

**MUZAFFARPUR INSTITUTE OF
TECHNOLOGY, MUZAFFARPUR**

COURSE FILE

OF

REFRIGERATION AND AIR CONDITIONING

(021X20)



FACULTY NAME

SARVESH KUMAR YADAV

ASSISTANT PROFESSOR

DEPARTMENT OF MECHANICAL ENGINEERING

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Muzaffarpur Institute of Technology, Muzaffarpur

Department of Mechanical Engineering

Vision

- To strengthen the region through imparting superior quality technical education and research; which enables the fulfillment of industrial challenge and establish itself as a Centre of Excellence in the field of Mechanical Engineering.

Mission

- To build an academic environment of teaching and lifelong learning for students to make them competitive in context with advance technological, economical and ecological changes.
- To enable the students to enhance their technical skills and communications through research, innovation and consultancy projects.
- To share and explore the accomplishments through didactic, enlightenment, R & D programs with technical institution in India and abroad.

Mechanical Engineering Program Educational Objectives

- Graduates will spread and enhance their technical capability and proficiency through vital domain of economical, environmental and social concerns affiliated with the mankind and industry.
- Graduates will be able to work professionally with modern methods in the area of Thermal, Mechanical System Design, Manufacturing, Measurement, Quality control and other interdisciplinary fields of concerns.
- Graduates will practice Mechanical engineering in sensible, flexible and ethical manner to benefit the society, industry and nation toward the rapidly changing global technical standards.
- Graduates will serve as ambassadors for engineering by their knowledge, creativity, imagination and innovation and set new extremes in their profession through lifelong learning.

Mechanical Engineering Student Outcomes

Mechanical Engineering Student Outcomes Students who complete the B.E. degree in ME will be able to:

1. An ability to apply the knowledge of mathematics, basic sciences and engineering concepts to solve the complex engineering problems.
2. The ability to conduct experiments and to critically analyze and interpret the experimental data to reach at substantial outcomes.
3. An ability to design systems, components, or processes to meet appropriate needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. An ability to identify, formulate, and solve the complex engineering problems.
5. An ability to function on multi-disciplinary teams that leads the multidisciplinary projects.
6. An understanding of professional and ethical responsibility.
7. An ability to communicate effectively with written, oral, and visual means.
8. An ability to understand the impact of engineering solutions in a global, environmental, economical and societal context.
9. An ability to recognize the need to engage in life-long learning.
10. An ability to attain knowledge of contemporary issues.

11. An ability to use the techniques, skills, and modern tools necessary for Mechanical engineering practice.
12. Possess ability to estimate costs, estimate quantities and evaluate materials for design and manufacturing purposes.

Course Description

This Course provides a simple understanding of Refrigeration and Air-conditioning fundamentals. Ideally suited to those with a little or no knowledge of the subject. The course consists of different refrigeration cycles and understanding of psychrometry and psychrometric processes used for the purpose of air-conditioning. Further, the comfort air-conditioning and indoor environment health are also addressed in this course.

Course Outcomes:

Upon successful completion of this course the student should be able to:

1. Familiarise you with the terminology associated with refrigeration and air-conditioning.
 2. To cover the basic principle of psychrometric and applied psychrometric.
 3. Familiarise you with load calculation and duct design.
 4. Familiarise you with the refrigerants, vapour compression refrigeration system and multi stage vapour compression system.
 5. Understand the concept of vapour compression refrigeration system and other cooling system.
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CO-PO MAPPING

Sr. No.	Course Outcome	PO
1	1. Familiarise you with the terminology associated with refrigeration and air-conditioning.	PO1,PO2
2	2. To cover the basic principle of psychrometric and applied psychrometric.	PO3
3	3. Familiarise you with load calculation and duct design.	PO1,PO3
4	4. Familiarise you with the refrigerants, vapour compression refrigeration system and multi stage vapour compression system.	PO1,PO3
5	5. Understand the concept of vapour compression refrigeration system and other cooling system.	PO2,PO3

B. Tech. VII Semester (Mechanical)

ME- 021X20 Refrigeration and Air conditioning

L T P/D Credit

Max Marks: 100

3-1-0 5

Final Exams: 70 Marks

Seasonal: 20 Marks

Internals: 10 Marks.

