REFRIGERATION AND AIR CONDITIONING (ME701PC)

COURSE PLANNER

I. Course Overview:

Refrigeration and air conditioning are a branch of science that deals with human comfort and cooling of the target space and to maintain the space below the specified sink temperature. The science and process of the refrigeration cycles will be explained in detail. With the development, the demand for luxury is also increasing thus the application of refrigeration and air conditioning. The most common myth associated with RAC is that it only deals with cooling of the targeted space, but it also deals with the heating of the space in colder regions like Europe countries.

COURSE PURPOSE:

The subject of refrigeration and air conditioning is useful to various engineering stream such as Mechanical, Chemical, Civil Engineering, Bio-Tech Engineering. This is important for country's progress in terms of development index. There is a need for Renewable Energy utilization for cooling and space heating application. The purpose can be summarized in understanding and application of concepts of RAC for better utilization of resources.

II. PRE REQUISITES:

The knowledge of following subjects is essential to understand Power Plant Engineering

- Thermodynamics
- Thermal Engineering
- Heat Transfer
- Compressors
- Economics

III. Course Objective

1. To apply basic concept of thermodynamics to various process of RAC cycles.
2. To understand the functionality of various components involved in the refrigeration and air conditioning systems
3. Understand the construction and working and effect of various coponents of air conditioning unit on the purpose of conditioning

IV. Course Outcome

Sr. No.	Description	Blooms Taxonomy Level
CO1	Differentiate between the various refrigeration systems	L1: Knowledge
CO2	Applications & analysis of Conventional Refrigeration cycle	L1: Knowledge
CO3	Understanding of various components of Refrigeration cycles	L3: Applications
CO4	Understanding of Vapor absorption cycle and analysis	L4: Analysis
CO5	Designing of air conditioning for industrial applications	L4: Analysis

I. HOW PROGRAM OUTCOMES ARE ASSESSED

Program outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Assignments and Exams
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Assignments and Exams
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	1	Assignments and Exams
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	Assignments and Exams

PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.		--
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	2	Assignments and Exams
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	1	Assignments and Exams
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.		--
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.		--
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.		--
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	3	Assignments and Exams

PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	Assignments and Exams

II. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED

Program Specific Outcomes (PSOs)		**Level**	**Proficiency assessed by**
PSO1	The student will be able to apply the knowledge of Mathematics, Sciences and engineering fundamentals to formulate, analyze and provide solutions for the problems related to Mechanical engineering and communicate them effectively to the concerned.	3	Lectures, Assignments
PSO2	Design mechanical systems in various fields such as machine elements, thermal, manufacturing, industrial and inter-disciplinary fields by using various engineering/technological tools to meet the mercurial needs of the industry and society at large.	2	Projects
PSO3	The ability to grasp the latest development, methodologies of mechanical engineering and posses competent knowledge of design process, practical proficiencies, skills and knowledge of programme and developing ideas towards research.	2	Guest Lectures

III. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

	Program Outcomes (POs)											
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	-	-	-	2	1	-	2
CO2	3	3	2	-	1	-	-	-	2	1	-	2
CO3	3	3	2	1	1	-	-	-	2	1	-	2
CO4	3	3	2	1	1	-	-	-	2	1	-	2
CO5	3	3	2	1	1	-	-	-	2	1	-	2
	3.00	**2.80**	**2.00**	**1.00**	**1.00**	**-**	**-**	**-**	**2.00**	**1.00**	**-**	**2.00**

PROGRAM SPECIFIC OUTCOMES:

Course Outcomes (COs)	Program Specific Outcomes (PSOs)		
	PSO1	**PSO2**	**PSO3**
CO1.	3	2	2
CO2.	3	2	2
CO3.	3	2	2
CO4.	3	2	2
CO5.	3	2	2
Average	**3.00**	**2.00**	**2.00**

COURSE CONTENT:

JNTUH SYLLABUS

Pre-requisite: Thermodynamics
Course Objective: To apply the principles of Thermodynamics to analyze different types of refrigeration and air conditioning systems and to understand the functionality of the major components.

Course Outcomes: At the end of the course, the student should be able to Differentiate between different types of refrigeration systems with respect to application as well as conventional and unconventional refrigeration systems. Thermodynamically analyse refrigeration and air conditioningsystems and evaluate performance parameters. Apply the principles of Psychometrics to design the airconditioning loads for the industrial applications.

