Name of Institute: Indus institute of technology
Name of Faculty: Krunal Parikh

Course code: ME0764
Course name: Refrigeration & Air Conditioning
Pre-requisites: Knowledge of thermodynamics and heat and mass transfer.
Credit points: 03
Offered Semester: 7th

Course coordinator (weeks 13)
Full name: Krunal Parikh
Department with siting location: Fluid Mechanics Lab, 1st floor, Bhanwar building
Telephone: 02764260277/3102
Email: krunalparikh.me@indusuni.ac.in
Consultation times: working Saturday 9 to 11

Students will be contacted throughout the session via mail with important information relating to this course.

Course Objectives

By participating in and understanding all facets of this course a student will:

1. The purpose of this course is to impart adequate knowledge in both ways practically as well as theoretically.
2. Imparting knowledge of various types of pumps and air cooling systems.
3. To familiarize the students with the fundamentals of heat transfer and cooling system.

Course Outcomes (CO)

After successful completion of the course, student will able:

CO1 - Illustrate the fundamental principles and applications of refrigeration and air conditioning system
CO2 - Obtain cooling capacity and coefficient of performance by conducting test on vapour compression refrigeration systems
CO3 - Present the properties, applications and environmental issues of different refrigerants
CO4 - Calculate cooling load for air conditioning systems used for various
CO5 - Operate and analyze the refrigeration and air conditioning systems.
CO6- Analyze the air conditioning processes using principles of Psychrometry

Course Outline

All type of heating and cooling systems like refrigerator, air condition, ice manufacturing, air cooling systems etc.

Method of delivery

Online lectures, self-study material, Active Learning Techniques

Study time

2 hour lecture and 2 hour laboratory session

CO-PO Mapping (PO: Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	-	-	-	-	-	-	-	-	1
CO2	3	2	3	1	3	-	-	-	-	-	-	-
CO3	3	2	2	2	3	-	-	-	-	-	-	-
CO4	2	2	1	-	-	-	-	-	-	-	-	1

Blooms Taxonomy and Knowledge retention (For reference)

(Blooms taxonomy has been given for reference)

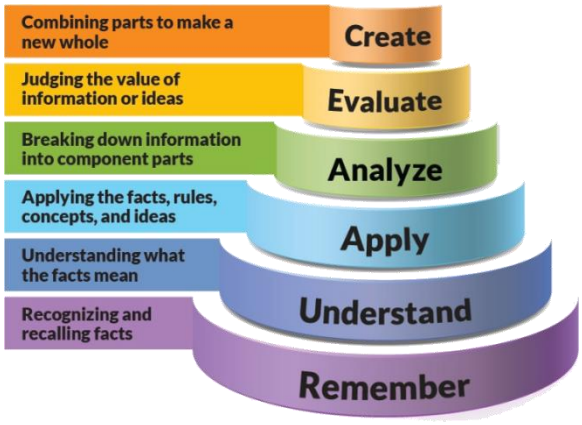

Figure 1: Blooms Taxonomy

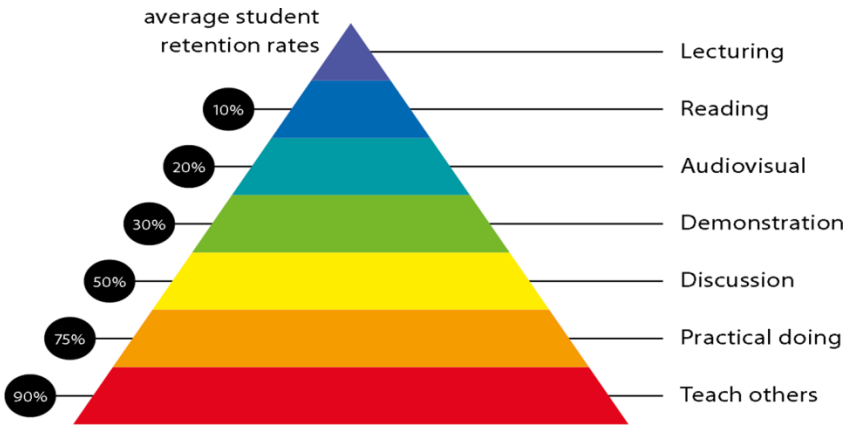

Figure 2: Knowledge retention

Graduate Qualities and Capabilities covered

(Qualities graduates harness crediting this Course)

General Graduate Qualities	Specific Department of Mechanical Graduate Capabilities
Informed Have a sound knowledge of an area of study or profession and understand its current issues, locally and internationally. Know how to apply this knowledge. Understand how an area of study has developed and how it relates to other areas.	**1 Professional knowledge, grounding & awareness**
Independent learners Engage with new ideas and ways of thinking and critically analyze issues. Seek to extend knowledge through ongoing research, enquiry and reflection. Find and evaluate information, using a variety of sources and technologies. Acknowledge the work and ideas of others.	**2 Information literacy, gathering & processing**
Problem solvers Take on challenges and opportunities. Apply creative, logical and critical thinking skills to respond effectively. Make and implement decisions. Be flexible, thorough, innovative and aim for high standards.	**4 Problem solving skills**
Effective communicators Articulate ideas and convey them effectively using a range of media. Work collaboratively and engage with people in different settings. Recognize how culture can shape communication.	**5 Written communication** **6 Oral communication** **7 Teamwork**
Responsible Understand how decisions can affect others and make ethically informed choices. Appreciate and respect diversity. Act with integrity as part of local, national, global and professional communities.	**10 Sustainability, societal & environmental impact**

Practical work:

Sr. No.	PRACTICAL NAME
1	To study about air cooling systems
2	To determine COP of VCR system
3	To study about different type of refrigerants
4	To determine COP of Electrolux refrigerator
5	To determine COP of ice candy machine
6	To determine efficiency of cooling tower
7	To determine COP of Mechanical Heat Pump heating side
8	To determine COP of Mechanical Heat Pump cooling side
9	To determine COP of air condition system

Lecture/tutorial times

As per the time table

Attendance Requirements

The University norms states that it is the responsibility of students to attend all lectures, tutorials, seminars and practical work as stipulated in the course outline. Minimum attendance requirement as per university norms is compulsory for being eligible for semester examinations.