REFRIGERATION AND AIR CONDITIONING

1. Air refrigeration system: Refrigeration machine, heat pump, coefficient of performance, ideal refrigeration cycle, Bell – Coleman, refrigeration cycle, open and closed systems, application of air-refrigeration in air-crafts. Lecture : 6

2. 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, intercooler, flash chamber, accumulator and heat exchanger. Lecture : 8

3. Vapour absorption system : Simple and modified vapour absorption refrigeration system, Electrolux refrigerator, COP of heat operated refrigeration system. Lecture : 5

4. Special refrigeration system: Absorption, cascade, vortex, thermoelectric and steam jet refrigeration system. Lecture : 4

5. 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. Lecture :3

6. Equipment:Elementary discussion of refrigerating equipment, ice plant and cold storage. Lecture:1

7. Psychometry: 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, psychrometric charts and its uses, psychrometric processes evaporative cooling. Lecture : 5

8. Air conditioning: General principle and requirement for 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. Lecture : 10

GATE SYLLABUS

Refrigeration and Air conditioning

Power Engineering: Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat.

**MUZAFFARPUR INSTITUTE OF TECHANOLOGY,
MUZAFFARPUR**

Time Table (7th Semester) 2018

W.E.F 23/07/2018

Branch- Mechanical Engineering

Day	I	II	III	IV	1.00 to 2.00 PM	V	VI	VII
	9:00 to 10.00 AM	10.00 to 11.00 AM	11.00 to 12.00 PM	12.00 to 1.00 PM		2.00 to 3.00 PM	3.00 to 4.00 PM	4.00 to 5.00 PM
Monday					L U N C H		RAC R-53 TEST	
Tuesday	RAC R-53							
Wednesday				RAC R-53				
Thursday		RAC R-53						
Friday								
Saturday								

Sarvesh Kumar Yadav
In Charge

Principal
MIT MUZAFFARPUR

Student List

Branch	Name	Roll. No.
MECHANICAL ENGINEERING	ASHISH CHAURASIA	15M01
	RAJ KAMAL	15M02
	VIVEK KUMAR	15M03
	RAM BHADRA JHA	15M04
	RITU RAJ	15M05
	SUMIT KUMAR	15M06
	PAWAN KUMAR PIYUSH	15M07
	HIMANSHU KUMAR	15M08
	ANMOL	15M09
	MADHU PRIYA	15M10
	SANJAN KUMAR YADAV	15M11
	PRAVEEN KUMAR	15M12
	VIKASH KUMAR KESHRI	15M13
	AHSAN SOHAIL	15M14
	MUKESH KUMAR ROY	15M15
	SAJAN KUMAR	15M16
	SUMAN KUMAR SINHA	15M17
	RITESH KUMAR	15M18
	SHANUR RAHMAN WAHID	15M19
	MD AFTAB ALAM	15M20
	DHEERAJ KUMAR	15M21
	SAROJ KUMAR PASWAN	15M23
	MAYANK	15M24

	ASHOK DAS	15M25
	ALOKRAJ	15M26
	ASHIWANI KUMAR	15M28
	NEHAL ANSARI	15M29
	DHARMENDRA KUMAR	15M30
	ASHVANI KUMAR	15M31
	DHANANJAY KUMAR	15M32
	RAHUL KUMAR	15M33
	RANJAN KUMAR	15M34
	ANURAG KUMAR RAVI	15M35
	RAVI RAJ	15M36
	ANKIT AKASH	15M37
	PRAMENDRA KUMAR	15M38
	RAMESH KUMAR	15M39
	GANGA RAM MANDAL	15M40
	ROHIT KUMAR	15M41
	UJJWAL KASHYAP	15M42
	NISHANT KIRAN	15M44
	AMAN KUMAR JHA	15M46
	NITISH KUMAR	15M47
	NAVEEN KUMAR	15M48
	DHANANJAY KUMAR CHOUDHARY	15M49
	AAKASH KUMAR	15M50
	DEEPAK KUMAR	15M51
	SURANJAN KUMAR	15M52
MECHANICAL	MONU KUMAR	15M53

ENGINEERING	SANJEEV KUMAR ADITYA	15M54
	ISHA SHARMA	15M55
	NEETU GUPTA	15M56
	AMIT KUMAR	15M57
	MERAJ AHMED	15M58
	MANISH KUMAR SINGH	15M59
	ABHINANDAN KUMAR	15M60
	RAM KUMAR MAHTO	15M61
	ROHIT RAJ	15M62
	VIKAS KUMAR SAXENA	15M63
	SUMIT KUMAR	15M64
	PRAKASH KUMAR	15M65
	ANAND MOHAN DEO	15M66
	ADITYA KUMAR	15M67
	ADITYA KUMAR	16(LE)M01
	SHAKTI KUMAR	16(LE)M02
	ROHIT KUMAR	16(LE)M03
	KUMARI PRIYA RANJAN	16(LE)M04
	KAMLESH KUMAR	16(LE)M05
	KUMAR PRATIK VISHWAS	16(LE)M06
	VIKRANT KUMAR	16(LE)M07
	NIRBHAY KUMAR	16(LE)M08
	RAUSHAN KUMAR SINGH	16(LE)M09
HIMANSHU CHANDRA	16(LE)M10	

