DARBHAMGA COLLEGE OF ENGINEERING DARBHANGA,BIHAR

COURSE FILE OF REFRIGERATION AND AIR CONDITIONING (02 1720)



FACULTY NAME: MADHAV RAM ASSISTANT PROFESSOR, DEPARTMENT OF MECHANICAL ENGINEERING

Vision of the Mechanical Engineering Department :

To produce quality mechanical engineers to pursue higher studies in thermal, manufacturing and design engineering, serve the national and multinational companies.

Mission of the Mechanical Engineering Department:

M1: To produce quality mechanical engineers through a good teaching learning ambience.

M2: To promote the graduates for studies and research in mechanical engineering.

M3: Graduates will serve the nation through public services.

M4: To produce mechanical engineers to apply their knowledge and skills while working as a professional engineer keeping ethical values.

Program Educational Objectives (PEOs) :

PEO 1	The graduates will demonstrate the knowledge and skills of mechanical engineering to obtain the solution to the complex design engineering problems.		
PEO 2	The graduate will apply the mechanical engineering concepts while pursuing academic and research activities.		
PEO 3	The graduates will showcase the professional skill with keeping societal ethical values.		

Program Outcomes (POs) :

PO 1	Engineering knowledge: An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.
PO 2	Problem analysis: Ability to Identify, formulates, review research literature, and analyze complex engineering problems.
PO 3	Design/development of solutions : Ability to design solutions for complex engineering problems by considering social, economic and environmental aspects
PO 4	Conduct investigations of complex problems: Use research-based knowledge to design, conduct analyze experiments to get valid conclusion.
PO 5	Modern tool usage: ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.
PO 6	The engineer and society: Ability to apply knowledge by considering social health, safety, legal and cultural issues.
PO 7	Environment and sustainability: Understanding of the impact of the adopted engineering solutions in social and environmental contexts.
PO 8	Ethics: Understanding of the ethical issues of the Mechanical engineering and applying ethical principles in engineering practices.
PO 9	Individual and teamwork: Ability to work effectively as an individual or in team, as a member or as a leader.
PO 10	Communication: An ability to communicate clearly and effectively through different modes of communication.
PO 11	Project management and finance: Ability to handle project and to manage finance related issue
PO 12	Life-long learning: Recognize the need for, and have the preparation and ability to

engage in independent and life-long learning.

Program Specific Outcomes (PSOs) :

PSO 1	Students should able to understand and apply the concept in the field of design, manufacturing, and in thermal areas.
PSO 2	Students should able to learn and apply the software like AutoCAD, Ansys, Catia for various applications.

Institute / College Name :	Darbhanga College of Engineering, Darbhanga		
Program Name	B.Tech Mechanical Engineering		
Course Code	02 1720		
Course Name	REFRIGERATION AND AIR CONDITIONING		
Lecture / Tutorial (per	3/0	Course Credits	3
week):			
Course Coordinator	Madhav Ram		
Name			

1. <u>Scope and Objectives of the Course</u>

This course is designed to familiarize with the terminology associated with refrigeration systems and air conditioning. The course curriculum focused to leads students toward a clear understanding and firm grasp of the basic refrigeration processes and the basics of psychrometry. This course also emphasize to acquire the skills required to model, analyse and design different refrigeration as well as air conditioning processes and components.

Course outcomes:

On successful completion of the course, the student will be able to,

- 1. illustrate the basic concepts of refrigeration system.
- 2. analyze the vapour compression cycle and interpret the usage of refrigerants.
- 3. explain the components of vapour compression system.
- 4. demonstrate the use of psychrometry in analyzing refrigeration systems.
- 5. discuss the theory and concept of air-conditioning systems.

Textbooks

TB1: Arora, C.P., '*Refrigeration and Air conditioning*', McGraw Hill Education, 3rd Edition, 2009.

TB2 Stoecker, W.F. and Jones, J.W., '*Refrigeration and Air conditioning*', Tata McGraw Hill, 1986.

2. <u>Reference Books</u>

RB1: Manohar Prasad, Refrigeration and Air Conditioning, New Age International, 2004.

