Registration Number:

Date & Session

ST. JOSEPH'S UNIVERSITY, BENGALURU -27
B.Sc. (PHYSICS)– 4th SEMESTER
SEMESTER EXAMINATION: MAY 2024
(Examination conducted in May/June 2024)
PH 422–THERMAL PHYSICS AND ELECTRONICS
(For Regular/Supplementary students only)

Time: 2 Hours **Max Marks: 60**

This paper contains 2 printed pages and 3 parts

PART - A

Answer any four of the following: **(4 x 8 = 32)**

1. (a)Calculate the work done during an isothermal process
   (b)State and explain Carnot's theorem. (4+4)

2. Obtain an expression for the pressure exerted by a gas based on Kinetic Theory of gases. (8)

3. (a) Give the physical significance of Gibb's Free energy.
   (b) Derive first two Maxwell's thermodynamic relations from thermodynamic potentials. (2+6)

4. (a) Bring out the principle of virtual ground.
   (b) Explain with a circuit diagram how op amp functions as non-inverting amplifier. (2+6)

5. (a) Mention any three differences between UJT and BJT.
   (b) Explain the drain characteristics of JFET with a circuit diagram. (3+5)

6. (a) With a neat circuit diagram, explain the construction and working of CE amplifier.
   (b) Explain the term CMRR. (6+2)

PART –B

Answer any four of the following: **(4 x 5 = 20)**

7. Calculate the change of entropy when 0.25 kg of ice at 273 K melts into water at 313 K. Specific latent heat of ice=$3.36 \times 10^5 Jkg^{-1}$; specific heat capacity of water = 4200 $Jkg^{-1}K^{-1}$

8. Find the pressure at which water would boil at 150°C, if the change in specific volume when 1kg of water is converted into steam is 1.676 m^3. Given, 1 atmosphere pressure is 1.013×10^5 Pa and latent heat of vapourisation of steam= $2.268 \times 10^6 Jkg^{-1}$.

9. Calculate the mean free path of N_2 molecule at 27°C and 1 atmospheric pressure. The molecular diameter of N_2 is 3.5×10^{-8} cm. Also calculate the collision frequency if the average velocity is 426 ms^{-1}.

10. The average voltage across half the secondary winding in a centre tap transformer used in a full wave rectifier is 220sin314t. The forward bias resistance of each diode is 30Ω and the load resistance of each diode is 3KΩ.Calculate the ripple factor.

11. A JFET has drain current of 5 mA. If the shorted drain current I_{DSS} = 10 mA and $V_{GS(off)}$ = -6 V, find the values of (i) V_{GS} and (ii) Pinch off voltage V_p

12. In a Colpitt's oscillator, the tuned circuit has C_1=800 pF, C_2= 400 pF and L = 58.6 µH. Calculate the frequency of oscillation.

PART –C

Answer any four of the following: **(4 x 2 = 8)**

13. Why does a perfect gas equation need modification?
14. A reversible adiabatic change is isentropic. Give reason.
15. Why does food get cooked faster in pressure cooker?
16. What is meant by biasing of transistor? Explain.
17. Can the source and drain in a JFET be interchanged. Justify.
18. An ideal opamp has infinite bandwidth. Justify.