UNIT – I
Introduction to Refrigeration: - Necessity and applications – Unit of refrigeration and C.O.P. –
Mechanical Refrigeration – Types of Ideal cycle of refrigeration.
Air Refrigeration: Bell Coleman cycle and Brayton Cycle, Open and Dense air systems – Actual air
refrigeration system – Refrigeration needs of Air crafts- Air systems – Application of Air Refrigeration,
Justification – Types of systems – Problems.

UNIT – II

Vapour compression refrigeration – working principle and essential components of the plant – Simple

Vapour compression refrigeration cycle – COP – Representation of cycle on T-S and p-h charts – effect

of sub cooling and super heating – cycle analysis – Actual cycle Influence of various parameters on

system performance – Use of p-h charts – Problems.

UNIT - III

System Components: Compressors – General classification – comparison – Advantages and Disadvantages. Condensers – classification – Working Principles. Evaporators – classification –

Working Principles. Expansion devices – Types – Working Principles. Refrigerants – Desirable

properties – common refrigerants used – Nomenclature – Ozone Depletion – Global Warming –

Azeotropes and Zeotropes.

UNIT - IV

Vapor Absorption System – Calculation of max COP – description and working of NH3 – water system

– Li – Br system. Principle of operation Three Fluid absorption system, salient features.

Steam Jet Refrigeration System – Working Principle and Basic Components

Principle and operation of (i) Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube.

UNIT – V

Introduction to Air Conditioning: Psychometric Properties & Processes – Sensible and latent heat

loads – Characterization – Need for Ventilation, Consideration of Infiltration – Load concepts of RSHF,

ASHF, ESHF and ADP.

Concept of human comfort and effective temperature –Comfort Air conditioning – Industrial air

conditioning and Requirements – Air conditioning Load Calculations.

Air Conditioning systems - Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, deodorants, fans and blowers.

Heat Pump – Heat sources – different heat pump circuits – Applications.

TEXT BOOKS:

1. Refrigeration and Air conditioning / CP Arora / Mc Graw Hill

2. Refrigeration and Air-Conditioning / RC Aora / PHI

REFERENCE BOOKS:

1. Principles of Refrigeration - Dossat / Pearson

2. Basic Refrigeration and Air-Conditioning / Ananthanarayanan / Mc Graw Hill

GATE SYLLABUS:

Refrigeration and Air-conditioning:

Vapour refrigeration cycle, heat pumps, gas refrigeration, Reverse Brayton cycle; moist air: psychrometric chart, basic psychrometric processes.

IES SYLLABUS:

Heat pump and Refrigeration cycles and systems, Refrigerants. Condensers, Evaporates and Expansion devices, Psychrometry, Charts and application to air conditioning, Sensible heating and cooling, Effective temperature, comfort indices, Load calculations, Solar refrigeration, controls, Duct design

Course Planner

Lecture No	Unit No.	Topics to be covered	Content to be covered under each topic	PPT Link	Pdf Link	Course Outcomes (COs)	Reference
1	1	Necessity and applications – Unit of refrigeration and C.O.P.	Definition of Refrigeration Necessity of Refrigeration Applications of RefrigerationUnits of refrigeration	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1
2		Mechanical Refrigeration – Types of Ideal cycle of refrigeration	Types of Refrigeration Explanation about Mechanical Refrigeration Types of Ideal cycle of Refrigeration	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1

3		Bell Coleman cycle and Brayton Cycle	Bell Coleman cycle Its processes Bell Coleman cycle Applications Brayton cycle Cycles of Brayton cycles Application of Brayton cycle Calculations on Brayton cycles	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1
4		Open and Dense air systems	Types of Air systems Open air systems Dense air systems Calculations on open and dense air systems	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1
5		Actual air refrigeration system	Air Refrigeration system Cycle of Air Refrigeration system Calculation of COP in air refrigeration systems	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1
6		Refrigeration needs of Air crafts-Air systems	Needs of refrigeration systems in air crafts Calculations of COP in aircrafts	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO3	T1

7		Application of Air Refrigeration, Justification	Importance of Air Refrigeration system Applications of Air Refrigeration systems	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO3	T1
8		Types of systems – Problems	Problems on Bell Coleman cycle Problems on Brayton cycle	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO2, CO3	T1
9		Types of systems – Problems	Problems on Air refrigeration system Calculations of COP	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO3	T1
10	2	Vapor compression refrigeration – working principle	Definition of Vapor Refrigeration system Components of Vapor Refrigeration system	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	

