

Faculty of Engineering & Technology, SRM University, Kattankulathur – 603203  
 School of Mechanical Engineering

**Department of Mechanical Engineering**  
**Course plan**

Course code : ME1011  
 Course title : Applied Thermal Engineering  
 Semester : 4  
 Academic year / semester : 2014-'15 / Even  
 (JAN – APRIL 2015)

Date : 04 Dec 2014

**Section details:**

Section	Class Room no	Details of Faculty member				Student contact time
		Name	Room No.	Inter com No.	e-mail id	
		Dr.G.Kasiraman	MEC103		<a href="mailto:kasiraman.g@ktr.srmuniv.ac.in">kasiraman.g@ktr.srmuniv.ac.in</a>	Wed 12:45 To 1:30P M
		Mr.V.Rajasekar	MEC103		<a href="mailto:rajasekar.v@ktr.srmuniv.ac.in">rajasekar.v@ktr.srmuniv.ac.in</a>	
		Mr.J.Thavamani	MEC105		<a href="mailto:thavamani.j@ktr.srmuniv.ac.in">thavamani.j@ktr.srmuniv.ac.in</a>	
		Mr.V.Mathan raj	MEB101 B	1832	<a href="mailto:mathanraj.v@ktr.srmuniv.ac.in">mathanraj.v@ktr.srmuniv.ac.in</a>	
		Mr.S.Malar Mannan	MEB201		<a href="mailto:malarmannan.s@ktr.srmuniv.ac.in">malarmannan.s@ktr.srmuniv.ac.in</a>	
		Mr.S.Sundaram	H101/B		<a href="mailto:sundaram.p@ktr.srmuniv.ac.in">sundaram.p@ktr.srmuniv.ac.in</a>	
		Mr.M.Shivasankar	H312/C		<a href="mailto:shivasankar.m@ktr.srmuniv.ac.in">shivasankar.m@ktr.srmuniv.ac.in</a>	
		Mr.M.D.Kathir Kaman	DIRE.B UILDIN G		<a href="mailto:kathirkaman.md@ktr.srmuniv.ac.in">kathirkaman.md@ktr.srmuniv.ac.in</a>	
		Mr.E.Kannan	DIRE.B UILDIN G		<a href="mailto:kannan.e@ktr.srmuniv.ac.in">kannan.e@ktr.srmuniv.ac.in</a>	
		Mr.Shambhoo yadav	DIRE.B UILDIN G		<a href="mailto:shambhooyadav@ktr.srmuniv.ac.in">shambhooyadav@ktr.srmuniv.ac.in</a>	
		Mr.A.Sathishkumar	DIRE.B UILDIN G /5		<a href="mailto:sathishkumar.a@ktr.srmuniv.ac.in">sathishkumar.a@ktr.srmuniv.ac.in</a>	
		Mr.K.V.Sreejith	DIRE.B UILDIN G		<a href="mailto:sreejith.v@ktr.srmuniv.ac.in">sreejith.v@ktr.srmuniv.ac.in</a>	

**Direct assessment details:**

Name of assessment	Marks	Topics (Tentative)	Tentative date	Duration
Cycle test - I	10	Gas Power Cycles & Simple Rankine Cycle	02/02/2015	100 minutes
Surprise test	05	Brayton cycle, Concept of Reheat and Regeneration in Brayton cycle.	10/02/2015	30 – 45 min
Cycle test - II	10	Reheat Rankine cycle, Regenerative rankine cycle, Binary cycle, Air Compressors	08/03/2015	100 minutes
Model exam	20	Entire Syllabus	12/04/2015	3 hours
End semester examination	50	Entire Syllabus		3 hours
Attendance	05	N/A		

