J.C. Bose University of Science and Technology, YMCA, Faridabad
Department of Mechanical Engineering
Teaching Plan (2025-26) Odd Semester

Name of Faculty			**Prof. Raj Kumar**		
Class			**M-52 (14.07.2025 to 21.11.2025)**		
Subject			**Refrigeration and Air Conditioning**		
No. of Credits	**3**	**Sessional**	**25 Marks**	**Total Theory**	**75 Marks**
L-T-P	**3 -0 - 3**	**Total**	**100 Marks**	**Duration of Exam**	**3 Hours**
Pre-Requisite	**Thermodynamics**	**Successive:**	**Air Conditioning Equipments, Estimation and Design of RAC Plants**		
Course Objectives	**The objective of studying this course is to describe the refrigerants, analyze refrigeration systems & various controls, estimation of the heating & cooling load and design air conditioning systems**				
Course Outcomes (COs):	**At the end of the course, the student shall be able to:**				
CO 1	**Classify the refrigerants and analyze the various conventional refrigeration systems.**				
CO 2	**Describe the refrigeration systems other than the conventional refrigeration systems.**				
CO3	**Analyze the different psychometric processes & evaluate cooling and heating loads.**				
CO 4	**Illustrate the different devices used in RAC systems.**				
	Syllabus outline and Plan				

Class	**Unit**	**Mode of Delivery**	**Course Content**
1	**Unit 1** **Basic of Refrigeration and Air refrigeration**	**PPT/ White Board/ Demonstration.**	• **Course objective and Outcome discussion,** • **General discussion on Refrigeration,** **Methods of refrigeration, Industrial Refrigeration; Unit of refrigeration; Coefficient of performance (COP),** • **Basic Thermodynamics recall and discussion is also part before start this lecture,** • **Counselling of class,** • **Summary.**
2	**Unit 1** **Basic of Refrigeration and Air refrigeration**	**PPT/ White Board/ Demonstration.**	• **Recall of discussions in previous class,** **Refrigerants mixtures - Definition, Classification, Nomenclature, Desirable**

			properties, Comparative study, secondary refrigerants, Introduction to eco-friendly new Refrigerants and their analysis Refrigerants properties and characteristics- Ozone depletion and global warming issues, • **Assignment 1 on "Refrigerants" distribution and discussion on it,** • **Questioning in class,** • **Surprise quizzes,** • **Counselling,** **Summary.**
3	**Unit 1** **Basic of Refrigeration and Air refrigeration**	**PPT/ White Board/ Demonstration.**	• **Recall of discussions in previous class,** **Air Refrigeration Systems: Brayton refrigeration or the Bell Coleman air refrigeration cycle,** • **Problems Discussion,** • **Questioning in class,** • **Surprise quizzes,** • **Counselling,** **Summary.**
4	**Unit 1** **Basic of Refrigeration and Air refrigeration**	**PPT/ White Board/ Demonstration.**	• **Problems Discussion,** • **Questioning in class,** • **Surprise quizzes,** • **Counselling.** • **Assignment 2 distribution on Carnot and Bell-Colemen and discussion on it,** **Summary.**
5	**Unit 1** **Basic of Refrigeration and Air refrigeration**	**PPT/ White Board/ Demonstration.**	• **Recall of discussions in previous class,** **Air-craft refrigeration systems, Simple cooling and Simple evaporative types, Boot strap and Boot strap evaporative types, Regenerative type and Reduced Ambient type system,** • **Questioning to students,** • **Discussion on other topics,** **Summary.**
6	**Unit 1** **Basic of Refrigeration and Air refrigeration**	**PPT/ White Board/ Demonstration.**	• **Recall of discussions in previous class,** **Comparison of different air refrigeration systems, advantages and disadvantages of air refrigeration cycle, Actual air conditioning system with controls,**

			• **Problems Discussion, Summary.**
7	**Unit 1 Basic of Refrigeration and Air refrigeration**	**PPT/ White Board/ Demonstration.**	• **Problems Discussion,** • **Questioning in class,** • **Surprise quizzes,** • **Counselling,** • **Assignment 3 distribution on "Air-Refrigeration Systems" and discussion on it,** • **Course objective and Outcome discussion, Summary.**
8	**Unit 2: Vapour Compression Refrigeration.**	**PPT/ White Board/ Demonstration.**	• **Recall of previous discussions on previous chapter,** • **Course objective and Outcome discussion,** **VC cycle on P-V, T-S and PH diagrams,** • **Problems Discussion,** • **Questioning in class,** • **Surprise quizzes,** • **Counselling,** • **Summary.**
9	**Unit 2: Vapour Compression Refrigeration.**	**PPT/ White Board/ Demonstration.**	• **Recall on previous discussions in this chapter,** **Effects of operating conditions on COP; Cooling and superheating; Comparison of VC cycle with Air Refrigeration cycle. Super critical vapour compression cycle,** • **Assignment 4 distribution on "Simple Vapour Compression Refrigeration System" and discussion on it,** • **Problems Discussion,** • **Questioning in class,** • **Surprise quizzes,** • **Counselling,** • **Summary.**
10	**Unit 2: Vapour Compression Refrigeration.**	**PPT/ White Board/ Demonstration.**	• **Recall on previous discussions in this chapter,** **Multistage Vapour Compression (VC) Refrigeration Systems: Necessity of compound compression, Compound VC cycle, Multistage compression with flash inter-cooling and / or water inter-**