11		Essential components of the plant – Simple Vapour compression refrigeration cycle	Simple Vapor Refrigeration system Components involved in Vapor Refrigeration system	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1
12		COP – Representation of cycle on T-S and p-h charts	Definition of COP Representation of T-S diagram in Vapor Refrigeration system P-S diagram in Vapor Refrigeration system	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1
13		Effect of sub cooling and super heating	Definition of Sub cooling Effects of Sub Cooling Definition of Superheating Effects of Super	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1
14		cycle analysis	Definition of Cycle Analysis Cycle processes Cycle calculations	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1

15		Actual cycle Influence of various parameters on system performance	Actual cycle performance Factors involved in the system Influence of parameters on the system	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO2, CO3	T1
16		Use of p-h charts – Problems	Use of P-H chart Problems involved in P-H chart	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO3	T1
17		Use of p-h charts – Problems	P-H chart problems	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO3	T1
18		Use of p-h charts – Problems	P- H chart problems	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing		

19		Compressors – General classification	Types of compressors Functioning of compressor Working principle of compressors	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing		
20		comparison – Advantages and Disadvantages	Comparison of compressors Advantages of compressorsDis advantages of the compressors	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing		
21		Condensers – classification	Different types of condensers Components involved in Condensers Processes involved in condenser	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing		
22	3	Working Principles of condensers	Working principles of condensers Advantages and dis advantages of condensers Applications of Condensers	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing		

23		Evaporators – classification	Types of Evaporators Functioning of Evaporators	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing		
24		Working Principles of Evaporators	Working Principles of Evaporators Advantages and dis advantages of Evaporators	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing		
25		Expansion devices – Types	Different types of Expansion devices The functioning of Expansion devices	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing		
26		Working Principles of Expansion devices	Working Principles of Expansion devices Advantages and dis advances of Expansion devices	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing		

27		Refrigerants – Desirable properties – common refrigerants used	Different types of Refrigerants The desirable properties of refrigerents	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1
28		Ozone Depletion – Global Warming, Azeotropes and Zeotropes	Definition of Ozone depletion Global Warning importance Explanation about Azeotropes Explanation about Zeotropes	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1
29	4	Vapor Absorption System – Calculation of max COP	Explanation about vapor Absorption system Different types of vapor absorption systems Calculation of max COP	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1
30		Description and working of NH3 – water system	Description vapor Absorption system Working of NH3 – Water systems	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1

31		Description and working of NH3 - (Li – Br) system.	Description of NH3-(Li-Br) system Working of NH3-(Li-Br) system Advantage and dis advantages of NH3-(Li-Br) system	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1IUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1
32		Principle of operation Three Fluid absorption system, salient features	Definition of three fluid absorption system Principle of operation three fluid absorption system Salient features of three fluid absorption system Components involved in three fluid absorption system	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1IUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO3	T1
33		Steam Jet Refrigeration System	Components involved Steam Jet Refrigeration System Importance of Steam Jet Refrigeration System	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1IUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO3	T1

34		Working Principle and Basic Components	Working principles of Steam Jet Refrigeration System Advantages and dis advantages of Steam Jet Refrigeration System	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO2, CO3	T1
35		Principle and operation of (i) Thermoelectric refrigerator	Definition of thermoelectric refrigerator Working principles of thermoelectric refrigerator Advantages and dis advantages of thermoelectric refrigerator	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO3	T1
36		Working Principle and Basic Components of Vortex tube or Hilsch tube	Basic components involved in Vortex tube Working Principle of Vortex tube Advantages and dis advantages of Vortex tube	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	

37	5	Introduction to Air Conditioning: Psychometric Properties & Processes	Introduction to Air Conditioning Types of Air conditioning Psychrometric properties of air Different processes involved in Psychrometric processes	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1
38		Sensible and latent heat loads – Characterization	Definition of Sensible heat, Definition of latent heat, Loads calculationsCharacterization of loads	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1
39		Need for Ventilation, Consideration of Infiltration – Load concepts of RSHF, ASHF, ESHF and ADP	Importance of ventilation, Importance of infiltration, Load calculations Definitions of RSHF, ASHF, ESHF and ADP	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1

40		Concept of human comfort and effective temperature	Definition of human comfort, Concept of human comfort, Effective temperature	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1
41		Air conditioning Load Calculations	Load calculations in air conditioningDifferent load calculations	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO3	T1
42		Air Conditioning systems - Classification of equipment, cooling, heating humidification and dehumidification	Different types of Air conditioning systems Classification of the equipment Concept of cooling Definitions of heating humidification and dehumidification	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO3	T1

