BIRLA INSTITUTE OF TECHNOLOGY
MESRA – 835215, RANCHI, INDIA

UG

Name: ……………………………………………. Roll No.: …………………………………………..

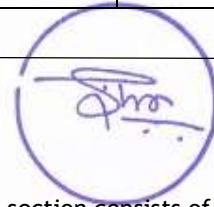Branch: ……………………………………………. Signature of Invigilator: ……………………

Semester: VIth   Date: 27/04/2022 (MORNING)

Subject with Code: **FT310 THERMODYNAMICS AND REFRIGERATION**

Marks Obtained	Section A (30)	Section B (20)	Total Marks (50)

INSTRUCTION TO CANDIDATE

1. The booklet (question paper cum answer sheet) consists of two sections. First section consists of MCQs of 30 marks. Candidates may mark the correct answer in the space provided / may also write answers in the answer sheet provided. The Second section of question paper consists of subjective questions of 20 marks. The candidates may write the answers for these questions in the answer sheets provided with the question booklet.

2. The booklet will be distributed to the candidates before 05 minutes of the examination. **Candidates should write their roll no. in each page of the booklet.**

3. Place the Student ID card, Registration Slip and No Dues Clearance (if applicable) on your desk. All the entries on the cover page must be filled at the specified space.

4. Carrying or using of mobile phone / any electronic gadgets (except regular scientific calculator)/chits are strictly prohibited inside the examination hall as it comes under the category of unfair means.

5. No candidate should be allowed to enter the examination hall later than 10 minutes after the commencement of examination. Candidates are not allowed to go out of the examination hall/room during the first 30 minutes and last 10 minutes of the examination.

6. Write on both side of the leaf and use pens with same ink.

7. The medium of examination is English. Answer book written in language other than English is liable to be rejected.

8. All attached sheets such as graph papers, drawing sheets etc. should be properly folded to the size of the answer book and tagged with the answer book by the candidate at least 05 minutes before the end of examination.

9. The door of examination hall will be closed 10 minutes before the end of examination. Do not leave the examination hall until the invigilators instruct you to do so.

10. Always maintain the highest level of integrity. Remember you are a BITian.

11. Candidates need to **submit the question paper cum answer sheets before leaving the examination hall**.

Department of Chemical Engineering
Birla Institute of Technology, Mesra

Subject Name: FT310 Thermodynamics & Refrigeration

Full Marks: 50
Time: 2 hours
SECTION A- Multiple Choice Questions (Answer All Questions)
Marks-30x1=30

1. The major limitation of the first law of thermodynamics is that it does not consider
   A. Heat as a form of energy
   B. Rate of change of a process
   C. Direction of change
   D. Spontaneous processes
2. All spontaneous processes are
   A. Reversible
   B. Irreversible
   C. Reversible adiabatic
   D. Adiabatic
3. Entropy change of a system is zero in
   A. Reversible process
   B. Adiabatic process
   C. Reversible adiabatic process
   D. Isothermal process
4. In thermodynamics, a *phase* means
   A. A closed system
   B. An open system
   C. A homogeneous system
   D. A heterogeneous system
5. A Carnot cycle consists of the following steps:
   A. Two isothermals and two isentropics
   B. Two isobarics and two isothermals
   C. Two isochorics and two isobarics
   D. Two isothermals and two isochorics
6. Which of the following refers to the term C.O.P. of refrigeration?
   A. Cooling for Performance
   B. Coefficient of Performance
   C. Capacity of Performance
   D. Co-efficient of Plant
7. Which is the desirable physical property of refrigerant?
   A. Toxic
   B. explosive
   C. low boiling point
   D. high freezing point
8. During a refrigeration cycle, heat is rejected by the refrigerant in a.......
   A. Condenser
   B. Compressor
   C. Evaporator
   D. Expansion valve
9. One ton of refrigeration is equal to

