CBSE | DEPARTMENT OF SKILL EDUCATION

Air Conditioning & Refrigeration (Subject Code-827)

MARKING SCHEME FOR CLASS XII (SESSION 2024 - 2025)

Max. Time: 3 Hours **Max. Marks: 60**

General Instructions:

1. Please read the instructions carefully.
2. This Question Paper consists of **24 questions** in two sections – Section A & Section B.
3. Section A has Objective type questions whereas Section B contains Subjective type questions.
4. **Out of the given (6 + 18 =) 24 questions, a candidate has to answer (6 + 11 =) 17 questions in the allotted (maximum) time of 3 hours.**
5. All questions of a particular section must be attempted in the correct order.
6. **SECTION A - OBJECTIVE TYPE QUESTIONS (30 MARKS):**
    - **i.** This section has 06 questions.
    - **ii.** There is no negative marking.
    - **iii.** Do as per the instructions given.
    - **iv.** Marks allotted are mentioned against each question/part.
7. **SECTION B – SUBJECTIVE TYPE QUESTIONS (30 MARKS):**
    - **i.** This section contains 18 questions.
    - **ii.** A candidate has to do 11 questions.
    - **iii.** Do as per the instructions given.
    - **iv.** Marks allotted are mentioned against each question/part.

SECTION A: OBJECTIVE TYPE QUESTIONS

Q. No.	QUESTION	Source Material (NCERT/PSSCIVE/ CBSE Study Material)	Unit/ Chap. No.	Page no. of source material	Marks
Q. 1	**Answer any 4 out of the given 6 questions on Employability Skills (1 x 4 = 4 marks)**				
i.	c) Providing empathy and support	CBSE Study Material/ NCERT Employability Skill	Unit-01	04	**1**
ii.	b) Analyzing what is going wrong and finding solutions	CBSE Study Material/ NCERT Employability Skill	Unit-01	26	**1**
iii.	c) Creating and editing spreadsheets	CBSE Study Material/ NCERT Employability Skill	Unit-03	39	**1**
iv.	c) An economic activity focused on profit-oriented organizations	CBSE Study Material/ NCERT Employability Skill	Unit-04	80	**1**
v.	b) protect and restore ecosystems	CBSE Study Material/ NCERT Employability Skill	Unit -05	114	**1**
vi.	d) Sound	CBSE Study Material/ NCERT Employability Skill	Unit-03	45	**1**
Q. 2	**Answer any 5 out of the given 7 questions (1 x 5 = 5 marks)**				
i.	b) By a horizontal line extending from left to right	Study Material	Unit-01	07	**1**
ii.	C) Conduction	Study Material	Unit-02	18	**1**
iii.	d) Expansion valve condenser	Study Material	Unit-03	30	**1**
iv.	a) Compressor, condenser, evaporator, and controls	Study Material	Unit-05	63	**1**
v.	a) Current starting relay	Study Material	Unit-04	60	**1**
vi.	a) To contain the refrigerant	Study Material	Unit-03	32	**1**
vii.	D. R-134a	Study Material	Unit-03	54	**1**
Q. 3	**Answer any 6 out of the given 7 questions (1 x 6 = 6 marks)**				
i.	c) By chilled brine pumped through pipes	Study Material	Unit-05	64	**1**
ii.	b) To isolate the refrigerated space from the surroundings	Study Material	Unit-02	18	1
iii.	b) Evaporative cooling	Study Material	Unit-05	67	**1**
iv.	d) Shell and coil condenser	Study Material	Unit-03	32	**1**
v.	b) To remove dissolved gases and solid impurities from the water	Study Material	Unit-05	65	**1**