43		heating humidification anddehumidification	Humidification Dehumidification	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1
44		filters, grills and registers, deodorants, fans and blowers	Uses of filters, grills and registers, deodorants, fans and blowers in air conditioning	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO2, CO3	T1
44		Heat Pump – Heat sources	Different types of heat pumps Schematic diagram of heat pump, Sources of heat pumps	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO3	T1
45		Different heat pump circuits – Applications.	Different types of heat pumps Schematic diagram of heat pump. Sources of heat pumps	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1

46		Different heat pump circuits – Applications.	Different types of heat pumps Schematic diagram of heat pump. Sources of heat pumps	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1
47		Different heat pump circuits – Applications.	Different types of heat pumps Schematic diagram of heat pump. Sources of heat pumps	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1
48		Different heat pump circuits – Applications.	Different types of heat pumps Schematic diagram of heat pump. Sources of heat pumps	https://drive.google.com/drive/folders/1Sfkm5b6ULB6S0uL6LYJ9CB6sPqHSNaax?usp=sharing	https://drive.google.com/drive/folders/1lUYBB8NYU9UDece9a0Cb1yRd-4ehXL8W?usp=sharing	CO1	T1

QUESTION BANK: JNTUH:

DESCRIPTIVE QUESTIONS:

UNIT-1

Q.No.	Questions	Blooms Taxonomy	Course Outcome
1	i) Define the following terms of refrigeration a. Refrigerating effect b. Ton of Refereigeration	Knowledge	1

	c. COP d. Referigerator and COP		
2	2. A refrigerator works on the Carnot cycle between the temperatures -70C and 27 0C. It makes 500 kg of ice per hour at -50 C from water at 140C. Find power required to drive the compressor and COP of the cycle. Take specific heat of ice as 2.4 kJ / kg 0C and latent heat 334.4 kJ/kg.	**Analysis**	**2**
3	Draw the refrigeration cycle on T-s diagram when the refrigerant is dry and saturated at the end of compression and find an expression for the COP in terms of a. temperature and entropies b. Enthalpies	**Knowledge**	**1**
4	A CO2 refrigerating plant works between the pressure limit of 56 and 21 bar. The vapour leaves the compressor at 34 0C and there is no under cooling in the condenser. Find theoretical COP of the system. Assume total heat per kg of vapour after leaving the compressor is 230kJ/kg.	**Apply**	**1**
5	Define refrigeration? Explain the necessity and applications of refrigeration? Define ton of refrigeration? Write about mechanical refrigeration system?	**Understand**	**1**
6	List out the advantages of vapour compression refrigeration system over air refrigeration system.	**Knowledge**	**1**
7	A refrigerating machine using NH3 operates between the temperature limits of -15C and 30C. Find the COP of the system. Also find the corresponding value for a reversed Carnot cycle operating between the same temperatures. Make the necessary assumptions.	**Apply**	**1**
8	What is sub-cooling and super heating? Explain with the help of diagram, why is super heating considered to be good in certain cases?	**Understand**	**2**
9	A F-12 refrigeration machine works between the pressures of 9.9 and 3.3 bars. The condition of the vapour leaving the compressor is 92% dry and there is under cooling in the condenser. Determine the theoretical COP of the machine.	**Knowledge**	**1**
10	Draw the refrigeration cycle on T-s diagram when the refrigerant is dry and saturated at the end of compression and find an expression for the COP in terms of	**Knowledge**	**2**

	a. Temperature and entropies b. Enthalpies		
11	A CO2 refrigerating plant works between the pressure limit of 56 bar and 21 bar. The vapour leaves the compressor at 340C and there is no under cooling in the condenser. Find theoretical COP of the system. Assume total heat per kg of vapour after leaving the compressor is230 kJ/kg.	**Apply**	**2**
12	Explain the simple vapour compression refrigeration system with essential components representing on T-S diagram? What are the advantages of VCR over air refrigeration system?	**Understand**	**2**

UNIT-2

Q.No.	Questions	Blooms Taxonomy	Course Outcome
1	Define evaporator? Classify the evaporators and explain any two types of evaporators used in refrigeration with neat diagram.	**Knowledge**	**3**
2	Define expansion device? Classify the expansion devices and explain the working principles of expansion device?	**Knowledge**	**3**
3	Define compressor? Classify the compressors and explain any one types of compressor used in refrigeration with neat diagram.	**Knowledge**	**3**
4	Define condenser? Classify the condenser devices and explain the working principles of condenser device?	**Knowledge**	**3**

