heat transfer- Basic Concepts	2, 5	PPT, BB
50	Laws of Radiation – Stefan Boltzman Law, Kirchoff Law-Problems	2, 5	PPT, BB
51	Black Body Radiation, Grey body radiation, Shape Factor, Electrical Analogy	2, 5	PPT, BB
52	Problems on Black and Grey Body Radiation	2, 5	PPT, BB
53	Radiation between two surfaces, Radiation Shields	2, 5	PPT, BB
54	Tutorial - Problems on Radiation Shields	2, 5	PPT, BB
55	Introduction to Gas Radiation. Introduction to Heat Exchangers.	2, 5	PPT, BB
56	LMTD - Parallel, Counter and Cross-flow heat exchangers.	2, 5	PPT, BB
57	Problems on Hear Exchangers	2, 5	PPT, BB
58	Tutorial - Problems on Heat Exchangers	2, 5	PPT, BB
59	Tutorial - Problems on Heat Exchangers	2, 5	PPT, BB
60	Heat Exchanger in automotive applications , Introduction to NTU concept.	2, 5	PPT, BB

Content beyond syllabus covered (if any):

- Combined mode of Heat Transfer in Automotive applications

* Session duration: 50 mins

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REFERENCES:

1. R.K. Rajput, "Applied Thermodynamics", 2nd edition, Laxmi Publishing (P) Ltd., New Delhi, 2015.
2. J.P. Holman, "Heat Transfer", 10th edition, Tata McGraw Hill, 2009.
3. Kothandaraman. C.P., Domkundwar. S, Domkundwar. A.V., "A course in Thermal Engineering", Fifth Edition, Dhanpat Rai & Sons, 2002.
4. P.K. Nag, "Heat Transfer", 3rd edition, Tata McGraw Hill, New Delhi, 2011.
5. C.P. Kothandaraman, "Fundamentals of Heat and Mass Transfer", 6th edition, New Age International, New Delhi, 2010.
6. P.K. Nag, "Basic and Applied Thermodynamics", 2nd edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2009.
7. Arora. C.P, "Refrigeration and Air Conditioning", Tata McGraw-Hill Publishers, 1994.
8. Rajupt. R.K., "Thermal Engineering", Laxmi Publications, Tenth Edition, 2017.

	Prepared by	Approved by
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Designation	PROFESSOR	HoD/AUT
Date	22.01.2024	22.01.2024
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