		L	T	P	C
<b>ME1011</b>	<b>Applied Thermal Engineering</b>	<b>3</b>	<b>2</b>	<b>0</b>	<b>4</b>
	Prerequisite				
	Nil				
<b>Student outcomes</b>	<b>Program Educational Objectives</b>				
	1. Apply / improve their knowledge in basic sciences for excelling in various disciplines of Mechanical Engineering with the emphasis on Design, Thermal and Manufacturing.	2. Enhance professional practice to meet the global standards with ethical and social responsibility.	3. Solve industrial, social, and environmental problems with modern engineering tools.	4. Develop skills to work in teams, think intellectually and pursue life-long learning.	
(a) an ability to apply knowledge of mathematics, science, and	X		X		

engineering												
(e) an ability to identify, formulate, and solve engineering problems		X						X				
Course designed by		Department of Mechanical Engineering										
1	Student outcome	a	b	c	D	e	f	g	h	i	j	K
		×				×						
2	Category	GENERAL			BASIC SCIENCES			ENGINEERING SCIENCES AND TECHNICAL			PROFESSIONAL SUBJECTS	
											X	
3	Broad area (for professional courses only, i.e 'under P' category)	Manufacturing		Design		Thermal		General				
						X						
4	Course Coordinator	Dr.G.Kasiraman										

## SYLLABUS

### ME1011 –APPLIED THERMAL ENGINEERING

#### PURPOSE

On completion of this course, the students are exposed to understand the concept and working of gas, vapour power cycles, air compressors, refrigeration and air conditioning systems.

#### INSTRUCTIONAL OBJECTIVES

- To study air/vapour cycles with reheat and regeneration
- Performance study of compressors are introduced
- Knowledge of eco-friendly refrigerants, refrigeration and air conditioning systems

#### GAS POWER CYCLES

Air standard cycles - Assumptions - Otto, Diesel, Dual - air standard efficiency - mean effective pressure and power; Brayton cycle - reheat and regeneration. (Elementary treatment only)

#### VAPOUR POWER CYCLES

Rankine cycle - performance - simple, reheat and regenerative cycle - Introduction to Binary vapour cycle (Elementary treatment only)

#### AIR COMPRESSORS

Reciprocating air compressors - types - construction - work of compression without clearance - effect of clearance - multistage - optimum intermediate pressure for perfect intercooling - compressor efficiencies and mean effective pressure.

Rotary compressors - Vane compressor, Roots blower (construction and working only)

#### REFRIGERATION SYSTEMS

Types of refrigeration systems - vapour compression and vapour absorption systems - working principle, refrigerants - properties. Eco friendly refrigerants.

Analysis of vapour compression refrigeration cycle, use of P-h chart, effect of sub cooling and superheating - calculations of COP (ammonia, R134a, R12 and R22 only)

#### PSYCHROMETRY AND AIR CONDITIONING

Properties of atmospheric air - psychrometric chart, psychrometric processes: Sensible heating and cooling, Cooling and dehumidification - Heating and humidification.

Description of summer, winter and year round air conditioning system, description of window and split air conditioning system, Cooling load calculations - simple problems only.

#### TEXT BOOKS

- Rajput, R. K., *Thermal Engineering*, Laxmi Publications, 6th Edition, New Delhi, 2006
- Domkundwar, A., *A Course in Thermal Engineering*, Dhanpat Rai & Co., New Delhi, 2000

#### REFERENCE BOOKS

- Sarkar, B. K., *Thermal Engineering*, 3rd Edition, Tata McGraw Hill, New Delhi, 2006
- Arora, S. C., Domkundwar, C. S., *A course in Refrigeration and Air Conditioning*, 4th Edition, New Age International (p) Ltd., New Delhi, 2002

