1.Expected learning outcome of the course

ME0047	Refrigeration and Air conditioning	L	T	P	C
		3	0	0	3

Student outcomes	Program Educational Objectives			
	1. Practice mechanical engineering in different discilines towards system design, realization, and manufacturing.	2. Enhance professional practice to meet the global standards with ethical and social responsibility.	3. Solve industrial, social, and environmental problems with appropriate techniques and tools.	4. Work in large cross-functional teams and pursue life-long learning.
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health		X	X	
(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 (G)	BASIC SCIENCES (B)	ENGINEERING SCIENCES AND TECHNICAL ART (E)	PROFESSIONAL SUBJECTS (P)
				X

3 Broad area (for professional courses only, i.e 'under P' category)	Manufacturing	Design	Thermal	General		
			X			

4 Course Coordinator	Mr. THAVAMANI.J

2. Mapping between instructional objectives and student Outcomes

SRM University

Department of Mechanical Engineering

Course Code: ME 0047

Course Title: Refrigeration and Air conditioning

INSTRUCTIONAL OBJECTIVE	STUDENT OUTCOME	JUSTIFICATION
1. Understand Vapour compression and vapour absorption system Operation.	(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health	Study of vapour compression and vapour absorption system operation and how is working , and know about system components
	e)An ability to identify, formulate, and solve engineering problems	Problems on sub cooled and superheated cop calculation .compare between the actual cop and theoretical cop.
2. Analyse the refrigeration cycles and methods for improving Performance.	(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health	Analyses of vapour compression and vapour absorption system operation cycle and how do improve the cop of the system, and system performance .
	e)An ability to identify, formulate, and solve engineering problems	Problems on sub cooled and superheated cop calculation .compare between the actual cop and theoretical cop.
3.Familiarize the components of refrigeration systems.	(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health	Study on components of refrigeration system (Evaporator, compressor, condenser, expansion valve,) refrigerant charging components.
	e)An ability to identify, formulate, and solve engineering problems	Known about the factor affecting the evaporator capacity, condenser capacity with relative the mathematical equation.
4.Design air conditioning systems using cooling load calculations.	(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health	The understanding of air properties and relative technical term cooling load in air conditioning system (DBT,WBT, huminity,DPT,)
	e)An ability to identify, formulate, and solve engineering problems.	Calculations of cooling load , sensible heat and lateral heat in air conditioning system involve the usage of property equations

		framed earlier.
5. Know the application of refrigeration and air conditioning systems.	(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health	Study of air conditioning and refrigeration system operation and how is working , and know about application.
	e)An ability to identify, formulate, and solve engineering problems	Study of air conditioning and refrigeration system operation ,cooling load calculation and formula.

3. Syllabus of the course:

ME0047	REFRIGERATION AND AIR CONDITIONING SYSTEM	L	T	P	C
	Prerequisite	3	0	0	3
	Applied thermal engineering				
PURPOSE					
To On completion of this course, the students are expected to gain knowledge about refrigeration and air conditioning system, analysis and design calculations.					
INSTRUCTIONAL OBJECTIVES					
1	Understand Vapour compression and vapour absorption system Operation.				
2	Analyse the refrigeration cycles and methods for improving Performance.				
3	Familiarize the components of refrigeration systems.				
4	Design air conditioning systems using cooling load calculations.				
5	Know the application of refrigeration and air conditioning systems.				

(Use of approved refrigeration tables are permitted in the University Examinations)

UNIT I - VAPOUR COMPRESSION REFRIGERATION SYSTEMS (9 hours)

Review of thermodynamic principles of refrigeration - Simple vapour compression system - analysis - Method for improving COP - Multistage and multiple evaporator system - Cascade system - COP comparison.

UNIT II - ABSORPTION REFRIGERATION SYSTEMS (9 hours)

Absorption refrigeration cycle - Water lithium bromide systems – Ammonia absorption refrigeration system - COP calculation of single effect absorption system - Refrigerant-absorbent combinations - Comparison of absorption system with vapour compression systems.

UNIT III - REFRIGERATION EQUIPMENTS & CONTROL (9 hours)

Compressors - Condensers and Cooling towers - Evaporators – Expansion devices. Refrigerants: properties - Selection of refrigerants - Alternate refrigerants. Refrigeration plant controls - Testing and charging of refrigeration units.

