

Ramgarhia Polytechnic College, Phagwara



Mechanical Engineering Department

Head of Department:	Er. Gaurav Kumar
Name of the Faculty:	Er. Amanjot Singh
Discipline:	Mechanical Engineering Department
Semester:	5 th
Subject:	Refrigeration & Air Conditioning
Lesson Plan Duration:	16 Weeks



































RATIONALE

The diploma holders in Mechanical Engineering are responsible for supervising and maintenance of RAC system. For this purpose, the knowledge and skill covering basic principles of refrigeration and air conditioning is required to be imparted to the students. Moreover, RAC industry is expanding and employment opportunities in this field are good.

Learning Outcomes

After undergoing this course, the students will be able to:

- CO1. Explain the working and construction features of refrigeration and air conditioning systems
- CO2. Draw and interpret various refrigeration cycles.
- CO3. Make basic calculation of psychometric properties and processes.
- CO4. Calculate heating and cooling load requirements of a room.
- CO5. Explain latest developments in the field of refrigeration and air conditioning.
- CO6. Calculate the properties of air by using psychometric chart.
- CO7. Detect faults in an air-conditioner/refrigerator.
- CO8. Carry out charging of air conditioner

PO \Rightarrow	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO \Downarrow							
CO1							
CO2							
CO3							
CO4							
CO5							
CO6							
CO7							
CO8							

Syllabus

Units	Details	Hours
1.	Fundamentals of Refrigeration Introduction to refrigeration and air conditioning, meaning of refrigerating effect, units of refrigeration, COP, difference between COP and efficiency, methods of refrigeration, Natural system and artificial system.	(02 hrs)
2.	Vapour Compression System Introduction, principle, function, parts and necessity of vapour compression system, T- and p- H charts, dry, wet and superheated compression. Effect of sub cooling, super heating, mass flow rate, entropy, enthalpy, work done, Refrigerating effect and COP. actual vapour compression system.	(12 hrs)
3.	Refrigerants Functions, classification of refrigerants, properties of R - 717, R – 22, R– 134 (a), CO ₂ , R – 11, R – 12, R – 502, Properties of ideal refrigerant, selection of refrigerant	(04 hrs)
4.	Air Refrigeration System Introduction, advantages and disadvantages of air-refrigeration system over vapour compression system, bell – Collemann cycle, calculation of mass flow rate, work done and COP	(08 hrs)
5.	Vapour Absorption System Introduction, principle and working of simple absorption system and domestic electrolux refrigeration systems. Solar power refrigeration system, advantages and disadvantages of solar power refrigeration system over vapour compression system.,	(06 hrs)
6.	Refrigeration Equipment Compressors- Function, various types of compressors. Condensers - Function, various types of condensers. Evaporators- Function, types of evaporators .Expansion Valves - Function, various types such as capillary tube, thermostatic expansion valve, low side and high side float valves, application of various expansion valves. Safety Devices-Thermostat, overload protector LP, HP cut out switch	(12 hrs)
7.	AIR CONDITIONING Psychrometry Definition, importance, specific humidity, relative humidity, degree of saturation, DBT, WBT, DPT, sensible heat, latent heat, Total enthalpy of air	(08 hrs)
8.	Applied Psychrometry and Heat Load Estimation. Psychrometric chart, various lines, psychrometric process, by pass factor, room sensible heat factor, effective room sensible heat factor, grand sensible heat factor, ADP, room DPT. Heating and humidification,	(09hrs)

	cooling and dehumidification, window airconditioning, split type air-conditioning, car air-conditioning, central airconditioning.	
9.	Latest development in refrigeration and air conditioning: Inverter technology, auto-defrosting, blast cooling, star rating.	(03hrs)

Reference Books:

1. Refrigeration and Air Conditioning by Domkundwar; Dhanpat Rai and Sons, Delhi.
2. Refrigeration and Air Conditioning by CP Arora; Tata McGraw Hill, New Delhi.
3. Refrigeration and Air Conditioning by R.S Khurmi and J.K. Gupta; S Chand and Company Limited, New Delhi.
4. Refrigeration and Air Conditioning by Dr. Harjeev Khanna; Dhanpat Rai and Sons, Delhi.
5. Refrigeration and Air Conditioning by Dr. R.K Rajput; S.K. Kataria and Sons, Ludhiana.

