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

Department of Mechanical Engineering

Course plan

Course code : ME1011 Date : 04 Feb 2016
Course title : Applied Thermal Engineering
Semester : 4
Academic year / semester : 2015-'16 / Even (FEB – MAY 2016)

Section details:

Section	Class Room no	Details of Faculty member				
		Name	Room No.	Intercom No.	e-mail id	Student contact time
1	H301F	Dr. G. Kasiraman	MEC107		kasiraman.g@ktr.srmuniv.ac.in	Wed 12:45 To 1:30PM
2	H301B	Mr. V.Mathanraj	MEB101 B	1832	madhanraj.v@ktr.srmuniv.ac.in	
3	H302F	Mr.G.Manikanda raja	MEB101 B		manikandaraja.g@ktr.srmuniv.ac.in	
4	H303B	Mrs. V. Praveena	MEB305		praveena.v@ktr.srmuniv.ac.in	
5	H309	Mr. A. Satishkumar	MH 208		sathishkumar .ja@ktr.srmuniv.ac.in	
6	H310	Mr. M. Ijas ahmed	MH 208		ijasahmed.m@ktr.srmuniv.ac.in	
7	H303F	Mr.S. Rajendrakumar	MEB208		rajendrakumar.s @ktr.srmuniv.ac.in	
8	H311	Mr. S. Arulkumar	MH 101		arulkumar.s@ktr.srmuniv.ac.in	
9	H306	Mr. M. Sivashankar	H313		sivashankar.mktr.srmuniv.ac.in	
10	H307	Mr. D. Kathirkaman	MEC111		kadhikaman.d@ktr.srmuniv.ac.in	
11	H302B	Mr. S. Ponshankar	H502		ponshankar.s@ktr.srmuniv.ac.in	
12	H308	Mr. A. Karthik	H315 ~~MEC111~~		karthik.a[illegible]@ktr.srmuniv.ac.in	

Direct assessment details:

Name of assessment	Marks	Topics (Tentative)	Tentative date	Duration
Cycle test - I	10	Gas Power Cycles & Simple Rankine Cycle	24/02/2016	100 minutes
Surprise test	05	Brayton cycle, Concept of Reheat and Regeneration in Brayton cycle.	10/03/2016	30 – 45 min
Cycle test - II	10	Reheat Rankine cycle, Regenerative rankine cycle, Binary cycle, Air Compressors	23/03/2016	100 minutes
Model exam	20	Entire Syllabus	25/04/2016	3 hours
End semester examination	50	Entire Syllabus		3 hours
Attendance	05	N/A		

		L	T	P	C
ME1011	**Applied Thermal Engineering**	**3**	**2**	**0**	**4**
	Prerequisite				
	Nil				

Student outcomes	Program Educational Objectives			
	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**		**Genaral**				
						X						
4	**Course Coordinator**	**Dr.G.Kasiraman**										

SYLLABUS

ME1011	APPLIED THERMAL ENGINEERING	L	T	P	C
	Total contact hours - 75	3	2	0	4
	Prerecuisite				
	Thermodynamics				
PURPOSE					
On completion of this course, the students are expected to understand the concept and working of gas, vapour power cycles, air compressors, refrigeration and air conditioning systems.					
INSTRUCTIONAL OBJECTIVES					
1.	To understand various gas power cycles.				
2.	To study vapour power cycles with reheat and regeneration.				
3.	To study the performance of air compressors.				
4.	To study the refrigeration and air conditioning systems				

UNIT I - GAS POWER CYCLES (15 hours)

Air standard cycles - Assumptions - Otto, Diesel, Dual - Air standard efficiency -Mean effective pressure and power; Brayton cycle - Reheat and regeneration.

UNIT II - VAPOUR POWER CYCLES (15 hours)

Rankine cycle - Performance - Comparison between Rankine cycle and Carnot cycle - Simple, reheat and regenerative cycle - Introduction to binary vapour cycle - Combined cycle.

UNIT III - AIR COMPRESSORS (15 hours)

Reciprocating air compressors - Types - Compression without clearance – Effect of clearance - multistage compression - Optimum intermediate pressure for perfect inter-cooling - Compressor efficiencies and mean effective pressure.