SRM UNIVERSITY

SCHOOL OF MECHANICAL ENGINEERING

LESSON PLAN

COURSE CODE : **ME 1011**

COURSE TITLE : **APPLIED THERMAL ENGINEERING**

YEAR / SEMESTER : II / IV

COURSE TIME – SEMESTER: EVEN

YEAR 2014-2015

SL No	Date/Hr	No. Of Hours	Title / Details of the chapter	References (Code of the Text / Reference Book)
1	1	1	<b>Unit I</b> Gas power cycles: Introduction, Air standard cycles, assumptions. Otto cycle description	T1 – Chapter 21
2	2	1	Derivation of expression for Otto cycle efficiency. Mean effective pressure, Compression ratio, Power	T1 – Chapter 21
3	3	1	Problems on Otto cycle.	T1 – Chapter 21
4	4	1	Problems on Otto cycle	T1 – Chapter 21
5	5	1	Problems on Otto cycle.	T1 – Chapter 21
6	6	1	Diesel cycle - Efficiency- derivation, mean effective pressure, Compression ratio, cut off ratio, Power	T1 – Chapter 21
7	7	1	Problems on diesel cycle.	T1 – Chapter 21
8	8	1	Problems on diesel cycle	T1 – Chapter 21
9	9	1	Problems on diesel cycle	T1 – Chapter 21
10	10	1	Dual cycle- Efficiency – derivation, mean effective pressure, constant volume pressure ratio, compression ratio, cut off ratio, Power	T1 – Chapter 21
11	11	1	Problems on dual cycle	T1 – Chapter 21
12	12	1	Problems on dual cycle	T1 – Chapter 21
13	13		Problems on dual cycle	T1 – Chapter 21

14	14	1	Components and working of gas turbine power plant, Brayton cycle – efficiency - problems	T1 – Chapter 21
15	15	1	Reheat and regeneration on brayton cycle,	T1 – Chapter 21
16	16	1	<b>Unit II</b> Vapour Power cycles : Steam power plant layout, Components, functions, processes.	T1 – Chapter 15
17	17	1	Rankine cycle, T-S diagram, H-S diagram (Mollier chart), Three conditions of steam at turbine entry – simple saturated, super heated, wet steam.	T1 – Chapter 15
18	18	1	Problems on rankine cycle – wet steam at turbine entry	T1 – Chapter 15
19	19	1	Problems on rankine cycle – dry steam at turbine entry	T1 – Chapter 15
20	20	1	Problems on rankine cycle – super heated steam at turbine entry	T1 – Chapter 15
21	21	1	Problems on rankine cycle – super heated steam at turbine entry,	T1 – Chapter 15
22	22	1	Solving problems using Mollier diagram	T1 – Chapter 15
23	23	1	Reheat rankine cycle – concept with diagrams	T1 – Chapter 15
24	24	1	Problems on reheat rankine cycle	T1 – Chapter 15
25	25	1	Regenerative rankine cycle – concept with diagrams	T1 – Chapter 15
26	26	1	Problems on regenerative rankine cycle.	T1 – Chapter 15
27	27	1	Problems on combined Reheat and regenerative rankine cycle	T1 – Chapter 15
28	28	1	Introduction to binary vapour cycle.	T1 – Chapter 15
29	29	1	Introduction to Combined cycle	T1 – Chapter 15
30	30	1	Discussion of Assignment / Cycle Test I	T1 – Chapter 15
31	31	1	<b>Unit III</b> Air Compressors: Types of compressors - Reciprocating air compressor – construction and working	T1 – Chapter 24

32	32	1	Expression for work without clearance- Single stage, problem	T1 – Chapter 24
33	33	1	Problems on Compression work	T1 – Chapter 24
34	34	1	Effect of clearance volume , Volumetric efficiency, problem	T1 – Chapter 24
35	35		Problems on volumetric efficiency	T1 – Chapter 24
36	36	1	Power required and efficiency of a single stage compressor, problem	T1 – Chapter 24
37	37	1	Multistage compression, Two stage compressor with complete intercooling, without intercooling,	T1 – Chapter 24
38	38	1	Minimum work required for a two stage compressor with perfect intercooling (Optimum intermediate pressure for perfect intercooling.)	T1 – Chapter 24
39	39	1	Problems on reciprocating compressors	T1 – Chapter 24
40	40	1	Problems on reciprocating compressors	T1 – Chapter 24
41	41	1	Problems on reciprocating compressors	T1 – Chapter 24
42	42	1	Rotary Compressors: Vane compressor- construction and working	T1 – Chapter 24
43	43	1	Roots blower – Construction and working	T1 – Chapter 24
44	44	1	Comparison between Reciprocating and Rotary compressors	T1 – Chapter 24
45	45	1	Discussion of Cycle test II question paper	
46	46	1	<b>Unit IV</b> Refrigeration systems: Applications- Unit of refrigeration – Coefficient of performance(COP) Review of heat engine, heat pump and refrigerators	T1 – Chapter 26
47	47	1	Vapour compression refrigeration systems – working principle, T-s and P-h diagrams, COP in terms of enthalpy	T1 – Chapter 26
48	48	1	Different cases – 1. Vapour compression cycle with dry saturated vapour after compression, 2. with wet	T1 – Chapter 26