			cooling; systems with individual or multiple expansion valves, • **Questioning to students,** • **Discussion on other topics,** • **Summary.**
11	**Unit 2:** **Vapour Compression Refrigeration.**	**PPT/ White Board/ Demonstration.**	• **Problems Discussion,** • **Questioning in class,** • **Surprise quizzes,** • **Counselling,** • **Assignment 5 distribution on "Multistage stage refrigeration" and discussion on it,** • **Summary.**
12	**Unit 2:** **Vapour Compression Refrigeration.**	**PPT/ White Board/ Demonstration.**	• **Recall on previous discussions in this chapter,** • **Production of low temperatures: Introduction to Cryogenics, Multistage refrigeration system, Two and three stage cascade systems,** • **Discussion,** • **Summary.**
13	**Unit 2:** **Vapour Compression Refrigeration.**	**PPT/ White Board/ Demonstration.**	• **Problems Discussion,** • **Questioning in class,** • **Counselling,** • **Assignment 4 distribution on "Air-Refrigeration Systems" and discussion on it.**
14	**Unit 2:** **Vapour Compression Refrigeration.**	**PPT/ White Board/ Demonstration.**	• **Problems Discussion,** • **Questioning in class,** • **Surprise quizzes,** • **Counselling,** • **Course objective and Outcome discussion,** • **Assignment discussion.**
15	**General Discussions**	**PPT/ White Board/ Demonstration.**	• **Recall of previous discussions on previous chapters,** • **Course objective and Outcome discussion,** • **Questioning in class,** • **Assignment Discussions,** • **General Discussions,** • **General Counselling.**
16	**Unit 3:**	**PPT/**	• **A brief Recall of previous**

	Other Refrigeration Systems	**White Board/ Demonstration.**	**discussions,** • **Course objective and Outcome discussion,** **Vapour Absorption Systems, Practical Ammonia Absorption System, COP of the Absorption System,** • **Problem Discussion,** • **Questioning.**
17	**Unit 3: Other Refrigeration Systems**	**PPT/ White Board/ Demonstration.**	• **Recall on previous discussions in this chapter,** **Lithium Bromide-Water Absorption Refrigeration Systems and Electrolux Refrigeration system,** • **Problems Discussion,** • **Questioning in class,** • **Surprise quizzes.**
18	**Unit 3: Other Refrigeration Systems**	**PPT/ White Board/ Demonstration.**	• **Recall on previous discussions in this chapter,** **Solar energy (Solar Concentrator) based absorption refrigeration systems,** • **Problems Discussion,** • **Questioning in class,** • **Surprise quizzes,** • **Summary.**
19	**Unit 3: Other Refrigeration Systems**	**PPT/ White Board/ Demonstration.**	• **Recall on previous discussions in this chapter,** **Vapour jet, thermoelectric and Vortex tube refrigeration, Relative merits and demerits, Applications,** • **Problems Discussion,** • **Questioning in class,** • **Surprise quizzes.**
20	**Unit 3: Other Refrigeration Systems**	**PPT/ White Board/ Demonstration.**	• **Problems Discussion,** • **Questioning in class,** • **Surprise quizzes,** • **Counselling,** • **Assignment 6 distribution on "VARS and other Refrigeration systems" and discussion on it,** • **Summary.**
21	**General Discussions**	**PPT/ White Board/ Demonstration.**	• **Recall of previous discussions on previous chapters,** • **Questioning in class,** • **Assignment Discussions,** • **Course objective and Outcome**

			discussion, • General Discussions, • General Counselling.
22	Unit 4 Psychometric & Air Conditioning Processes	PPT/ White Board/ Demonstration.	• General Discussion on Refrigeration, • Course objective and Outcome discussion, • General Discussion on Air Conditioning, Properties of moist Air, Gibbs Dalton law, • Summary
23	Unit 4 Psychometric & Air Conditioning Processes	PPT/ White Board/ Demonstration.	• Recall on previous lecture, Specific humidity, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temp., Thermodynamics wet bulb temp, • Problem discussion, • Summary.
24	Unit 4 Psychometric & Air Conditioning Processes	PPT/ White Board/ Demonstration.	• Recall on previous lecture, Psychometric chart; Psychometric of air-conditioning processes, Psychometric processes in air washer, • Summary.
25	Unit 4 Psychometric & Air Conditioning Processes	PPT/ White Board/ Demonstration.	• Recall on Psychometry, • Assignment 7 distribution on "Psychometric and AC" and discussion on it, • Problems, • Summary.
26	Unit 4 Psychometric & Air Conditioning Processes	PPT/ White Board/ Demonstration.	• Assignment 7 discussion, • Problems, • Course objective and Outcome discussion, • Summary.
27	General Discussions	PPT/ White Board/ Demonstration.	• Recall of previous discussions on previous chapters, • Questioning in class, • Assignment Discussions, • Course objective and Outcome discussion, • General Discussions, • General Counselling.
28.	Unit 5	PPT/	• Recall on previous lecture,