COURSE PLAN

College Name	MIT MUZAFFARPUR
Batch	2018
Semester	7
Course code	021X20
Course Name	Refrigeration and Air conditioning
Coursr Credit	5
Branch	Mechanical
Sections	VII sem
Course Coordinator	Sarvesh Kumar Yadav
Lecture/Tutorial Per Week	3/0

1. Scope and Objective of Course:

This course introduces students to Familiarise you with the terminology associated with refrigeration and air-conditioning.To cover the basic principle of psychrometric and applied psychrometric. Familiarise you with load calculation and duct design. Familiarise you with the refrigerants, vapour compression refrigeration system and multi stage vapour compression system. Understand the concept of vapour compression refrigeration system and other cooling system.

Text Book:

1. Refrigeration and air conditioning by C P Arora
2. Refrigeration and air conditioning by Manohar Prasad
3. Refrigeration and air conditioning by Jordon & Priester

Reference Book:

1. Refrigeration and air conditioning by Domkundwar
2. Refrigeration by Stoecker

COURSE PLAN: Refrigeration and Air Conditioning

S.No	Topic Name	Web Links for video lectures	Text Book / Reference Book / Other reading material	Periods
1	Dynamics of Machinery			
1.1	Air refrigeration system: Refrigeration machine, heat pump	https://onlinecourses.nptel.ac.in/noc16_me12/course	TB2	1
1.2	Coefficient of performance, ideal refrigeration cycle		TB2	1
1.3	Bell – Coleman, refrigeration cycle	nptel.ac.in/courses/112106133/Module_6/4_Reversed_Brayton_Cycle.pdf	TB2	1
1.4	Open and closed systems,		TB2	1
1.5	Application of air- refrigeration in air-crafts.		TB2	2
2	Various compression systems			
2.1	Simple vapour compression refrigeration cyclesub cooling and superheating of vapour	nptel.ac.in/courses/112106133/Module_6/6_Simple_Vapor_Compression_RS.pdf	RB1	2
2.2	Merits and Refrigerants demerits of this system over air refrigeration system		RB1	2
2.3	factors affecting the performance of a vapour compression refrigeration system		RB1	2
	wet and dry compression, multistage vapour compression system	https://nptel.ac.in/courses/112105129/pdf/RAC%20Lecture%2010.pdf		1
	Intercooler, flash chamber, accumulator and heat exchanger			1
3.0	Vapour absorption system			
3.1	Simple and modified vapour absorption refrigeration system		TB2	2

3.2	Electrolux refrigerator			2
3.3	COP of heat operated refrigeration system		TB2	1
4.0	Special refrigeration system			
4.1	Absorption, cascade, Vortex		RB2	2
4.2	Thermoelectric and steam jet refrigeration system		RB2	2
5	Refrigerants			
5.1	classification and nomenclature of refrigerants, selection of refrigerants	nptel.ac.in/courses/112105129/pdf/R&AC%20Lecture%2026.pdf	RB2	1
5.2	primary and secondary refrigerants		RB2	1
5.3	Properties of some common refrigerants, physical, chemical and thermodynamics properties		RB2	1
5.4	Leakage of refrigerants and methods of detection			1
6	Equipment			
6.1	Elementary discussion of refrigerating equipment,		TB2	1
6.2	Ice plant and cold storage		TB2	1
7	Psychrometry			
7.1	Properties of air vapour mixture, wet bulb, dew point & dry bulb temperatures, humidity, specific humidity		TB2	2
7.2	Degree of saturation, relative humidity	https://nptel.ac.in/courses/112105129/pdf/R&AC%20Lecture%2027.pdf	TB2	1
7.3	Humidity ratio total heat Psychrometric relation		TB2	1
7.4	Psychrometric charts and its uses		TB2	1
7.5	Psychrometric processes evaporative cooling.		TB2	1
8	Air conditioning			
8.1	General principle and requirement for comfort and air conditioning, thermodynamics of human body		TB2	2

8.2	Estimation of heating and cooling loads, capacity of cooling coils		TB1	2
8.3	Humidification and dehumidification unit and conditioner		TB2	2
8.4	Central air conditioner, year around air condition, humidity and temperature control		RB1	2
8.5	Industrial application of air conditioning system		RB2	2

Part-B	Topics for Mid Semester Examination(Serial Numbers only)	1 to 4
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Part-C	Assignment Numbers	Topics
1	Assignment #1	1,2
2	Assignment #2	3
3	Assignment #3	4,5
4	Assignment #4	6,7,8

