**DAG-003-2014002**    Seat No. _____

# B. Sc. (Sem. IV) (CBCS) Examination

## April – 2022

## Physics : 401

*(Thermodynamics & Electronics) (New Course)*

**Faculty Code : 003**

**Subject Code : 2014002**

Time : $2\frac{1}{2}$ Hours]                                [Total Marks : **70**

**Instructions :**

(1)  All questions are compulsory.

(2)  Symbols have their usual meaning.

(3)  Figures on right hand sides indicate full marks.

**1**  (A)  Fill up the blanks.                                    4

1.  The first law of thermodynamics establish the relation between heat and _____.

2.  Heat capacity per unit mass is known as _____.

3.  When a system undergoes from an initial state to final state in such a way that no heat leaves or enters the system, the process is called _____.

4.  The _____ gas shows heating effect on passing through the porous plug.

(B)  Solve any one :                                             2

1.  What will be the efficiency of a Carnot's engine working between 127 degree and 27 degree Celsius temperature?

2.  What will be the ratio of the temperature of sink and source of engine having efficiency 50%?

(C)  Answer any one :                                             3

1.  Describe zeroth law of thermodynamics.

2.  State results of Porous plug experiment.

(D)  Answer any one in detail :                                        **5**

    1.  Explain specific heat of gas.

    2.  State and prove Carnot's theorem.

**2**  (A)  Fill up the blanks :                                        **4**

    1.  All natural processes take place in universe are _____.

    2.  "At absolute zero temperature, the entropy tends to zero and the molecules of a system are in perfect order". This is known as _____.

    3.  When temperature of a system is decreased, the entropy and disorder in it _____.

    4.  For a perfect gas, PV = _____.

  (B)  Solve any one :                                          **2**

    1.  Calculate surface temperature of a star, whose wavelength of maximum intensity of emission is 5796 angstrom. The value of Wien's displacement constant is 0.2898 cmK .

    2.  Calculate the radiant emitance of a blackbody at a temperature 5000 K. $\sigma = 5.672 \times 10^{-8}$ SI unit.

  (C)  Answer any one :                                         **3**

    1.  Describe concept of entropy.

    2.  Explain thermal radiation.

  (D)  Answer any one :                                         **5**

    1.  Describe temperature entropy diagram.

    2.  Derive Stefan Boltzmann law.

**3**  (A)  Fill up the blanks :                                        **4**

    1.  The Helmholtz free energy function is defined as F = _____.

    2.  The _____ thermodynamic potential is constant in a reversible isobaric process.

    3.  The _____ thermodynamic potential function remains constant during isothermal isochoric process.

    4.  The relation between Gibb's and Helmholtz function is given as _____.

(B) Solve any one :                                                                 2

1. If $C_P = C_V + T\left(\dfrac{\partial P}{\partial T}\right)_V \left(\dfrac{\partial P}{\partial T}\right)_P \cdot$ Then show that

   $C_P - C_V = R$.

2. State Maxwell's thermodynamic relations.

(C) Answer any one :                                                                 3

1. If $\dfrac{E_S}{E_T} = \dfrac{\left(\dfrac{\partial P}{\partial T}\right)_S \left(\dfrac{\partial T}{\partial V}\right)_S}{\left(\dfrac{\partial P}{\partial S}\right)_T \left(\dfrac{\partial S}{\partial V}\right)_T}$, then show that $\dfrac{E_S}{E_T} = \dfrac{C_P}{C_V}$.

2. Derive first TdS equation.

(D) Answer any one :                                                                 5

1. Obtain specific heat equation $C_P - C_V = TE\alpha^2 V$.
2. Explain Joule Thomson effect and Joule Thomson coefficient.


4  (A) Do as directed :                                                              4
   1. What is full form of IGFET ?
   2. Draw the symbol of n-channel JFET.
   3. Which type of current carriers in p-channel JFET ?
   4. The transconductance of a JFET is defined as ratio of change in drain current to ..... (complete the sentence)

(B) Solve any one :                                                                  2
   1. In JFET, the change in gate voltahe is 0.5 V and corresponding change in drain current is 3 mA at constant drain to source voltage. What will be the transconductance?

   2. Make a truth table of Boolean expression $Y = \overline{A \oplus B}$.

(C) Answer any one :                                                                 3
   1. State advantages of JFET.
   2. Prove $A + BC = (A + B) \cdot (A + C)$ using truth table.

(D) Answer any one :                                                                 5
   1. Write note on Thermistor.
   2. Describe NAND as a universal gate.

**5** **(A)** Fill up the blanks. **4**

1. The general condition for bridge balance is _____.

2. The value of unknown _____ can be determined by Maxwell's bridge.

3. The quality factor of R-C series circuit is given by Q = _____.

4. The power factor of R-C series circuit is given as cosθ = _____.

**(B)** Solve any one : **2**

1. Draw a circuit diagram of Wien's series bridge.

2. Find the quality factor of a circuit having an inductor L = 1H connected in parallel to a resistance R = 10 KΩ at angular frequency $\omega$ = 1000 rad//sec.

**(C)** Answer any one : **3**

1. Calculate the operating frequency for a Hartley oscillator. $L_1$ = 500 μ*H*, $L_2$ = 50 μ*H*, *C* = 10 *PF* and *M* = 10 μ*H*.

2. Describe the classification of ac bridges.

**(D)** Answer any one : **5**

1. Explain Owen's bridge.

2. Describe construction and working of Colpitt's oscillator.

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