Delivery/Instructional Methodologies

Sr.No.	Description
1.	Chalk and Talk
2.	PowerPoint Presentation

Assessment Methodologies

Sr. No.	Description	Type
1.	Student Assignment	Direct
2.	Test	Direct
3.	Board Examination	Direct
4.	Student Feedback	Direct

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
	N/A	N/A	N/A

Topics beyond syllabus/advanced topics

Units	Details	Hours
N/A	N/A	N/A

Web Source References

Sr. No.	URL
1.	https://nptel.ac.in/

Lesson Plan

Week	Theory		Practical	
	Lecture Day		Practical Day	02hrs per week
1 st	1 st	Introduction to refrigeration, and air conditioning	1.	Identify various tools of refrigeration kit
	2 nd	Meaning of refrigerating effect		
	3 rd	Units of refrigeration, COP		
	4 th	Difference between COP and efficiency		
	5 th	Methods of refrigeration,		

2 nd	6 th	Natural system and artificial system	2.	Practice in cutting, bending, flaring, swaging and brazing of tube
	7 th	Vapour Compression System Introduction,		
	8 th	Principle, function, parts and necessity of vapour compression system,		
3 rd	9 th			
	10 th			
11 th			3.	Study of thermostatic switch, LP/HP cut out overload protector filters, strainers and filter driers.
12 th	T- and p- H charts, dry, wet and superheated compression.			
4 th	13 th		4.	Identify various parts of a refrigerator and window air conditioner
	14 th	Effect of sub cooling, super heating, mass flow rate, entropy, enthalpy, work done		
	15 th			
	16 th	Refrigerating effect and COP		
5 th	17 th	Actual vapour compression system	5.	To find COP of Refrigeration system
	18 th	Refrigerants Functions, classification of refrigerants		
	19 th	Properties of R - 717, R - 22, R-134 (a), CO2, R - 11, R - 12, R - 502.		
	20 th			
6 th	21 st	Properties of ideal refrigerant, selection of refrigerant	6.	REVISION
	22 nd			
	23 rd	REVISION		

	24 th	1st Sessional Test (Tentative)		
7 th	25 th	Air Refrigeration System Introduction, advantages and disadvantages of air-refrigeration system over vapour compression system	7.	Charging of a refrigerator/ air conditioner
	26 th	Bell – Collemann cycle, calculation of mass flow rate, work done and COP		
	27 th			
	28 th	Vapour Absorption System Introduction, principle and working of simple absorption system		
8 th	29 th	Domestic electrolux refrigeration systems	8.	To detect faults in a refrigerator/ air conditioner
	30 th			
	31 st	Solar power refrigeration system, advantages and disadvantages of solar power refrigeration system over vapour compression system.,		
	32 nd			
9 th	33 rd	Refrigeration Equipment Compressors- Function, various types of compressors	9.	To measure air flow using anemometer
	34 th			
	35 th	Condensers - Function, various types of condensers		
	36 th			
10 th	37 th	Evaporators- Functions	10.	Visit to an ice plant or
	38 th	Types of evaporators .Expansion Valves - Function, various types		
	39 th			

	40 th	such as capillary tube, thermostatic expansion valve, low side and high side float valves, application of various expansion valves. Safety Devices-Thermostat, overload protector LP, HP cut out switch		cold storage plant. or central air conditioning plant
11 th	41 st	Psychrometry Definition, importance, specific humidity, relative humidity, degree of saturation.	11.	Visit to an ice plant or cold storage plant. or central air conditioning plant
	42 nd	DBT, WBT, DPT, sensible heat, latent heat, Total enthalpy of air.		
	43 rd			
	44 th			
12 th	45 th	PTM	12.	REVISION
	46 th	2nd Sessional Test (Tentative)		
	47 th	Psychrometric chart, various lines,		
	48 th			
13 th	49 th	Psychrometric process, by pass factor, room sensible heat factor, effective room sensible heat factor, grand sensible heat factor, ADP, room DPT	13.	Visit to an ice plant or cold storage plant. or central air conditioning plant
	50 th			
	51 st			
	52 nd			
14 th	53 rd	Heating and humidification, cooling and dehumidification	14	Visit to an ice plant or cold storage plant. or
	54 th			
	55 th			

	56 th			central air conditioning plant
15 th	57 th	Window airconditioning, split type air-conditioning	15.	REVISION
	58 th	Car air-conditioning, central airconditioning.		
	59 th			
	60 th	Inverter technology, auto-defrosting, blast cooling, star rating.		
16 th	61 st		16.	VIVA
	62 nd	PTM		
	63 rd	REVISION		
	64 th	3rd Sessional Test (Tentative)		