5. Evaluation Scheme:

Component 1	Mid Semester Exam	20
Component 2	Assignment Evaluation	05
Component3	Attendance	05
Component 4**	End Term Examination**	70
	Total	100

Internal assessment is done through quiz tests, presentations, assignments and tutorial. 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 weight age followed by the University is given below

** 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.

6. Syllabus:

S.No	Topic Name	No of lectures	Weight age
Refrigeration and Refrigeration			
	Air refrigeration system: Refrigeration machine, heat pump Coefficient of performance, ideal refrigeration cycle Bell – Coleman, refrigeration cycle Open and closed systems, Application of air- refrigeration in air-crafts.	6	12%
Various compression systems			
	Simple vapour compression refrigeration cyclesub cooling and superheating of vapour Merits and Refrigerants demerits of this system over air refrigeration system factors affecting the performance of a vapour compression refrigeration system wet and dry compression, multistage vapour compression systemIntercooler, flash chamber, accumulator and heat exchanger	8	16%
Vapour absorption system			
	Simple and modified vapour absorption refrigeration system Electrolux refrigerator COP of heat operated refrigeration system	5	12%
Special refrigeration system			
	Absorption, cascade, Vortex Thermoelectric and steam jet refrigeration system	4	10%
Refrigerants			
	Classification and nomenclature of refrigerants, selection of refrigerants primary and secondary refrigerants Properties of some common refrigerants, physical, chemical and thermodynamics properties Leakage of refrigerants and methods of detection	3	10%
Equipment			
	Elementary discussion of refrigerating equipment, Ice plant and cold storage	1	6%

Psychrometry		
Properties of air vapour mixture, wet bulb, dew point & dry bulb temperatures, humidity, specific humidity Degree of saturation, relative humidity Humidity ratio total heat Psychrometric relation Psychrometric charts and its uses Psychrometric processes evaporative cooling.	5	15%
Air conditioning		
General principle and requirement for 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	10	19%

7. This document is approved by:

Designation	Name	Signature
Course Coordinator	Sarvesh kumar yadav	
H.O.D	Dr. Vikas kumar	
Principal	Dr. J.N. Jha	
Date		

Lecture Plan: Dynamic of Machines

S.No	Topic Name	Lecture Number	Date
1	Dynamics of Machinery		
1.1	Air refrigeration system: Refrigeration machine, heat pump	1,2	
1.2	Coefficient of performance, ideal refrigeration cycle	3	
1.3	Bell – Coleman, refrigeration cycle	4	
1.4	Open and closed systems,	5	
1.5	Application of air- refrigeration in air-crafts.	6	
2	Various compression systems		
2.1	Simple vapour compression refrigeration cyclesub cooling and superheating of vapour	7,8	
2.2	Merits and Refrigerants demerits of this system over air refrigeration system	9,10	
2.3	factors affecting the performance of a vapour compression refrigeration system	11,12	
	wet and dry compression, multistage vapour compression system	13	
	Intercooler, flash chamber, accumulator and heat exchanger	14	
3.0	Vapour absorption system		

3.1	Simple and modified vapour absorption refrigeration system	15,16	
3.2	Electrolux refrigerator	17	
3.3	COP of heat operated refrigeration system	18,19	
4.0	Special refrigeration system		
4.1	Absorption, cascade, Vortex	20,21	
4.2	Thermoelectric and steam jet refrigeration system	22,23	
5	Refrigerants		
5.1	classification and nomenclature of refrigerants, selection of refrigerants	24	
5.2	primary and secondary refrigerants	25	
5.3	Properties of some common refrigerants, physical, chemical and thermodynamics properties	26	
5.4	Leakage of refrigerants and methods of detection	27	
6	Equipment		
6.1	Elementary discussion of refrigerating equipment,	28	
6.2	Ice plant and cold storage	29	
7	Psychrometry		
7.1	Properties of air vapour mixture, wet bulb, dew point & dry bulb temperatures, humidity, specific humidity	30	
7.2	Degree of saturation, relative humidity	31	
7.3	Humidity ratio total heat Psychrometric relation	32	
7.4	Psychrometric charts and its uses	33	
7.5	Psychrometric processes evaporative cooling.	34	
8	Air conditioning		
8.1	General principle and requirement for comfort and air conditioning, thermodynamics of human body	35,36	
8.2	Estimation of heating and cooling loads, capacity of cooling coils	37,38	

8.3	Humidification and dehumidification unit and conditioner	39,40	
8.4	Central air conditioner, year around air condition, humidity and temperature control	41,42	
8.5	Industrial application of air conditioning system	43,44	