

IIPM SCHOOL OF ENGINEERIN AND TECHNOLOGY

**LESSON PLAN: 2022-23**

**REFRIGERATION AND AIR CONDITIONING**

**Branch : Mechanical Semester: 5th**

**Duration : 60**

**Faculty name : Saritprava Sahoo**

**SYLLABUS**

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| **Unit – I** | **AIR REFRIGERATION CYCLE.**  1.1 Definition of refrigeration and unit of refrigeration.  1.2 Definition of COP, Refrigerating effect (R.E )  1.3 Principle of working of open and closed air system of refrigeration.  1.3.1 Calculation of COP of Bell-Coleman cycle and numerical on it.1.10Work **Self Study:** **Concepts to Understand** **Thermodynamic** |
| **Unit – II** | **SIMPLE VAPOUR COMPRESSION REFRIGERATION SYSTEM**  2.1 schematic diagram of simple vapors  2.2 Types  2.2.1 Cycle with dry saturated vapors after compression.  2.2.2 Cycle with wet vapors after compression.  2.2.3 Cycle with superheated vapors after compression.  2.2.4 Cycle with superheated vapors before compression.  2.2.5 Cycle with sub cooling of refrigerant  2.2.6 Representation of above cycle on temperature entropy and pressure enthalpy diagram  2.2.7 Numerical on above (determination of COP,mass flow)  **Self Study:** Conversion from Automata to Grammar and vice versa |
| **Unit – III** | **VAPOUR ABSORPTION REFRIGERATION SYSTEM**  3.1 Simple vapor absorption refrigeration system  3.2 Practical vapor absorption refrigeration system  3.3 COP of an ideal vapor absorption refrigeration system  3.4.Numerical on COP. |
| **Unit – IV** | **REFRIGERATION EQUIPMENTS**  **4.1 REFRIGERANT COMPRESSORS**  4.1.1 Principle of working and constructional details of reciprocating and rotary compressors.  4.1.2 Centrifugal compressor only theory  4.1.3 Important terms.  4.1.4 Hermetically and semi hermetically sealed compressor.  **4.2 CONDENSERS**  4.2.1 Principle of working and constructional details of air cooled and water cooled condenser  4.2.2 Heat rejection ratio.  4.2.3 Cooling tower and spray pond.  4.3 EVAPORATORS  4.3.1 Principle of working and constructional details of an evaporator.  4.3.2 Types of evaporator.  4.3.3 Bare tube coil evaporator, finned evaporator, shell and tube evaporator. |
| **Unit – V** | **REFRIGERANT FLOW CONTROLS, REFRIGERANTS & APPLICATION OF REFRIGERANTS**  **5.1 EXPANSION VALVES**  5.1.1 Capillary tube  5.1.2 Automatic expansion valve  5.1.3 Thermostatic expansion valve  **5.2 REFRIGERANTS**  5.2.1 Classification of refrigerants  5.2.2 Desirable properties of an ideal refrigerant.  5.2.3 Designation of refrigerant.  5.2.4 Thermodynamic Properties of Refrigerants.  5.2.5 Chemical properties of refrigerants.  5.2.6 commonly used refrigerants, R-11, R-12, R-22, R-134a, R-717  5.2.7 Substitute for CFC  **5.3 Applications of refrigeration**  5.3.1 cold storage  5.3.2 dairy refrigeration  5.3.3 ice plant  5.3.4 water cooler  5.3.5 frost free refrigerator |
| **Unit – VI** | **PSYCHOMETRICS &COMFORT AIR CONDITIONING SYSTEMS**  **6.1 Psychometric terms**  6.2 Adiabatic saturation of air by evaporation of water  6.3 Psychometric chart and uses.  6.4 Psychometric processes  6.4.1 Sensible heating and Cooling  6.4.2 Cooling and Dehumidification  6.4.3 Heating and Humidification  6.4.4 Adiabatic cooling with humidification  6.4.5 Total heating of a cooling process  6.4.6 SHF, BPF,  6.4.7 Adiabatic mixing  6.4.8 Problems on above.  6.5 Effective temperature and Comfort chart |
| **Unit – VII** | **7.0 AIR CONDITIONING SYSTEMS**  7.1 Factors affecting comfort air conditioning. .  7.2 Equipment used in an air-conditioning.  7.3 Classification of air-conditioning system  7.4 Winter Air Conditioning System  7.5 Summer air-conditioning system.  7.6 Numerical on above |