RB2: 'Refrigeration and air conditioning by Domkundwar.

- **RB3:** 'Dossat R.D., Principle of Refrigeration, 4th ed., Prentice-Hall, 1997.
- **RB4:** Refrigeration and air conditioning by Jordon & Priester.

Other readings and relevant websites

S.No.	Link of Journals, Magazines, websites and Research Papers
1.	https://www.sciencedirect.com/search?qs=refrigeration%20and%20air%20conditio
	ning&show=25&sortBy=relevance
2.	https://www.ashrae.org/
3.	https://www.worldscientific.com/worldscinet/ijacr
4.	http://www.ashraeindia.org/
5.	https://www.rehva.eu/news/news-single/article/international-journal-of-air-
	conditioning-and-refrigeration-ijacr.html
6.	https://nptel.ac.in/downloads/112105129/
7.	https://lecturenotes.in/materials/7098-refrigeration-and-air-

conditioning?utm	source=subjectpage&utm	_medium=web&utm_	<u>campaign=materi</u>
<u>alpage</u>			

Course Plan

Lecture Number	Date of Lecture	Topics	Web Links for video lectures	Text Book / Reference Book /	Page numbers
				Other reading material	of Text Book(s)
1-6		Air refrigeration		TB1, RB3	367-385
		Refrigeration machine	https://youtu.be/O		
		heat nump coefficient	XIZhavnNIII		
		of performance ideal	<u>Alziqypi Ol</u>		
		refrigeration cycle Bell –	https://www.youtu		
		Coleman refrigeration	he com/watch?v=0		
		cycle open and closed	Zp7L zYFMCs		
		systems application of			
		air- refrigeration in air-			
		crafts			
7-14		Various compression		TR1 RR2	87-122
/ 17		systems		1D1, KD2	07 122
		Simple vapour	https://youtu.be/x9		
		compression refrigeration	virfC8niI		
		cycle merits and	Jincomi		
		Refrigerants demerits of	https://www.youtu		
		this system over air	be.com/watch?v=X		
		refrigeration system.	O2PBDMEHfs		
		factors affecting the			
		performance of a vapour			
		compression refrigeration			
		system, sub cooling and			
		superheating of vapour.			
		wet and dry			
		compression. multistage			
		vapour compression			
		system, intercooler, flash			
		chamber, accumulator			
		and heat exchanger.			
		Assi	ignment 1		•
15-19		Vapour absorption		TB2, RB1	402-419
		system			
		Simple and modified	https://youtu.be/Gh		
		vapour absorption	<u>p-O1bMMuU</u>		
		refrigeration system,			
		Electrolux refrigerator,	https://www.youtu		
		COP of heat operated	be.com/watch?v=4		
		refrigeration system.	w3Obp8ILpA		
20-23		Special refrigeration		TB2, RB1	214-228
		system		,	
		absorption cascade	https://www.youtu		

r				
	vortex, thermoelectric	be.com/watch?v=p		
	and steam jet	<u>ugraGZxebc</u>		
	refrigeration system.			
	Assi	gnment 2		
24-26	Refrigerants		TB1, RB4	128-154
	classification and	https://youtu.be/6_		
	nomenclature of	<u>ePn_LkIQM</u>		
	refrigerants, primary and			
	secondary refrigerants,	https://www.youtu		
	properties of some	be.com/watch?v=0		
	common refrigerants,	BOVDcMxlyY		
	physical, chemical and			
	thermodynamics			
	properties, selection of			
	refrigerants, leakage of			
	refrigerants and methods			
	of detection			
27	Equipment		TB1, RB1	236-246
	Elementary discussion of	https://voutu.be/Na	,	
	refrigerating equipment.	kOoD-G0IY		
	ice plant and cold storage.			
	Assi	gnment 3		
	Mid-Semester Exam (Svlla	bus covered from 1-	27 lectures)	
28-32	Psychrometry		TB1. RB3	446-469
	Properties of air vapour	https://youtu.be/aA		
	mixture, wet bulb dew	OJzp7ckGo		
	point & dry bulb			
	temperatures humidity	https://www.voutu		
	specific humidity	he com/watch?v-8		
	humidity ratio degree of	Id1SZOpWY0		
	saturation relative			
	humidity total heat			
	numenty, total near			
	psychometric charts and			
	its uses psychometric			
	ns uses, psycholitetric			
	cooling			
22 12	Air conditioning		TD1 DD2	474 508
33-42	General principle and	https://woutu bo/wa	1D2, KD3	4/4-308
	requirement for comfort	nups.//youtu.oc/yq		
	and air conditioning	<u>pR/uuIIDEA</u>		
	thermodynamics of	https://www.voutu		
	human hody astimation	ha com/watch?w_V		
	of besting and easling	$\frac{\text{UC.COM/Watch?v-1}}{\text{UCN5D hmms}}$		
	of fleating and cooling	<u>Ugnod-unpg</u>		
	loads, capacity of			
	cooling colls,			
	numidification and			
	aenumicification unit			
	and conditioner, central			
	air conditioner, year			
	around air condition,			
	numidity and			

