GUJARAT TECHNOLOGICAL UNIVERSITY

BE-7 SEMESTER – OLD PAPER – S22 TO S25 – QUESTION BANK

Subject Name & Code:

Refrigeration and Air Conditioning Engineering- 3171918

Chapter 1: Introduction and Refrigerants

Repeated Questions:

1. **Define Ton of Refrigeration, COP, and Refrigerant.**
   - Appeared in: WINTER 2023 (Q1a - 03 marks), WINTER 2022 (Q1a - 03 marks), SUMMER 2022 (Q1a - 03 marks).
2. **List/Explain desirable properties of refrigerants.**
   - Appeared in: SUMMER 2024 (Q1b - 04 marks), SUMMER 2022 (Q1b - 04 marks), SUMMER 2025 (Q3b - 04 marks).
3. **Discuss future industrial refrigerants.**
   - Appeared in: SUMMER 2024 (Q2b - 04 marks), WINTER 2024 (Q1b - 04 marks).
4. **How to calculate Total Equivalent Warming Impact (TEWI)?**
   - Appeared in: SUMMER 2023 (Q1a - 03 marks).
5. **State important applications of refrigeration systems.**
   - Appeared in: SUMMER 2025 (Q1a - 03 marks).

Other Important Questions:

- Enlist different types of refrigeration systems. (SUMMER 2024 - Q1a - 03 marks)
- Enlist requirement for working fluid to use as a refrigerant in vapour compression cycle. (SUMMER 2023 - Q1b - 04 marks)
- Explain ice plant with a neat sketch. (SUMMER 2025 - Q1b - 04 marks)

Chapter 2: Air Refrigeration Systems

Repeated Questions:

1. **Explain Bootstrap air refrigeration system with a neat sketch.**
   - Appeared in: SUMMER 2024 (Q1c - 07 marks), SUMMER 2025 (Q2c - 07 marks).
2. **Explain Regenerative air refrigeration system with a neat sketch/T-s diagram.**
   - Appeared in: SUMMER 2023 (Q3c - 07 marks), WINTER 2024 (Q3c - 07 marks).
3. **Why is air cycle refrigeration most suitable for aircraft?**
   - Appeared in: SUMMER 2023 (Q3a - 03 marks).
4. **State different heat loads for Aircraft refrigeration.**
   - Appeared in: WINTER 2024 (Q1a - 03 marks).
5. **Numerical on Bell-Coleman / Simple Air Cycle:**
   - **Example (SUMMER 2023 - Q3c):** In a Bell-Coleman plant, air is drawn at 1 bar, 10°C and compressed to 5 bar. Cooled to 25°C and expanded to 1 bar. Calculate theoretical COP and refrigeration effect per kg. (07 marks)
   - **Other Appearances:** WINTER 2022 (Q1c - 07 marks), SUMMER 2022 (Q4c - 07 marks), SUMMER 2025 (Q1c - 07 marks), WINTER 2024 (Q2c - 07 marks). *This is a VERY important numerical topic.*

Other Important Questions:

- Write merits and demerits of Air Refrigeration System. (WINTER 2022 - Q1b - 04 marks)
- Explain Reduced Ambient system. (Implied in WINTER 2024 - Q2c numerical).

Chapter 3: Compound Compression & Advanced VCR Systems

Repeated Questions:

1. **Explain Cascade Refrigeration System with a neat sketch.**
    - Appeared in: SUMMER 2024 (Q2c - 07 marks), WINTER 2023 (Q2c - 07 marks), WINTER 2024 (Q1c - 07 marks), SUMMER 2022 (Q2c - 07 marks).
2. **Explain Multi-Evaporator systems with back pressure valves and multiple expansion valves with P-h diagram.**
    - Appeared in: WINTER 2022 (Q2c - 07 marks), WINTER 2023 (Q2c - 07 marks), WINTER 2024 (Q2c - 07 marks), SUMMER 2022 (Q2c - 07 marks).
3. **Why is a compound system used for a large temperature lift? Explain flash intercooling.**
    - Appeared in: SUMMER 2023 (Q2c - 07 marks).
4. **Numerical on Multi-Stage Compression:**
    - **Example (SUMMER 2023 - Q2c):** Calculate power needed to compress ammonia in a two-stage cycle with and without intercooling. (07 marks)