**TEXT BOOKS& OTHER REFERENCES BOOKS**

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| **Text Books** | |
| 1. | “**REFRIGERATION AND AIR CONDITIONING**”, **R.S.Khurmi &J.K.Gopta**, S.Chand. |
| 2. | “**REFRIGERATION AND AIR CONDITIONING**”, **DOMKUNDRA AND ARORA**, Dhanpat Rai. |
| **Suggested / Reference Books** | |
| 1. | “**REFRIGERATION AND AIR CONDITIONING**” **C.P ARRORA**, TMH. |
| 2. | “**REFRIGERATION AND AIR CONDITIONING**”,**P.L BALLANY**, KHANNA  PUBLISHER. |

**Objective :** Comfort is the basic requirement of customers and machines through air conditioning & hence learning the concept of air-conditioning and methods of air-conditioning facilities quality design of air conditioning.

**Learning Outcome :** Understanding effectiveness of

* Working of open & closed air system of air refrigeration system.
* Working and construction of compressor, Condenser, evaporator, expansion valve used for air conditioning and refrigeration.
* Vapor Compression refrigeration system and Vapor Absorption refrigeration system.
* Different refrigerants properties and equipment for air conditioning.
* Cooling load for the specified requirement

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| **Sl.No** | **Chapter** | **Proposed Week for Teaching** | **Period**  **No.** | **Subject Name** | **Important Teaching Points** | **Content Source** |
| 1 | **I** | 1st | 1 | **Air Refrigeration Cycle** | * Definition of Refrigeration, and unit of Refrigeration. * Ton of Refrigeration * Definition of COP, Refrigerating effect (R.E) | **Refrigeration And Air**  **Conditioning**  **R.S.Khurmi**  **&J.K.Gopta** |
| 2 | 2 | * Principle of working of open and closed air system of refrigeration. |
| 3 | 3 | * Bell-Coleman cycle |
| 4 | 4 | * Calculation of COP of Bell-Coleman cycle |
| 5 | 2nd | 1 |
| 6 | 2 | * Solved Simple Numerical |
| 7 | 3 | * ASSIGNMENT |
| 8 | 4 | * CLASS TEST |
| 9 | **II** | 3rd | 1 | **Simple Vapour Compression Refrigeration System** | * Simple Vapour Compression Refrigeration System with schematic diagram and types |  |
| 10 | 2 |
| * Cycle With Dry Saturated Vapors After Compression, with PV & TS Diagram And Determination Of COP,Mass Flow |
| 11 |
| 12 | 3 | * Solved Simple Numerical |
| 13 | 4 | * Cycle with wet vapors after compression with PV & TS Diagram and Determination Of COP,Mass Flow | **Refrigeration And Air**  **Conditioning**  **R.S.Khurmi**  **&J.K.Gopta** |
| 14 |
| 15 |
| 16 | 4th | 1 | * Solved Simple Numerical |
| 17 | 2 | * Cycle with superheated vapors after compression with PV & TS Diagram and Determination Of COP, Mass Flow |
| 18 | 3 | * Solved Simple Numerical |
| 19 | 4 | * Cycle with superheated vapors before compression with PV & TS Diagram and Determination of COP, Mass Flow |
| 20 | 5th | 1 | * Solved Simple Numerical |
| 21 | 2 | * Cycle with sub cooling of refrigerant with PV & TS Diagram and Determination of COP, Mass Flow |
| 22 | 3 | * Solved Simple Numerical |
| 23 | 4 | * ASSIGNMENT |
| 24 | **III** | 6th | 1 | **Vapour Absorption Refrigeration System** | * CLASS TEST |
| 25 | 2 | * Simple vapor absorption refrigeration system with PV & TS Diagram and Determination of COP | **Refrigeration And Air**  **Conditioning**  **R.S.Khurmi**  **&J.K.Gopta** |
| 26 | 3 | * Solved Simple Numerical |
| 27 | 4 | * Practical vapor absorption refrigeration system with PV & TS Diagram and Determination of COP |