UNIT IV - DESIGN OF AIR CONDITIONING SYSTEMS (9 hours)

Different heat sources - Conduction and radiation load - Occupants load - Equipment load-fresh air load infiltration-air load - Estimation of total load, bypass factor consideration - Effective sensible heat factor (ESHF) - Cooling coils and dehumidifier air washers.

UNIT V - APPLICATIONS OF REFRIGERATION AND AIR CONDITIONING SYSTEMS (9 hours)

Preservation of different products - Ice factory - Dairy plant refrigeration systems -

Air conditioning of hotels and restaurants - Air conditioning of theatres and auditorium - Air conditioning of hospitals.

TOTAL: 45

TEXT BOOKS

1. Arora.S.C and Domkundwar.S, "A course in Refrigeration and Air conditioning", Dhanpat Rai (P) Ltd., New Delhi, 2012.

2. Ananthanarayanan.P.N, "Basic Refrigeration and Air Conditioning", Tata McGraw Hill, 3rd edition, New Delhi, 2006.

REFERENCES

1. Manohar Prasad, "Refrigeration and Air conditioning", New Age International (P) Ltd, New Delhi, 2010.

2. Roy J. Dossat,"Principles of Refrigeration", Pearson Education Asia, 4th edition, 2001.

3. Arora, C. P.,"Refrigeration and Air Conditioning", Tata McGraw Hill, New Delhi, 2006.

ME0047 – REFRIGERATION AND AIR CONDITIONING SYSTEM												
Course Designed by		Department of Mechanical Engineering										
1	Student Outcome	A	b	C	D	E	F	G	H	I	J	K
		×				×						
2	Mapping of instructional objectives with student outcome	1-5				1-5						
3	Category	GENERAL (G)		BASIC SCIENCES (B)		ENGINEERING SCIENCES AND TECHNICAL ART(E)					PROFESSIONAL SUBJECTS (P)	
											X	
4	Approval	23rd Meeting of Academic Council, May 2013										

4. Course plan

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

Course Title: : Refrigeration and Air conditioning systems Semester :5[June – Nov 2014)

Section details:

Section	Class Room No.	Details of Faculty member				
		Name	Room No.	Interc om No.	e-mail id	Student contact time
A,B,C,D,E	H407	Mr.J.Thavamani	MEC111	1822	thavamani.j@ktr.srmuniv.ac.in	Mon 3pm to 4.30 pm
F,G,H,I,J	H408	Mr.V.Srinivasan	MEB104 H		Srinivasan.v@ktr.srmuniv.ac.in	Mon 12.45 to 1.30 pm

Direct assessment details:

Name of assessment	Marks	Topics	Tentative date	Duration
Cycle test – I	10	Vapour compression and refrigeration system	04.08.14	100 minutes
Surprise test	05	Absorption refrigeration systems	Third Week of August	10 – 15 min
Cycle test – II	10	Refrigeration equipments and control, design of air conditioning system	10-09-2014	100 minutes
Model examination	20	Entire Syllabus	17-10-2014	3 hours
End semester examination	50	Entire Syllabus	November 2013	3 hours
Attendance	05	N/A		

SRMUNIVERSITY

SCHOOL OF MECHANICAL ENGINEERING

LESSON PLAN

Course Code: ME0047

Course Title: Refrigeration and Air conditioning Systems

Year/Sem: III year-5th semester (Odd)

Sl.No	Date	No of Hours	Title/Details of Chapter	Reference code of text book
UNIT I - VAPOUR COMPRESSION REFRIGERATION SYSTEMS				
1		**1**	Review of thermodynamic principles of refrigeration-	**T1,Ch1.3,Pp 1.2**
2		**2**	Simple vapour compression system - analysis-	**T1,Ch4.1,Pp 4.2**
3		**3**	calculation-COP	**T1,Ch4.4,Pp4.5**
4		**4**	Method for improving COP	**T1,Ch4.8,Pp4.12**
5		**5**	Multistage and multiple evaporator system	**T1,Ch5.7,Pp 5.21**
6		**6**	Cascade system - COP comparison.	**T1,Ch9.4,Pp9.5**
7		**7**	Simple problem-sub cooling	**T1,Ch4.8,Pp4.12**
8		**8**	Simple problem-super heating	**T1,Ch4.9,Pp4.15**
9		**9**	Simple problem-sub cooling &super heating	**T1,Ch4.8,Pp4.12**
UNIT II - ABSORPTION REFRIGERATION SYSTEMS				
10		**1**	Absorption refrigeration cycle Water lithium bromide systems	**T1,Ch6.2,Pp 6.2** **T1,Ch6.3,Pp6.3**
11		**2**		