Other Important Questions:

- List methods of improving COP of a simple VCR cycle. (SUMMER 2023 - Q2a - 03 marks)
- Mention limitations of Simple VCR cycle. Explain compound compression with flash chamber. (SUMMER 2025 - Q3c - 07 marks)

Chapter 4: Vapour Absorption Refrigeration Systems (VARS)

Repeated Questions:

1. **Explain Lithium Bromide-Water ($LiBr-H_2O$) absorption system with a neat sketch.**
   - Appeared in: SUMMER 2023 (Q4c - 07 marks), SUMMER 2024 (Q3c - 07 marks), WINTER 2024 (Q3c - 07 marks), SUMMER 2025 (Q2c - 07 marks).
2. **Explain practical Ammonia-Water (H_2O-NH_3) cycle/Electrolux refrigerator.**
   - Appeared in: SUMMER 2024 (Q2c - 07 marks), WINTER 2023 (Q3b - 04 marks), SUMMER 2022 (Q4b - 04 marks), WINTER 2022 (Q3c - 07 marks).
3. **Compare Vapour Compression (VCR) and Vapour Absorption (VAR) systems.**
   - Appeared in: WINTER 2022 (Q2b - 04 marks), WINTER 2023 (Q2a - 03 marks), WINTER 2024 (Q3a - 03 marks).
4. **What are desirable characteristics of absorbent-refrigerant pair?**
   - Appeared in: SUMMER 2023 (Q4c - 07 marks), SUMMER 2025 (Q2a - 03 marks).
5. **Derive COP of an ideal VARS.**
   - Appeared in: SUMMER 2025 (Q2b - 04 marks).

Other Important Questions:

- Under what situation is VARS preferred over VCRS? (SUMMER 2023 - Q4a - 03 marks)
- Function of analyzer, rectifier, and generator in VARS. (SUMMER 2022 - Q2a - 03 marks)
- Numerical on VARS (SUMMER 2023 - Q4c - 07 marks).

Chapter 5: Refrigeration System Components

Repeated Questions:

1. **Explain Thermostatic Expansion Valve (TXV) with a neat sketch.**
    - Appeared in: WINTER 2023 (Q3c - 07 marks), SUMMER 2025 (Q3c - 07 marks).
2. **Enlist/Types of compressors and explain any one.**
    - Appeared in: SUMMER 2024 (Q3a - 03 marks), SUMMER 2025 (Q3b - 04 marks).
3. **Explain different expansion devices.**
    - Appeared in: SUMMER 2024 (Q3a - 03 marks).
4. **Explain screw and scroll compressors.**
    - Appeared in: WINTER 2024 (Q2b - 04 marks).
5. **Function of components: Oil separator, Sight glass, Drier, etc.**
    - Appeared in: SUMMER 2022 (Q1c - 07 marks).

Other Important Questions:

- Explain shell and tube condenser. (WINTER 2022 - Q3a - 03 marks)
- Advantages of centrifugal compressor over reciprocating. (WINTER 2022 - Q3b - 04 marks)
- Explain capillary tube and TXV. (WINTER 2022 - Q3b - 04 marks)
- Define volumetric, isothermal, and adiabatic efficiency of a compressor. (SUMMER 2025 - Q4a - 03 marks)
- Explain flooded type evaporator. (SUMMER 2025 - Q3b - 04 marks)
- Explain evacuation and charging of refrigerants. (SUMMER 2024 - Q3b - 04 marks)

Chapter 6: Human Comfort and Load Analysis

Repeated Questions:

1. **Define Human Comfort and explain factors affecting it.**
    - Appeared in: WINTER 2022 (Q4b - 04 marks), WINTER 2023 (Q4a - 03 marks), SUMMER 2025 (Q4b - 04 marks), WINTER 2024 (Q4a - 03 marks).
2. **Define Effective Temperature and explain factors affecting it/significance.**
    - Appeared in: SUMMER 2022 (Q3b - 04 marks), SUMMER 2023 (Q3b - 04 marks), WINTER 2022 (Q4b - 04 marks), SUMMER 2025 (Q4c - 07 marks).
3. **Explain the Flywheel Effect of building material.**
    - Appeared in: WINTER 2022 (Q4a - 03 marks), SUMMER 2022 (Q3b - 04 marks), WINTER 2024 (Q3b - 04 marks).
4. **Explain Sensible Heat Factor (SHF) and related numerical using Psychrometric chart.**
    - **Example (WINTER 2022 - Q4c):** Calculate SHF for an office given inside/outside conditions and loads. (07 marks)
5. **Explain different types of loads (sensible, latent, solar, infiltration, etc.).**
    - Appeared in: SUMMER 2022 (Q3c - 07 marks), WINTER 2023 (Q4b, Q4c - 04 & 07 marks), SUMMER 2025 (Q3a - 03 marks).

Other Important Questions:

- What is infiltration? (SUMMER 2025 - Q3a - 03 marks, WINTER 2024 - Q3b - 04 marks)
- Explain Instantaneous Heat Gain (IHG) and Instantaneous Cooling Load (ICL). (WINTER 2024 - Q3a - 03 marks)
- Explain load calculations for automobiles. (SUMMER 2024 - Q4c - 07 marks, SUMMER 2022 - Q3c - 07 marks)
- Importance of site survey. (SUMMER 2025 - Q4b - 04 marks)

Chapter 7: Duct Design and Air Distribution

Repeated Questions:

1. **Explain Duct Design Methods: Equal Friction, Velocity Reduction, Static Regain.**
    - Appeared in: WINTER 2022 (Q5a - 03 marks), SUMMER 2022 (Q5c - 07 marks), SUMMER 2025 (Q5b - 04 marks), WINTER 2024 (Q4c - 07 marks).
2. **Numerical on Equivalent Diameter of Ducts and Pressure Drop.**
    - **Example (SUMMER 2023 - Q5c):** Find equivalent diameter for a rectangular duct for (a) same flow rate, (b) same velocity. Calculate pressure drop. (07 marks)
    - **Other Appearances:** WINTER 2023 (Q5c - 07 marks), WINTER 2022 (Q5c - 07 marks), SUMMER 2025 (Q4c - 07 marks). *Crucial numerical topic.*
3. **Explain economic factors influencing duct layout.**
    - Appeared in: SUMMER 2024 (Q5b - 04 marks), SUMMER 2022 (Q5a - 03 marks), WINTER 2024 (Q4b - 04 marks).
4. **Define/Explain terms: Throw, Drop, Spread.**
    - Appeared in: SUMMER 2022 (Q5a - 03 marks), WINTER 2024 (Q4a - 03 marks).

Other Important Questions:

- Requirements of air distribution system. (SUMMER 2024 - Q5c - 07 marks)
- Factors affecting grill performance. (SUMMER 2023 - Q5a - 03 marks)
- Different pressure losses in ducts. (WINTER 2024 - Q4b - 04 marks)

Chapter 8: Air-Conditioning Systems

Repeated Questions:

1. **Differentiate/Compare: All-Air, All-Water, Air-Water systems.**
   - Appeared in: SUMMER 2023 (Q1c - 07 marks).
2. **Explain Summer and Winter Air Conditioning systems with sketches.**
   - Appeared in: WINTER 2022 (Q5b - 04 marks), WINTER 2023 (Q5b - 04 marks), SUMMER 2022 (Q5b - 04 marks).
3. **Compare/Explain Split, Package, and Central AC systems.**
   - Appeared in: SUMMER 2023 (Q5b - 04 marks), WINTER 2023 (Q5a - 03 marks), SUMMER 2022 (Q4a - 03 marks), WINTER 2024 (Q5b - 04 marks).
4. **Explain a Split AC system with a neat sketch.**
   - Appeared in: WINTER 2023 (Q3a - 03 marks), SUMMER 2024 (Q5b - 04 marks).

Other Important Questions:

- Classify air conditioning systems. (WINTER 2023 - Q5a - 03 marks)
- Why all-water system is compact? (SUMMER 2023 - Q5a - 03 marks)
- Explain Packaged AC plant. (SUMMER 2024 - Q5c - 07 marks)
- Explain Central AC for a multi-storey building. (SUMMER 2025 - Q5c - 07 marks)

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