vi.	c) It is connected in parallel with the starting winding.	Study Material	Unit-04	61	**1**
vii.	B) Specific Humidity	Study Material	Unit-01	07	**1**
Q. 4	**Answer any 5 out of the given 6 questions (1 x 5 = 5 marks)**				
i.	c) To stop the compressor if oil pressure is insufficient	Study Material	Unit-04	56	**1**
ii.	C) Directly spraying water into the room	Study Material	Unit-01	09	**1**
iii.	(C)R-134a	Study Material	Unit-03	54	**1**
iv.	C) 7.5 m/s	Study Material	Unit-02	21	**1**
v.	D. Refrigerators	Study Material	Unit-06	96	**1**
vi.	C. High operating pressures and low refrigerating effect	Study Material	Unit-03	54	**1**
Q. 5	**Answer any 5 out of the given 6 questions (1 x 5 = 5 marks)**				
i.	B) PUF (Polyurethane Foam)	Study Material	Unit-02	19	**1**
ii.	b) Stops the compressor at excessive discharge pressure	Study Material	Unit-04	55	**1**
iii.	A. -29°C	Study Material	Unit-03	52	**1**
iv.	A. All-air system	Study Material	Unit-06	71	**1**
v.	c) To circulate air through the condenser	Study Material	Unit-03	30	**1**
vi.	B. To remove air or gases from a space by suction	Study Material	Unit-03	71	**1**
Q. 6	**Answer any 5 out of the given 6 questions (1 x 5 = 5 marks)**				
i.	C) Adiabatic Humidification	Study Material	Unit-01	12	**1**
ii.	C) Moisture entering through permeable walls	Study Material	Unit-02	17	**1**
iii.	c) To briefly increase motor starting torque	Study Material	Unit-04	59	**1**
iv.	B. Tube axial fans	Study Material	Unit-06	72	**1**
v.	C. Saline humidity	Study Material	Unit-06	70	**1**
vi.	C. Green	Study Material	Unit-03	53	**1**

SECTION B: SUBJECTIVE TYPE QUESTIONS

Q. No.	QUESTION	Source Material (NCERT/PSSCIVE/ CBSE Study Material)	Unit/ Chap. No.	Page no. of source material	Marks
Answer any 3 out of the given 5 questions on Employability Skills in 20 – 30 words each (2 x 3 = 6 marks)					
Q. 7	Active listening is important because it enhances job effectiveness, improves relationships, and boosts overall well-being by fostering understanding and collaboration.	CBSE Study Material/ NCERT Employability Skill	Unit-01	04	**2**
Q. 8	Maintaining a positive attitude is crucial for students because it helps them cope with challenges like exam results and job interviews, encouraging persistence and resilience to achieve their goals despite setbacks.	CBSE Study Material/ NCERT Employability Skill	Unit-02	26	**2**
Q. 9	Ojasvi can edit an item's name by double-clicking the cell to add text, using the Formula Bar to correct text, or clicking the cell and typing new text, then pressing Enter.	CBSE Study Material/ NCERT Employability Skill	Unit-03	45	**2**
Q. 10	Entrepreneurship is seen as both an art and a science because it requires a structured, stepwise progression (science) and the skill to adapt and innovate creatively (art) for profitability and growth.	CBSE Study Material/ NCERT Employability Skill	Unit-04	80	**2**
Q. 11	Green jobs help transition to environmentally sustainable production and consumption and can be found in sectors like energy, material conservation, water conservation, waste management, and pollution control, including both traditional and new sectors.	CBSE Study Material/ NCERT Employability Skill	Unit-05	112	**2**
Answer any 3 out of the given 5 questions in 20 – 30 words each (2 x 3 = 6 marks)					
Q. 12	It results in fog, and the final condition lies to the left or above the saturation curve on the psychrometric chart.	Study Material	Unit-01	15	**2**
Q. 13	Sensible heat gain refers to the direct addition of heat to an enclosed space through conduction, convection, and radiation, causing a temperature rise.	Study Material	Unit-02	17	**2**
Q. 14	Water-cooled condensers are preferred in such scenarios, as they efficiently utilize water for heat transfer and cooling purposes.	Study Material	Unit-03	30	**2**
Q. 15	Batch pasteurization involves filling a vat almost full with raw milk, heating it up to about 62°C, and holding it for 30 minutes before cooling it down and passing it to bottles.	Study Material	Unit-05	65	**2**
Q. 16	It uses extensive ductwork to distribute conditioned air from a central room to different required spaces.	Study Material	Unit-06	69	**2**
Answer any 2 out of the given 3 questions in 30– 50 words each (3 x 2 = 6 marks)					
Q. 17	In the indirect method, air is passed through an air washer where it is either sprayed with water directly or pre-heated before spraying. This method is more effective as it ensures better mixing and humidity control before the air is supplied to the room.	Study Material	Unit-01	09	**3**