	Heating and cooling load calculation for HVAC system design	**White Board/ Demonstration.**	• **Course objective and Outcome discussion,** **Outside and inside design conditions; Sources of cooling load and heating load,** • **Problem,** • **Summary.**
29	**Unit 5** **Heating and cooling load calculation for HVAC system design**	**PPT/ White Board/ Demonstration.**	• **Assignment 8 distribution on "Cooling Load Calculation" and discussion on it,** • **Problems,** • **Summary.**
30	**Unit 5** **Heating and cooling load calculation for HVAC system design**	**PPT/ White Board/ Demonstration.**	• **Recall on previous lecture,** **Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, Heat generation inside conditioned space,** • **Summary**
31	**Unit 5** **Heating and cooling load calculation for HVAC system design**	**PPT/ White Board/ Demonstration.**	• **Recall on previous lecture,** • **Problem,** • **Summary.**
32	**Unit 5** **Heating and cooling load calculation for HVAC system design**	**PPT/ White Board/ Demonstration.**	• **Recall on Previous Lecture,** **Comfort and industrial air conditioning, Load calculations and Heat pumps,** • **Problems,** • **Summary.**
33	**Unit 5** **Heating and cooling load calculation for HVAC system design**	**PPT/ White Board/ Demonstration.**	• **Recall of previous discussions on previous chapters,** • **Questioning in class,** • **Assignment Discussions,** • **Course objective and Outcome discussion,** • **General Discussions,** • **General Counselling.**
34	**General Discussions**	**PPT/ White Board/ Demonstration.**	• **Recall of previous discussions on previous chapters,** • **Questioning in class,** • **Assignment Discussions,** • **Course objective and Outcome discussion,** • **General Discussions,** • **General Counselling.**
35	**Unit 6** **Equipment selection**	**PPT/ White**	• **Recall on previous lecture,** • **Course objective and Outcome**

	for HVAC system	Board/ Demonstration.	discussion, Air distribution system; Basic of Duct systems design, • Problem, • Summary.
36	Unit 6 Equipment selection for HVAC system	PPT/ White Board/ Demonstration.	• Recall on previous lecture, Filters; Refrigerant piping; Design of summer air-conditioning and Winter air conditioning systems, • Summary.
37	Unit 6 Equipment selection for HVAC system	PPT/ White Board/ Demonstration.	• Recall on previous lecture, Temperature sensors, Pressure sensors, Humidity sensors, Actuators, Safety controls, • General discussion, • Summary.
38	Unit 6 Equipment selection for HVAC system	PPT/ White Board/ Demonstration.	• Discussion, • Counselling, • Summary.
39	Unit 6 Equipment selection for HVAC system	PPT/ White Board/ Demonstration.	• Recall on previous lecture, Accessories, Different types of compressors used in refrigeration, • General discussion, • Summary
40	Unit 6 Equipment selection for HVAC system	PPT/ White Board/ Demonstration.	• Assignment distribution and discussion on it, • Summary.
41	General Discussions	PPT/ White Board/ Demonstration.	• Recall of previous discussions on previous chapters, • Questioning in class, • Assignment Discussions, • General Discussions, • General Counselling.
42	General Discussions	PPT/ White Board/ Demonstration.	• Discussion on Course Objectives and outcomes, • General Discussions and Counselling.

Books and other references:

1. Refrigeration & Air conditioning –R.C. Jordan and G.B. Priester, Prentice Hall of India.

2. Refrigeration & Air conditioning –C.P. Arora, TMH, New Delhi.

3. A course in Refrigeration & Air Conditioning –Arora & Domkundwar, Dhanpat Rai & sons.

4. Refrigeration & Air conditioning –W.F. Stocker and J.W. Jones, TMH, New Delhi.

5. Refrigeration & Air conditioning-Manohar Prasad Wiley Estern limited, New Delhi.

6. Refrigeration and Air Conditioning by D.S.Kumar, S.K.Kataria & Sons, New Delhi

Web Links: S.N	Address of web source	Content
1	https://nptel.ac.in/courses/112/105/112105129	Refrigeration and air conditioning concept and design
2	https://www.danfoss.com/en-gb/service-and-support/learning/cooling-learning/	Refrigeration system design and components