Rotary compressors - Vane compressor, roots blower - Comparison between reciprocating compressors and rotary compressors.

UNIT IV - REFRIGERATION SYSTEMS (15 hours)

Vapour compression systems - Working principle, refrigerants - Classifications - Properties - Eco friendly refrigerants. Analysis of vapour compression refrigeration cycle, use of P-h chart, effect of sub cooling and superheating - Calculations of COP. Vapour absorption systems - types - Working principle, comparison.

UNIT V - PSYCHROMETRY AND AIR CONDITIONING (15 hours)

Properties of atmospheric air - Psychrometric chart, relations. Psychrometric processes - Sensible heating and cooling, cooling and dehumidification, heating and humidification, adiabatic mixing of two air streams.

Air conditioning - Classifications - summer, winter, year round air conditioning system, window, split and centralized - Introduction to heat load calculations.

TOTAL : 75

TEXT BOOKS

1. RajputR.K, "*Thermal Engineering*", Laxmi Publications, 8th Edition, New Delhi, 2010.

2. Kothandaraman.C.P, Domkundwar.S, Anand Domkundwar, "*A Course in Thermal Engineering*", Dhanpat Rai & Co. (P) Ltd., 2010.

DATA BOOKS

1. Ramalingam.K.K, "*Steam Tables*", SciTech Publishers, 2009.

2. Mehta.F.S, Mathur.M.L, "*Refrigeration & Psychrometric Properties Tables & Charts*", 2nd Edition, Jain Publishers, 2007.

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.

LESSON PLAN

COURSE CODE : **ME 1011**

COURSE TITLE : **APPLIED THERMAL ENGINEERING**

YEAR / SEMESTER : II / IV

COURSE TIME – SEMESTER: EVEN YEAR 2015-16

SL No	Date/Hr	No. Of Hours	Title / Details of the chapter	References (Code of the Text / Reference Book)
1	1	1	**Unit I** Gas power cycles: Introduction, Air standard cycles, assumptions. Otto cycle description	T1 – Chapter 2 1
2	2	1	Derivation of expression for Otto cycle efficiency. Mean effective pressure, Compression ratio, Power	T1 – Chapter 2 1
3	3	1	Problems on Otto cycle.	T1 – Chapter 2 1
4	4	1	Problems on Otto cycle	T1 – Chapter 2 1
5	5	1	Problems on Otto cycle.	T1 – Chapter 2 1
6	6	1	Diesel cycle - Efficiency- derivation, mean effective pressure, Compression ratio, cut off ratio, Power	T1 – Chapter 2 1
7	7	1	Problems on diesel cycle.	T1 – Chapter 2 1
8	8	1	Problems on diesel cycle	T1 – Chapter 2 1
9	9	1	Problems on diesel cycle	T1 – Chapter 2 1
10	10	1	Dual cycle- Efficiency – derivation, mean effective pressure, constant volume pressure ratio, compression ratio, cut off ratio, Power	T1 – Chapter 2 1
11	11	1	Problems on dual cycle	T1 – Chapter 2 1
12	12	1	Problems on dual cycle	T1 – Chapter 2 1
13	13		Problems on dual cycle	T1 – Chapter 2 1
14	14	1	Components and working of gas turbine power plant, Brayton cycle – efficiency - problems	T1 – Chapter 2 1

15	15	1	Reheat and regeneration on brayton cycle,	T1 – Chapter 21
16	16	1	**Unit II** 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	**Unit III** 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,	T1 – Chapter 24

			problem	
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	**Unit IV** 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 vapour after compression,	T1 – Chapter 26
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-	T1 – Chapter 26

			cooling of refrigerant.	
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	**Unit V** Psychrometry and Air Conditioning: 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	I	Centralized Air conditioning plant	T1 – Chapter 27
73	73	I	Visit to Central Air conditioning plant inside the campus	T1 – Chapter 27
74	74	I	Cooling load calculations – Problem	T1 – Chapter 27
75	75	I	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:

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15/2/16

Course Coordinator: Dr. G. Kasiraman

for 5/2/16

Dean/Mechanical