12		3	Simple problem-LiBr cop calculation	T1,Ch6.7,Pp 6.9
13		4	Ammonia Absorption Refrigeration system	T1,Ch6.5,Pp 6.5
14		5	Simple problem-ammonia cop calculation	T1,Ch6.1,Pp 6.17
15		6	COP calculation of single effect absorption system	T1,Ch6.1,Pp 6.17
16		7	Refrigeration absorbent combinations	T1,Ch7.1,Pp7.2
17		8	Simple problem-refrigeration absorbent	T1,Ch6.1,Pp 6.22
18		09	comparison of absorption system with vapour compression systems	T1,Ch6.1,Pp 6.15
19		10	Simple problem-VCS system Simple problem-VA system	T1,Ch6.1,Pp 6.15 T1,Ch7.1,Pp7.2
UNIT III - REFRIGERATION EQUIPMENTS & CONTROL				
20		1	Compressors –type	T1,Ch13.1,Pp 13.2
21		2	Condensers type	T1,Ch13.2,Pp13.28
22		3	Cooling towers type	T1,Ch13.2,Pp13.27
23		4	Evaporators	T1,Ch13.3,Pp13.55
24		5	Expansion devices type	T1,Ch13.4,Pp13.60
25		6	Refrigerants: properties	T1,Ch11.2,Pp11.2
26		7	Selection of refrigerants-alternate refrigerants.	T1,Ch11.8,Pp11.25
27		8	Refrigeration plant controls-	T1,Ch11.9,Pp11.28
28		9	Testing and charging of refrigeration units.	T1,Ch29.2,Pp29.2
UNIT IV - DESIGN OF AIR CONDITIONING SYSTEMS				
29		1	Different heat sources - Conduction	T1,Ch19.3,Pp19.3

			and radiation	
30		**2**	load-occupants load - Equipment load-fresh air load infiltration-air load	**T1,Ch19.3,Pp19.5**
31		**3**	Simple problem-conduction	**T1,Ch19.3,Pp19.6**
32		**4**	Simple problem-load calculation	**T1,Ch19.3,Pp19.25**
33		**5**	Estimation of total load	**T1,Ch19.3,Pp19.25**
34		**6**	Bypass factor consideration	**T1,Ch19.10,Pp19.20**
35		**7**	effective sensible heat factor (ESHF)	**T1,Ch19.11,Pp19.24**
36		**8**	Simple problem-SHF& ESHF	**T1,Ch19.10,Pp19.21**
37		**9**	Cooling coils and dehumidifier air washers.	**T1,Ch23.3,Pp23.24**
UNIT V - PPLICATIONS OF REFRIGERATION AND AIR CONDITIONING SYSTEMS				
38		**1**	Preservation of different products	**T1,Ch30.10,Pp30.7**
39		**2**	ice factory	**T1,Ch31.9,Pp31.8**
40		**3**	dairy plant refrigeration systems	**T1,Ch31.9,Pp31.9**
41		**4**	air conditioning of hotels	**T1,Ch31.3,Pp31.2**
42		**5**	air conditioning of restaurants	**T1,Ch31.3,Pp31.2**
43		**6**	air conditioning of theatres	**T1,Ch31.5,Pp31.4**
44		**7**	air conditioning of auditorium	**T1,Ch31.5,Pp31.4**
45		**8**	air conditioning of hospitals.	**T1,Ch31.5,Pp31.4**
46		**9**	Review of Air conditioning	**T1,Ch31.5,Pp31.4**

TEXT BOOKS

1. Arora.S.C and Domkundwar.S, "A course in Refrigeration and Air conditioning", Dhanpat Rai (P) Ltd., New Delhi, 2012.
2. Ananthanarayanan.P.N, "Basic Refrigeration and Air Conditioning", Tata McGraw Hill, 3rd edition, New Delhi, 2006.

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1. Manohar Prasad, "Refrigeration and Air conditioning", New Age International (P) Ltd, New Delhi, 2010.
2. Roy J. Dossat,"Principles of Refrigeration", Pearson Education Asia, 4th edition, 2001.
3. Arora, C. P.,"Refrigeration and Air Conditioning", Tata McGraw Hill, New Delhi, 2006.

Handling Faculty:

NAME	SIGNATURE
Mr.J.THAVAMANI	
Mr.V.SRINIVASAN	

COURSE COORDINATOR

HOD IN CHARGE 01/7/2014