Q. 18	Purging is essential to remove air that may leak into the system during operation. Air presence increases high-side pressure and condenser water consumption, affecting system efficiency. When air presence exceeds 10% above normal, purging becomes necessary to maintain optimal system performance.	Study Material	Unit-03	36	**3**
Q. 19	The three modes of heat transfer are conduction, convection, and radiation. Conduction occurs through a stationary medium, essential for transferring heat through walls and structures. Convection involves the bulk movement of fluids, important for distributing conditioned air. Radiation transfers heat through electromagnetic waves, affecting how heat from the sun impacts building interiors. These modes are crucial in designing efficient air conditioning systems that manage both sensible and latent heat gains.	Study Material	Unit-02	18	**3**
Answer any 3 out of the given 5 questions in 50– 80 words each (4 x 3 = 12 marks)					
Q. 20	Refrigerant driers are essential components in refrigeration systems, especially those using halocarbon refrigerants. These driers contain desiccants that absorb moisture from the refrigerant, preventing corrosion, ice formation, and degradation of system performance. Moisture can react with refrigerants, leading to acidic compounds that corrode system components. By removing moisture, driers ensure the purity and stability of the refrigerant, prolonging the lifespan of system components and maintaining optimal efficiency. Regular maintenance and replacement of driers are crucial to prevent moisture-related issues and ensure the smooth operation of refrigeration systems.	Study Material	Unit-03	35	**4**
Q. 21	Absorbents are chemicals that take up moisture from the air and undergo a chemical or physical change during this process. Examples include water solutions or brines of calcium chloride, lithium chloride, lithium bromide, and ethylene glycol. Adsorbents, on the other hand, are solid substances that take up moisture without changing chemically or physically. They work by trapping moisture in their porous structures. Examples of adsorbents include silica gel, which is prepared by mixing fused sodium silicate and sulphuric acid, and activated alumina, a porous form of aluminium oxide. Both types are used to control humidity in various air conditioning applications.	Study Material	Unit-01	13	**4**
Q. 22	Proper air distribution ensures that conditioned air reaches all parts of a room uniformly, maintaining comfortable temperatures and humidity levels. It prevents drafts and hot or cold spots, enhancing comfort and energy efficiency. Different systems like ejector, downward, and upward flow cater to specific requirements, ensuring effective ventilation and removal of	Study Material	Unit-02	21	**4**

	contaminants. Good design and placement of ducts and outlets are vital for optimal performance and occupant satisfaction.				
Q. 23	Overload protectors are essential safety devices designed to safeguard electrical circuits, particularly motors, against excessive current and potential damage. When current exceeds safe levels, overload protectors intervene by opening the circuit, interrupting power flow to prevent overheating and subsequent component failure. The operation of overload protectors typically involves a bi-metal disc or strip sensitive to temperature changes caused by current flow. As current surpasses safe limits, the temperature of the bi-metal element increases, causing it to bend and activate a mechanical switch, thereby opening the circuit. This action halts current flow, preventing further escalation of temperature and protecting the circuit from damage. Overload protectors are critical in motor circuits, where fluctuations in load and operating conditions can lead to increased current draw. Without overload protection, sustained high currents could result in overheating of motor windings, insulation breakdown, and ultimately motor failure. By promptly disconnecting power when current exceeds safe levels, overload protectors ensure motor safety, prevent damage, and extend equipment lifespan.	Study Material	Unit-04	62	**4**
Q. 24	Refrigeration requirements vary across food categories. Dairy products, like milk, are pasteurized at 62°C and cooled to 4.4°C, while butter is stored between -17.8°C to -33°C. Meat products are chilled using ammonia systems at -25°C and stored at -29°C to maintain quality. Poultry meat often utilizes flake ice for chilling and air blast freezers at -24°C to -40°C for freezing, preventing dehydration. Fishery products are blast frozen in rooms with circulating cold air to preserve texture and quality. Fruits and vegetables use controlled atmosphere storage, modifying oxygen and CO2 levels to extend shelf life, and dehydro-freezing combines dehydration and freezing for durability. Each product faces unique challenges: dairy requires consistent pasteurization, meat needs rapid chilling to prevent spoilage, poultry avoids dehydration, fish needs quick freezing, and produce requires precise atmospheric conditions for freshness.	Study Material	Unit-05	65	**4**