UNIT-3

Q.No	Question	Blooms Taxonomy	Course Outcome
1.	An ammonia refrigerator works between 180C and 280C. The vapour is dry at the end of isentropic compression. Assuming there is no under cooling, calculate (a) Theoretical COP (b) Power of the compressor to absorb 92000 kJ of heat per hour. Compare the COP obtained with that of an ideal reverse Carnot cycle working between the same temperature limits. Represent both the cycles on p-h	**Apply**	**4**

	chart		
	(a) Explain how would you detect whether a refrigerant is under charged or overcharged. (b) An ammonia refrigerator works between - 6.7 0C and 26 0C. The vapour leaves the compressor in dry and saturated condition. Assuming there is no under cooling; find the theoretical COP of the system.	**Knowledge**	**4**
2.	(a) Discuss the advantages of vapor absorption refrigeration system over Vapour Compression refrigeration system. (b) What are the different refrigerant absorbent working pairs and what is the effect of evaporator temperature on performance of absorption systems?	**Understand**	**3**
3.	(a) Explain with the help of neat sketches the various components and their functions for a vapour absorption refrigeration system. (b) Discuss the function of rectifier and analyser in vapour absorption refrigeration systems.	**Understand**	**4**
4.	(a) Mention the function of each fluid in a three-fluid vapour absorption system. (b) Explain how the function of compressor in vapor compression system is achieved in vapor absorption refrigeration system.	**Understand**	**4**
5.	Explain the working and operation of Li-Br-water absorption system detailing its features and applications?	**Understand**	**4**
6.	(a) What is the situation under which the Steam Jet Refrigeration system is recommended? What are its limitations? Can it be used for obtaining sub-zero temperatures? (b) Explain the various components of Steam Jet Refrigeration system and clearly discuss the function of each component.	**Understand**	**4**
7.	A steam jet refrigeration system is to supply 1200 kg per minute of chilled water at 6.5C. The makeup water from the mains is at 27C. If the steam supply is available at 9.5 bar and 200C and nozzle, entrainment and diffuser efficiency can be assumed as 89%, 63% and 72% respectively, the quality of vapour entering the ejector may be assumed 0.98, and condensate leaves the condenser at 33C.Determine: (a) Steam consumption in kg/hour and kg/hr per ton of refrigeration (b) Heat rejected in the condenser in kJ/hr and kJ/hr per ton of refrigeration.	**Apply**	**4**

UNIT-4

Q.No.	Questions	Blooms Taxonomy	Course Outcome
1	A laboratory has a volume of 450 m3, and is to be maintained at 220C, 55% RH.The air in the room is to be completely changed once every hour and is drawn from the atmosphere at 1.1 bar, 340C, 83% RH, by a fan absorbing 0.5 kW. This air passes through a cooler which reduces its temperature and causes condensation, the condensate being drained o_ at 60C. The resulting saturated air is heated to room condition. The total pressure is constant throughout. Determine: The temperature of the air leaving the cooler, The rate of condensation, The heat transfer in the cooler.	**Apply**	**5**
2	(a) Discuss the conditions of comfort you would prescribe for one building in a city, which has hot and humid climate. (b) An air-conditioned room is maintained at 27^0C DBT and 52% R.H. The sensible heat load of the room is 27 kW, and room SHF is 0.80. Determine: i. room latent heat gain ii. The apparatus dew point temperature iii. The air supply to the room in m3/min, if it is supplied to room at apparatus dew point temperature.	**Understand**	**5**
3	(a) When do the DBT, WBT and DPT become equal? (b) Air at 37^0C, 44 percent relative humidity, is cooled to 23^0C by spraying water at 13^0C into it. The mixture pressure remains constant at 101.3 kPa. Assuming that all of the water evaporates and that the mixing occurs in an insulated duct, calculate the mass of water added per kilogram of air. (c) What are different latent heat loads that are to be considered in the design of air conditioners?	**Apply**	**5**
4	For hot and dry weather conditions show the arrangement of summer air conditioning system and represent the processes on psychometric chart. Air at 420C and 32% relative humidity is passed through an adiabatic air washer at the rate of 30 m3/min. Find the state of air leaving the air washer, if the effectiveness of the air washer is 82%. Explain the following terms: Specific volume of humidity	**Apply**	**5**