	temperature control, industrial application of air conditioning system.			
A sei en mart 1				

Assignment 4

Evaluation Scheme:

Component 1	Mid Semester Exam	20
Component 2	Assignment /Attendance/Class Test	10
Component 3**	End Term Examination**	70
	Total	100

** The End Term Comprehensive examination will be held at the end of semester. The mandatory requirement of 75% attendance in all theory classes is to be met for being eligible to appear in this component.

SYLLABUS

Topics	No of lectures	Weightage
Air refrigeration system : Refrigeration machine, heat	6	14%
pump, coefficient of performance, ideal refrigeration cycle,		
Bell - Coleman, refrigeration cycle, open and closed systems,		
application of air- refrigeration in air-crafts.		
Various compression systems : Simple vapour compression refrigeration cycle, merits and Refrigerants demerits of this system over air refrigeration system, factors affecting the performance of a vapour compression refrigeration system, sub cooling and superheating of vapour, wet and dry compression, multistage vapour compression system,	8	19%
intercooler, flash chamber, accumulator and heat exchanger.		
Vapour absorption system : Simple and modified vapour absorption refrigeration system, Electrolux refrigerator, COP of heat operated refrigeration system.	5	13%
Special refrigeration system , absorption, cascade, vortex, thermoelectric and steam jet refrigeration system	4	10%
Refrigerants : classification and nomenclature of refrigerants, primary and secondary refrigerants, properties of some common refrigerants, physical, chemical and thermodynamics properties, selection of refrigerants, leakage of refrigerants and methods of detection.	3	8%
Equipment: Elementary discussion of refrigerating	1	4%
equipment, ice plant and cold storage.		
Psychrometry : Properties of air vapour mixture, wet bulb, dew point & dry bulb temperatures, humidity, specific humidity, humidity ratio, degree of saturation, relative humidity, total heat psychrometric relation, psychometric charts and its uses, psychometric processes evaporative cooling.	5	12%

Air conditioning : General principle and requirement for	10	20%
comfort and air conditioning, thermodynamics of human		
body, estimation of heating and cooling loads, capacity of		
cooling coils, humidification and dehumidification unit and		
conditioner, central air conditioner, year around air		
condition, humidity and temperature control, industrial		
application of air conditioning system.		

This Document is approved by:

Designation	Name	Signature
Course Coordinator	Mr. Madhav Ram	
H.O.D	Mr. Vishnu Singh	
Principal	Dr. Achintya	
Date		

Evaluation and Examination Blue Print:

Internal assessment is done through quiz tests, presentations, assignments and project work. Two sets of question papers are asked from each faculty and out of these two, without the knowledge of faculty, one question paper is chosen for the concerned examination. Examination rules and regulations are uploaded on the student's portal. Evaluation is a very transparent process and the answer sheets of sessional tests, internal assessment assignments are returned back to the students.

The components of evaluations along with their weightage followed by the University is given below

Mid semester exam	20%
Assignments/Quiz test /Seminars	10%
End term examination	70%
(From amongst the three sessional	tests best of two are considered)