A.21/kJ/min

B.210/kJ/min

C.420/kJ/min

D.620/kJ/min

10. Piston is a part of _____compressor in refrigeration system.
    A. Rotary
    B. Reciprocating
    C. Centrifugal
    D. None of the above

11. The refrigerants used with these compressors should have _____ specific volume.
    A. High
    B. Low
    C. Moderate
    D. Anything

12. The refrigerating effect produced by the sublimation of dry ice takes place at a temperature of _____ °C.
    A) 0
    B) -4
    C) –195.6
    D) –78.5

13. In a vapour compression cycle, the refrigerant immediately after expansion valve
    A. Liquid
    B. Sub-cooled liquid
    C. Saturated liquid
    D. Wet vapor

14. The inside diameter of the capillary used in refrigeration is generally about _____.
    A. 0.5-2.28mm
    B. 0.5-2.28cm
    C. 0.5-2.25µm
    D. 0.5-2.28m

15. Global warming potential is a measure of
    A. Degradation to the ozone layer
    B. Greenhouse effect
    C. Both A & B
    D. None of the above

16. Liquid nitrogen is not recommended in refrigerated trucks because of
    A. Low refrigeration effect
    B. Extremely low boiling point
    C. Both A & B
    D. None of the above

17. In most cases secondary refrigerant usage
    A. Sensible heat transfer
    B. Latent heat transfer
    C. Both A& B
    D. Either A or B

18. Multiple evaporators are used in vapor compression cycle to
    A. Increase the COP
    B. Refrigerate different product at different temperature
    C. Decrease the load on compressor
    D. None of the above.

19. Secondary refrigerants are used for
    A. Household applications
    B. Industrial application
    C. Multiple evaporator system
    D. None of the above.
20. Delivery pipe in refrigeration system connects
    A. Compressor and Condenser
    B. Condenser and collector
    C. Collector and evaporator
    D. Evaporator and compressor
21. The product and refrigerant are separated by a barrier throughout the freezing process for
    A. Air-Blast Contact Freezers
    B. Immersion type refrigerator
    C. Plate Freezers
22. _____ is used as insulation material in refrigeration system
    A. Polyamide
    B. Polyurethane
    C. PVC
    D. Polypropylene
23. The density of a frozen food will be _____ the unfrozen food.
    A. Less than
    B. More than
    C. Equal
24. Thermal diffusivity is the _____ divided by density and specific heat capacity at constant pressure.
    A. Enthalpy
    B. Thermal conductivity
    C. Entropy
    D. Internal energy
25. Specific heat is measured by _____ technique.
    A. TGA
    B. Thermal conductivity
    C. DSC
    D. DMA
26. Find the number of degrees of freedom for $N_2(g) + 3H_2(g) = 2NH_3(l)$
    A. zero
    B. one
    C. two
    D. three
27. For ideal gases, $\Delta H = \int C_p dT$ is valid
    A. For constant volume process
    B. For constant pressure process
    C. Irrespective of the nature of the process
    D. The statement is never true
28. Dry ice is carbon dioxide when it is in a _____ state.
    A. Liquid
    B. Gas
    C. Solid
    D. None of the above
29. The following microorganism is active from -5 to 20 deg. C
    A. Thermophiles

B. Mesophiles
C. Psychrotropes
D. Psychrophiles
30. The following food has low respiration rate
    A. Cauliflower
    B. Tomatoes
    C. Carrot
    D. Potatoes

SECTION B - Long Answer Type (Answer all the questions)

Total Marks 4x5=20

1. Derive the expression of entropy change for an ideal gas.

2. State and prove the Clausius inequality for entropy.

3. Discuss the growth of microorganisms in food items with temperature.

4. Five hundred kgs of fruits are supplied to a cold storage at 20oC. The cold storage is maintained at -5°C and the fruits get cooled to the storage temperature in 10 hours. The latent heat of freezing is 105 kJ/kg and specific heat of fruit is 1.256 kJ/kg K. Find the refrigeration capacity of the plant.

5. Discuss the role of thermos-static expansion valve in refrigeration system.