	air, Specific volume of humidity air , Density of humidity air , Enthalpy of humidity air		
5	Define relative humidity, specific humidity, and dew-point temperature and describe a theoretical method for determining their values	**Understand**	**5**
6	(a) What is the difference between wet bulb temperature and thermodynamic wet bulb temperature? (b) Twelve grams of moisture per kg of dry air is removed from atmospheric air when it is passed through an air-conditioning system and its temperature becomes 27^0C. The atmospheric conditions are 44^0C DBT and 64 % R .H. Find the following: Relative Humidity, Dew point Temperature, Wet bulb temperature (Take air pressure as 4.03bar)	**Understand**	**5**
7	.The air in a room is to be maintained at 19 0C and 54 % R.H. by air supplied at a of 14°C. The designs out-door conditions are as follows: Sensible heat gain: 20000 kJ/hr, Latent heat gain: 4000 kJ/hr, Out-door conditions: 30C DBT and 42% R.H.The ratio of recirculated air to fresh air is fixed at2.8: 1 by weight .The plant consists of direct expansion cooling coil and after-heater and a constant speed fan. Calculate: i. The quantity of air supplied per minute in cubic metres ii. The load on refrigerating plant in tons of refrigeration assuming the bypass factor of the cooling coil 0.15 iii. The load on after - heater in kW.	**Analysis**	**5**
8	What is a sling psychrometer? Make a neat sketch and explain its use.	**Understand**	**5**
9	a) Why ventilation is required? Explain why different ventilation standards for different purposes are recommended. (b)What are the important considerations in the design of an air conditioning system	**Understand**	**5**
10	The following data refer to an air conditioning system for industrial process for hot and wet summer conditions: outdoor conditions = 33 0C DBT and 78% RH, required	**Analysis**	**5**

	conditions = 20 0C DBT and 73% RH, amount of out-door air supplied= 220 m3/min, coil dew point temperature = 12 C. If the required condition is achieved by first cooling and dehumidifying and then by heating, find: The capacity of the cooling coil and its by-pass factor, The capacity of the heating coil and surface temperature of the heating coil if the by-pass factor is 0.18		
11	The following data refer to an air conditioning system for industrial process for hot and wet summer conditions: outdoor conditions = 33 0C DBT and 78% RH, required conditions = 20 0C DBT and 73% RH, amount of out-door air supplied= 220 m3/min, coil dew point temperature = 12 C. If the required condition is achieved by first cooling and dehumidifying and then by heating, find: The capacity of the cooling coil and its by-pass factor, The capacity of the heating coil and surface temperature of the heating coil if the by-pass factor is 0.18	**Analysis**	**5**

UNIT-5

Q.No	Question	Blooms Taxonomy	Course Outcome
1	Which type of air cleaner would be selected for removing very small dirt particles and smoke from the air? Explain its working principle.	**Understand**	**5**
2	Explain the advantages and disadvantages of viscous filters over dry filters.	**Understand**	**5**
3	(a)What are the specific problems concerned to factory air conditioning. (b) What methods are adopted for factory air conditioning?	**Knowledge**	**5**
4	What are the various sources for heat pump? Discuss each one of them briefly.	**Knowledge**	**5**
5	Briefly explain the working of a constant volume variable temperature air conditioning system with the help of refrigeration control with a neat sketch.	**Knowledge**	**5**

JNTUH OBJECTIVE QUESTIONS

UNIT-1

1. The co-efficient of performance (COP) of a refrigerator working on a reserved carnot cycle is mathematically equal to [ ]

   a. (T1-T2)/ T1
   c. T2/(T1-T2)
   b. T1/ (T2 -T1)
   d. (T2 -T1) /T1

2. Horse power per ton of refrigeration is expressed as [ ]

   a. 4.75/COP
   c. 4.75*COP
   b. COP/4.75
   d. 47.5/COP

3. Air refrigeration operates on [ ]

   a. carnot cycle
   c. rankine cycle
   b. reversed carnot cycle
   d. brayton cycle.

4. The relative coefficient of performance is [ ]

   a. actual COP/theoretical COP
   c. actual COP X theoretical COP
   b. theoretical COP/actual COP
   d. 1- actual COP X theoretical COP

5. one ton of refrigeration is equal to the refrigeration effect corresponding to melting of 1000 kg of ice [ ]

   a. in 1 hour
   c. in 24 hours
   b. in 1 minute
   d. in 12 hours

6. If T_1 and T_2 be the highest and lowest absolute temperatures encountered in a refrigeration Cycle working on a reversed Carnot cycle, then COP is equal to [ ]

   a. $T_1/T_1 - T_2$
   c. $T_1 - T_2 / T_1$
   b. $T_2 / T_1 - T_2$
   d. $T_1 - T_2 / T_2$