| 28 | 7th | 1 |
| 29 | 2 | * Solved Simple Numerical |
| 30 | 3 | * ASSIGNMENT |
| 31 | 4 | * CLASS TEST |
| 32 | **IV** | **8th** | 1 | Refrigeration Equipments | * Refrigerant Compressors:   + - Principle of working and constructional details of reciprocating and rotary compressors | **Refrigeration And Air**  **Conditioning**  **R.S.Khurmi**  **&J.K.Gopta** |
| 33 | 2 | * + - Important terms.     - Centrifugal compressor only theory |
| 34 | 3 | * + - Hermetically and semi hermetically sealed compressor. |
| 35 | **IV** |  | 4 | Refrigeration Equipments | * ASSIGNMENT |  |
| 36 | **9th** | 1 | * **Condensers**   + Principle of working and constructional details of air cooled and water cooled condenser | **Refrigeration And Air**  **Conditioning**  **R.S.Khurmi**  **&J.K.Gopta** |
| 37 | 2 |
| 3 | * + Heat rejection ratio. |
| 4 | * + Cooling tower and spray pond. |
| 38 | 10th | 1 | * **Evaporators**   + Principle of working and constructional details of an evaporator. |
| 39 | 2 |
| 40 | 3 | * + Types of evaporator.   + Bare tube coil evaporator, finned evaporator, shell and tube evaporator. |
| 41 | 4 | * ASSIGNMENT |
| 42 | **11th** | 1 | * ASSIGNMENT |
| 43 | V | 2 | **Refrigerant Flow Controls, Refrigerants & Application**  **Of Refrigerants** | * CLASS TEST | **Refrigeration And Air**  **Conditioning**  **R.S.Khurmi**  **&J.K.Gopta** |
| 44 | 3 | * ASSIGNMENT |
| 45 | 4 | * REFRIGERANTS * Classification of refrigerants * Desirable properties of an ideal refrigerant. * Designation of refrigerant. |
| 46 | 12th | 1 | * R-11, R-12, R-22, of Thermodynamic Properties and Chemical properties of refrigerants. |
| 47 | 13th | 2 | * R-134a, R-717 of Thermodynamic Properties and Chemical properties of refrigerants. * Substitute for CFC |
| 48 | 3 | * ASSIGNMENT |
| 49 | 4 | * Applications of refrigeration * cold storage * dairy refrigeration |
| 50 | 14th | 1 | * ice plant * water cooler |
| 51 | **VI** | 2 | * frost free refrigerator * ASSIGNMENT |
| * CLASS TEST |
| 52 |  |  | 3 | **Psychometrics &Comfort Air Conditioning Systems** | * Psychometric terms * Adiabatic saturation of air by evaporation of water * Psychometric chart and uses. | **Refrigeration And Air**  **Conditioning**  **R.S.Khurmi**  **&J.K.Gopta** |
| 53 | 4 | * Psychometric processes of * Sensible heating and Cooling * Cooling and Dehumidification |
| 54 | 15th | 1 | * Solve simple numerical |
| 55 | 2 | * Psychometric processes of * Heating and Humidification * Adiabatic cooling with humidification |
| 56 | 3 | * Solve simple numerical |
| 57 | 4 | * Psychometric processes of * Total heating of a cooling process * SHF, BPF * Adiabatic mixing |
| 58 | 16th | 1 | * Solve simple numerical |
| 59 | 2 | * Effective temperature and Comfort chart |
| 3 | * ASSIGNMENT |
| 4 | * CLASS TEST |
| 60 | **VII** | **17th** | 1 | **Air Conditioning Systems** | * Factors affecting comfort air conditioning. . * Equipment used in an air-conditioning. | **Refrigeration And Air**  **Conditioning**  **R.S.Khurmi**  **&J.K.Gopta** |
| 61 | 2 |
| 62 | 3 | * Classification of air-conditioning system |
| 63 | 4 | * Winter Air Conditioning System |
| 18th | 1 | * Summer air-conditioning system. |
| 64 | 2 | * Solve simple numerical |
| 65 | 3 | * ASSIGNMENT |
| 66 | 4 | * CLASS TEST |

Faculty Member HOD Principal/ Director