AD-104

April-2019

B.Sc., Sem.-IV

CC-204 : Physics

Time : 2:30 Hours]

[Max. Marks : 70

Instructions :
(1) Symbols have their usual meaning.
(2) Number on R.H.S. of equations indicate marks.

1. (A) Write the following :

(i) Explain Debye's theory of specific heat of solids and show that 7

$$C_V = 3RF_D\left(\frac{\theta_D}{T}\right)$$

(ii) Derive equation of average thermal energy of simple harmonic oscillator. 7

OR

(i) Write a note on salient features of the dispersion curve for the one dimensional monoatomic crystal with necessary figure.

(ii) Explain the following phonon collision processes :

(a) N(Normal) – processes

(b) U(Umklapp) – processes

(B) Answer in short : (any **four**) 4

(a) Write Dulong-Petit Law.

(b) Define first Brillouin zone.

(c) What is a phonon ?

(d) According to Einstein's theory what is number of oscillators in a given solid matter ?

(e) Write the equation of Young's modulus in terms of force constant.

(f) Write down the equation showing relation between specific heat and temperature of solids for low temperature.

2. (A) Write the following :

(i) Derive the entropy for an ideal gas. 7

(ii) Derive 7

$$C_P - C_V = -T\left(\frac{\partial V}{\partial P}\right)_P^2\left(\frac{\partial P}{\partial V}\right)_T$$

OR

(i) Explain Clausius's theorem and obtain, $\oint \frac{dQ}{T}$.

(ii) Obtain second $T - dS$ equation and discuss its applications.

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(B) Answer in short : (any **four**)

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    (a)   On which factors does the value of Gruneison parameter depends ?

    (b)   Define the co-efficient of linear expansion α(alpha) for thermal energy.

    (c)   What is anisotropic process ?

    (d)   What is throttling process ?

    (e)   Define inversion temperature.

    (f)   Write first energy equation.

3.   (A) Write the following :

    (i)   Explain in detail a Fixed Bias circuit.

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    (ii)   Draw Black-Box diagram for a transistor circuit. Explain and define hybrid parameters.

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OR

    (i)   Explain collector-to-Base bias circuit and derive stability factor for that.

    (ii)   Draw the input and output characteristics curves for a CE circuit. Obtain four h-parameters h_{ie}, h_{fe}, h_{re}, h_{oe} from these curves.

(B) Answer in short : (any **three**)

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    (a)   Convert binary number $(1010)_2$ to its equivalent decimal number.

    (b)   Convert decimal number $(19)_{10}$ to its equivalent binary number.

    (c)   Convert Hexadecimal number $(A6F)_{16}$ to its equivalent binary number.

    (d)   Convert Hexadecimal number $(B7)_{16}$ to its equivalent decimal number.

    (e)   Write equivalent gray code of binary number $(1110)_2$.

4.   (A) Write the following :

    (i)   Derive an equation for the frequency of spectral lines in case of No.... Zeeman effect.

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    (ii)   Write a detailed note on the vector atom model with necessary figures and equations.

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OR

    (i)   Derive an expression for magnetic moment of electron revolving around nucleus in circulator orbit.

    (ii)   Explain in detail the Stark effect.

(B) Answer in short : (any **three**)

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    (a)   Write Hund's law.

    (b)   Write Pauli's exclusion principle.

    (c)   Define Larmor frequency.

    (d)   Define Paschen Back effect.

    (e)   Write an equation for Bohr Magneton.

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