Seat No. _____

HI-003-1014002

B. Sc. (Sem. IV) Examination

April - 2023

Physics : P - 401

(Thermodynamics & Electronics) (Old Course)

Faculty Code : 003

Subject Code : 1014002

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

Instructions : (1) All questions are compulsory.
(2) Symbols have their usual meanings.
(3) Figures to the right side indicate marks.

1 (a) Answer the following in short: **4**

(1) What is the unit of specific heat in C.G.S. unit?

(2) Write the Mayer's formula.

(3) The efficiency of any heat engine can never be 100%. (True / False)

(4) Write Lord Kelvin's statement for second law of thermodynamics.

(b) Answer in brief : (any **one**) **2**

(1) Find the efficiency of a Carnot's engine working between 127°C and 27°C.

(2) Carnot's engine has same efficiency between 1000 K and 500 K and between x K and 1000 K. Calculate x-the temperature of sink.

(c) Answer in detail : (any **one**) **3**

(1) Describe zeroth law of thermodynamics.

(2) Obtain Mayer's formula.

(d) Give answer in detail : (any **one**) **5**

(1) Explain in detail Carnot's cycle.

(2) Write and prove Carnot's theorem.

2 (a) Answer the following in short: **4**

(1) Write the unit of entropy.

(2) In reversible process, the total change in entropy is always zero. (True / False)

(3) Write Stefan's Law.

(4) Thermal radiation travels in straight line. (True / False)

(b) Answer in brief : (any **one**) **2**

(1) Compute the change in entropy when 25 gm of ice at 0°C is converted into water at the same temperature. (Latent heat of fusion is 80 cal./gm.)

(2) Calculate the change in entropy for 3 gm of nitrogen doubles in volume at constant temperature.

(c) Answer in detail : (any **one**) **3**

(1) Explain change in entropy in reversible process.

(2) Write properties of thermal radiation.

(d) Write notes on : (any **one**) **5**

(1) Derive Stefan - Boltzmann's Law.

(2) Describe entropy of a steam.

3 (a) Answer the following in short: **4**

(1) The internal energy of the system remains constant in an isochoric adiabatic process. (True / False)

(2) Halmholtz free energy F is defined as _____.

(3) Enthalpy remains constant in a reversible isobaric adiabatic process. (True / False)

(4) Write specific heat equation.

(b) Answer in brief : (any **one**) **2**

(1) At 373 K, 1 gm of water occupies 1601 cm^3 on evaporation. Calculate latent heat of steam if $\frac{dP}{dT} = 35985 \frac{dyne}{cm^2 K}$.

(2) Compare the radiant emittance of a black body at 200 K and 2000 K. $\sigma = 5.672 \times 10^{-8}\ mks$.

(c) Answer in detail : (any **one**) **3**

(1) Describe internal energy.

(2) Explain Gibb's free energy.

(d) Write notes on : (any **one**) **5**

(1) Write the Maxwell's four thermodynamical relations and derive specific heat equation.

(2) State the Maxwell's thermodynamical relations and deduce T_{ds} equation.

4 (a) Answer the following in short: **4**

(1) Write the full form of LASER.

(2) Draw circuit symbol of LED.

(3) JFET is less noisy than BJT. (True / False)

(4) Write the truth table of AND gate.

(b) Answer in brief : (any **one**) **2**

(1) In JFET, if 2 V changes of V_{DS} produces 0.2 mA change in I_D. Find the a.c. drain resistance if V_{GS} = –1.5 V.

(2) The parameters of UJT are $R_{BB} = 5\,k\Omega$ and $\eta = 0.6$, find the values of R_{B_1} and R_{B_2}.

(c) Answer in detail : (any **one**) **3**

(1) Explain the working of LED.

(2) Draw and explain characteristics of UJT.

(d) Write notes on : (any **one**) **5**

(1) Define the JFET parameters and obtain the relation between them.

(2) Explain universal gates.

5 (a) Answer the following in short: **4**

(1) In LR circuit $P = VI\cos\phi$, where $\cos\phi$ is called _____.

(2) The frequency of LC oscillations is given by f = _____.

(3) Write the balance condition for ac bridge.

(4) Which bridge is used to find unknown capacitance?

(b) Answer in brief : (any **one**) **2**

(1) In Maxwell's bridge the balance is obtained when $C_1 = 0.01\,\mu F$, $R_1 = 470\ k\Omega$, $R_2 = 2.7\ k\Omega$ and $R_3 = 100\ k\Omega$. Find the inductive impedance.

(2) Find the resonance frequency of series LC circuit if $L = 200\,\mu H$ and $C = 200\ PF$.

(c) Answer in detail : (any **one**) **3**

(1) Explain RL series circuit.

(2) Describe the Barkhausen criteria.

(d) Write note on : (any **one**) **5**

(1) Explain the construction and working of Wein bridge oscillator.

(2) Obtain the general conditions for bridge balance.