7. Heat is absorbed by a refrigerant, during a refrigeration cycle in a [ ]

   a. Condenser
   c. Compressor
   b. Evaporator
   d. Throttle valve

8. A domestic refrigerator has the co-efficient of performance [ ]

a. equal to 1.0 c. more than 1.0

b. less than 1.0 d. any value

9. On the pressure-enthalpy diagram, condensation and desuperheating is represented by a horizontal line because the process [ ]

(a)Takes place at constant pressure (b) Takes place at constant temperature

(c) Takes place at constant entropy (d) Takes place at constant enthalpy

10. Most of the domestic refrigerators work on the following refrigeration system [ ]

(a) vapour compression (b)vapour absorption

(c)Carnot cycle (d)Electrolux refrigerator

11. . Presence of a flash gas in the liquid feed to the expansion valve can cause the problem of [ ]

(a)feeding the evaporator unevenly (b)loss of cooling capacity

(c)damage to the valve (d) all of the above

UNIT---2

1. For better cop of refrigerator, the pressure range corresponding to temperature in evaporator and condenser must be [ ]

a. Small c. Equal

b. High d. anything

2. The bank of tubes at the back of domestic refrigerator are [ ]

a. condenser tubes c. capillary tubes

b. evaporator tubes d. throttling device

3. Presence of moisture in a refrigerant affect the working of [ ]

a. compressor c. evaporator

b. condenser d. expansion valve

4. The widely used refrigerant in domestic refrigerator ,is_____.
5. The refrigerant used for steam jet refrigeration is_____.
6. The boiling point of Freon-22 is_____.
7. The refrigerant should have the freezing temperature_____.
8. The refrigerant with lowest specific volume is_____

UNIT---3

1. The refrigerant used in vapour absorption refrigerator is [ ]

    a. freon-12
    c. CO_2
    b. ammonia
    d. Aqua-ammonia

2. Which of the following refrigerant used in the steam jet refrigeration? [ ]

    a. Ammonia
    c. Water
    b. R12
    d. Air

3. The c.o.p of the vapour absorption cycle as compared to vapour compression is_____.
4. Allowable pressure on high-pressure side or ammonia absorption system is of the order of _____.

UNIT—4

1. Air-Conditioning is the simultaneous control of ----------in a confined space

a. Temperature and air movement

b. Temperature and humidity

c. Temperature, humidity and air movement

d. Temperature, humidity, purity and air movemen

2. The temperature of air –water mixture recorded by a thermometer when its bulb is covered with a wick saturated with water and placed in the air-water stream is called [ ]

a. Dry bulb temperature

b. Wet bulb temperature

c. Saturation temperature

d. Dew point temperature

3. The Wet bulb depression is zero when Relative humidity equals [ ]

e. 0

f. 0.5

g. 0.75

h. 1

4. During sensible cooling of air its wet bulb temperature _____and dew point_____.

5. Air at 20^0c DBT and 40% RH is heated up to 40^0c using an electric heater whose surface temperature is maintained uniformly at 45^0c .The bypass factor of the heater is_____.

6. The mixing of two or more streams of moist air in Air-conditioning is_____ process.

7. If *S* is the sensible heat and *L* the latent heat, then sensible heat factor is given by _____.

UNIT---5

1. Which is not true in the context of axial flow fans? [ ]

a. Produces flow of air in a direction parallel to the axis of rotation

b. Suitable for handling large volumes

c. Quiet and efficient operation

d. Used in Industrial ventilation and Air-conditioning system

2. The filters used to arrest the impurities from air in air –conditioning system are placed [ ]

a. At entry to the fan

b. a head of heating/cooling coils

c. behind the heating/cooling coils

d. ahead or behind the heating/cooling coils

3. The process generally used for Summer air-conditioning is _____

4. A fibrous material such as glass wool having cardboard frames and retaining grills is used in _____ filters.

5. Grills are used for _____in Air-conditioning system.

6. A desicant is a solid substance capable of removing _____ from a gas ,liquid or solid

ii) GATE QUESTIONS:

1. If a mass of moist air in an airtight vessel is heated to a higher temperature, then

(A) Specific humidity of the air increases (B) Specific humidity of the air decreases

(C) Relative humidity of the air increases (D) Relative humidity of the air decreases

2. A moist air sample has dry bulb temperature of 30ºC and specific humidity of

11.5g water vapour per kg dry air. Assume molecular weight of air as 28.93. If

the saturation vapour pressure of water at 30ºC is 4.24kPa and the total pressure

is 90kPa, then the relative humidity (in %) of air sample is

(A) 50.5 (B) 38.5 (C) 56.5 (D) 68.5

3. In an ideal vapour compression refrigeration cycle, the specific enthalpy of

refrigerant (in kJ/kg) at the following states is given as:

Inlet of condenser: 283 Exit of condenser: 116 Exit of evaporator: 232

The COP of this cycle is (A) 2.27 (B) 2.75 (C) 3.27 (D) 3.75

4. The pressure, dry bulb temperature, and relative humidity of air in a room are 1bar, 30ºC and 70% respectively. If the saturated steam pressure at 30ºC is 4.25kPa, the specific humidity of the room air in kg water vapour / kg dry air is

(A) 0.0083 (B) 0.0101 (C) 0.0191 (D) 0.0232

iii) <u>IES QUESTIONS:</u>

1.In an ideal vapour compression refrigeration cycle the refrigeration effect is 80 kJ/kg of refrigerant flow. The COP is 4. If the flow of the refrigerant is 2 kg/s, the heat rejected in the condenser is

(a) 50 Kw (b) 100 kW (c) 150 kW (d) 200kW

2. In the expansion valve of a refrigerator the following property remains constant

(a) entropy(b) enthalpy(c) Internal energy (d) product

3. The saturation temperature of water vapour at its partial pressure is equal to

(a) wet bulb temperature (b) dew point temperature

(c) adiabatic saturation temperature (d) dry bulb temperature

3..A refrigerator operating on standard vapour compression cycle has COP = 5.5 and is driven by 40 kW compressor. Saturated liquid and saturated vapour enthalpies at condensing temperature of 30°C are 69.55 kJ/kg and 201.45 kJ/kg respectively. Saturated refrigerant vapour leaving the evaporator has enthalpy of 187.53 kJ/kg. Find refrigerant temperature at compressor discharge. (Take c pof

refrigerant vapour as 0.6155 kJ/kg K.

(a) 40.2°C (b) 41.2°C (c) 42.2°C (d) 43.2°C

4. In a 3 ton capacity water cooler, water enters at 30°C and leaves at15°

C steadily. What is the water flow rate per hour?

(a) 60 kg (b) 100 kg (c) 602 kg (d) 2520 kg

5..In a vapour compression cycle, a good refrigerant should have a

(a) large latent heat of vaporization at condenser pressure.

(b) large latent heat of evaporator Pressure.

(c) condenser pressure close to critical pressure

(d) low critical pressure

6.It is not a cause for discouragement of the use of Chloroflourocarbon

(CFC) refrigerants in domestic refrigerators and air conditioners for

(a)their ozone depletion potential (b) their global warming potential

(c) their tendency to migrate to the upper atmosphere by molecular

diffusion. (d) their toxicity and non availability

7. The room sensible heat loss is 30,000 kJ/h and the latent heat loss is 20,000 kJ/h. Then the sensible heat factor is

(a)0.6 (b) 0.6 (c) 0.3 (d) 3.

8..When unsaturated air is adiabaticallysaturated, which of the following properties decrease?

1. Dry bulb temperature 2. Wet bulb temperature 3. Relative Humidity

4. Specific Humidity

9.It is desired to condition the outside air from 80% relative humidity and45°C humidity and 25°C dry bulb temperature. The practical arrangement will be

(a) heating and humidification

(b) heating and dehumidification

(c) cooling and humidification

(d) cooling and dehumidification

10.Which parameters are the independent variables in the construction of psychometric plot for a particular value of barometric pressure?

(a) Dry bulb temperature and specific humidity

(b) Wet bulb temperature and relative humidity

(c) Dry bulb temperature and wet bulb temperature

(d) Dry bulb temperature and enthalpy

11. If air at 2°C is heated to 25°C using heater with a surface temperature of30°C then, the by-pass factor is

(a) 2.0 (b) 0.5 (c) 1.0 (d) None of the above

12..The atmospheric air at dry bulb temperature 15°C enters a heating coil maintained at 40°C. If the air leaves the heating coil at 30°C, the coil efficiency is equal to

(a) 0.2 (b) 0.4 (c) 0.6 (d) 0.75

13.Equal friction method for designing air conditioning duct.

(a) ensures constant static pressure at all terminals in the duct.

(b) ensures same velocity in the duct all through in all branches

(c) automatically reduces the air velocity in the duct in the direction of flow.

(d) does non of the above,

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SEMINARS:

1. Deffrent Refrigeration Systems
2. Deffrent air-conditioning systems

CASE STUDIES/SMALL PROJECTS:

1. Making of vapour compression refrigeration systems.
2. Making of vapour absorption refrigeration systems.
3. Servicing of refrigerators.
4. Design of air conditioning systems.