			vapour after compression,	
49	49	1	Vapour compression cycle with super heated vapour after compression, and with super heated vapour before compression	T1 – Chapter 26
50	50	1	Vapour compression cycle with under cooling or sub-cooling of refrigerant.	T1 – Chapter 26
51	51	1	Analysis, use of p-h chart,. Problems on calculation of COP (ammonia, R134a, R12 and R22 only)	T1 – Chapter 26
52	52	1	Problems on vapour compression cycles for (R12)	T1 – Chapter 26
53	53	1	Problems on vapour compression cycles for (R12)	T1 – Chapter 26
54	54	1	Problems on vapour compression cycles for (R22)	T1 – Chapter 26
55	55	1	Problems on vapour compression cycles for (R22)	T1 – Chapter 26
56	56	1	Problems on vapour compression cycles for (R 134 a)	T1 – Chapter 26
57	57	1	Refrigerants – essential properties, eco friendly refrigerants.	T1 – Chapter 26
58	58	1	Vapour absorption systems –Aqua ammonia, working	T1 – Chapter 26
59	59	1	Comparison between VC and VA system	T1 – Chapter 26
60	60	1	Discussion / Assignment on Refrigeration	T1 – Chapter 26
61	61	1	<b>Unit V Psychrometry and Air Conditioning:</b> Properties of atmospheric air	T1 – Chapter 9
62	62	1	Psychrometric chart- different curves	T1 – Chapter 9
63	63	1	Psychrometric processes – sensible heating, cooling, cooling and dehumidification, heating and humidification	T1 – Chapter 9
64	64	1	Problems on Sensible heating and cooling	T1 – Chapter 9
65	65	1	Problems on cooling and dehumidification	T1 – Chapter 9
66	66	1	Problem on heating and humidification	T1 – Chapter 9
67	67	1	Adiabatic mixing of two streams	T1 – Chapter 9

68	68		Problems on mixing of two streams	T1 – Chapter 9
69	69	1	Description of summer and winter air conditioning systems	T1 – Chapter 27
70	70	1	Year round air conditioning systems	T1 – Chapter 27
71	71	1	Window and split air conditioning systems	T1 – Chapter 27
72	72	1	Centralized Air conditioning plant	T1 – Chapter 27
73	73	1	Visit to Central Air conditioning plant inside the campus	T1 – Chapter 27
74	74	1	Cooling load calculations – Problem	T1 – Chapter 27
75	75	1	Discussion / Revision/ Assignment	T1 – Chapter 27

### TEXT BOOKS

T1 - Rajput, R. K., *Thermal Engineering*, Laxmi Publications, 6th Edition, New Delhi, 2010.

T2 - Domkundwar, A., *A Course in Thermal Engineering*, Dhanpat Rai & Co., New Delhi, 2010.

### REFERENCES

1. Sarkar.B.K, "*Thermal Engineering*", 3rd Edition, Tata McGraw Hill, New Delhi, 2009.
2. Rudramoorthy.R, "*Thermal Engineering*", Tata McGraw Hill, New Delhi, 2003.
3. Eastop.T.D, Mcconkey.A, "*Applied Thermodynamics for Engineering Technologists*", 5th Edition, Pearson Edition Publications, 2009.

Signature of the faculty members:

Mr. V. Rajasekar, V. Raja    Mr. J. Tharamani    Mr. Shan 4/12/14

Mr. V. Mahalingam    Mr. S. Malanmani    Mr. P. Sankaranarayanan P. Sanyal 4/12

Mr. M. Shivasubramanian M. G. Sankaranarayanan    Mr. M. D. Kethirakavali 4/12/14

Mr. Shendryagan    Mr. A. Sathish Kumar    Mr. K. V. Sreejith 03/12/14

4/12/14    A. Sathish Kumar    M. M. D. KATH

Course Coordinator: Dr. G. Kasiraman

H.O.D. / Mechanical Engineering