Details of referencing system to be used in written work

Text books

1. Rajput R.K “Refrigeration and air conditioning”; S. K. Kataria & Sons; Delhi, 2009

2. Manohar Prasad, "Refrigeration and Air Conditioning", Wiley Eastern Ltd., 1983

3. Arora. C.P., Refrigeration and Air Conditioning, Tata McGraw-Hill New Delhi, 1988

4. S C Arora & S Domkundwar, ‘Refrigeration and Air-Conditioning’ Dhanpat Rai Publication, 2009

Additional Materials

1. Ahmadul Ameen "Refrigeration and Air Conditioning", Prentice Hall of India Pvt. Ltd. 2010

2. Ramesh Arora ," Refrigeration and Air-conditioning", Prentice Hall of India, 2010

ASSESSMENT GUIDELINES

Your final course mark will be calculated from the following:

Theory subject:	
CIE	60%
Final exam (*closed book*)	40%
Lab subject:	
CIE	60%
Final exam (*closed book*)	40%

SUPPLEMENTARY ASSESSMENT

Students who receive an overall mark less than 40% in internal component or less than 40% in the end semester will be considered for supplementary assessment in the respective components (i.e internal component or end semester) of semester concerned. Students must make themselves available during the supplementary examination period to take up the respective components (internal component or end semester) and need to obtain the required minimum 40% marks to clear the concerned components.

Practical Work Report/Laboratory Report:

A report on the practical work is due the subsequent week after completion of the class by each group.

Late Work

Late assignments will not be accepted without supporting documentation. Late submission of the reports will result in a deduction of -% of the maximum mark per calendar day

Format

All assignments must be presented in a neat, legible format with all information sources correctly referenced. **Assignment material handed in throughout the session that is not neat and legible will not be marked and will be returned to the student.**

Retention of Written Work

Written assessment work will be retained by the Course coordinator/lecturer for two weeks after marking to be collected by the students.

University and Faculty Policies

Students should make themselves aware of the University and/or Faculty Policies regarding plagiarism, special consideration, supplementary examinations and other educational issues and student matters.

Plagiarism - Plagiarism is not acceptable and may result in the imposition of severe penalties. Plagiarism is the use of another person's work, or idea, as if it is his or her own - if you have any doubts at all on what constitutes plagiarism, please consult your Course coordinator or lecturer. Plagiarism will be penalized severely.

Do not copy the work of other students.
Do not share your work with other students (except where required for a group activity or assessment)

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Course schedule

	Week #	Topic & contents	CO Addressed	Teaching Learning Activity (TLA)
	Weeks 1	Second law of thermodynamic for Refrigeration and Air conditioning, Working principle of R&AC. unit of refrigeration and C.O.P. – Mechanical refrigeration – types of ideal cycles of refrigeration, Necessity and applications	CO-1,2	Online Lecture , PPT
	Weeks 2	Air refrigeration: Bell Coleman cycle - open and dense air systems, Bootstrap air refrigeration system, types of air cycles, advantages and is advantages.refrigeration systems used in air crafts and problems.	CO-2	Online Lecture , PPT
	Week 3	Working principle and essential components of the plant – simple vapour compression refrigeration cycle – COP – representation of cycle on T-S and p-h charts, actual cycle influence of various parameters on system performance – use of p-h charts – numerical problems.	CO-3,1	Online Lecture , PPT
	Week 4	Comparison of VCRS & VARS , Advantages of VARS Refrigeration Systems, Types of VARS Systems (practical water -NH3 cycle Li–Br system) and its working, Electrolux Refrigeration Systems.	CO-1,3	Online Lecture , PPT
	Week 5	Development, classification, designation of refrigerants, secondary refrigerants, future industrial refrigerants.	CO-1,3	Online Lecture , PPT
	Week 6	Determination of condition of air entering conditioned space. Air conditioning systems – summer, winter and year-round-year air conditioning systems -- central and unitary systems. Requirement of air conditioning	CO-1,4	Online Lecture , PPT
	Week 7	human comfort – comfort chart and limitations – effective temperature – factors governing effective temperature – design considerations.	CO-1,3	Online Lecture , PPT
	Week 8	Classification, system components, all air, all water, air water systems, room air conditioners, packaged air conditioning plant, central air conditioning systems, split air conditioning systems.	CO-1,4	Online Lecture , PPT

	Week 9	Compressors, condensers, expansion devises, evaporators its types construction and working, comparison and selection, refrigeration piping accessories and controls, thermal insulation properties and classification, thickness of insulation.	CO-1,4	Online Lecture , PPT
	Week 10	Air filters – humidifiers – fan – blowers control systems for temperature and humidity – noise control. Installation and charging of refrigeration unit, Testing for leakage, Cause for faults and rectification.	CO-1,3	Online Lecture , PPT
	Week 11	Various heat sources contributing heat load – solar load -equipment load - infiltration air load Factors affecting the thermal conductivity, types of insulating materials, reflective insulating blinds,	CO-1,4	Online Lecture , PPT
	Week 12	heat transfer through insulation used for air-conditioning, economical thickness of insulation, few insulated systems, importance of relative humidity for the selection of insulation.	CO-1,4	Online Lecture , PPT

B.TECH MECHANICAL ENGINEERING (2019)