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VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (CBCS) II-Semester Advanced Supplementary Examinations, June/July-2017

Applied Physics
(Civil Engg.)

Time: **3** hours Max. Marks: **70**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

1. The spin of a particle is 2½. What statistics does it follow?
2. The wave function of electrons in a one dimensional potential box of dimension of width 'a' is $\Psi_n = A \sin(n\pi/a)x$, where n = 1, 2, 3... Evaluate A by normalizing the wave function.
3. Define the terms lattice, basis, crystal system and unit cell.
4. State and discuss Meissner's effect in superconductivity.
5. List the failures of the free electron model.
6. The resistivity of Si at 300 K is 3.16x 10^3 ohm m. Calculate the intrinsic carrier density. Mobilities of electrons and holes in Si are 0.14 m^2/V Sec and 0.05 m^2/V sec respectively.
7. The reactance of the inductor is 80 Ω at 500 Hz. Find its inductance.
8. A radio is tuned to a station whose frequency is 800 kHz. The antenna circuit contains R = 5Ω and L = 5 mH, find the capacitance.
9. What are the advantages in producing ultrasonic waves using magnetostriction method?
10. What are the limitations of Sabine's formula?

Part-B (5 × 10 = 50 Marks)

11. a) A particle in an infinite square well potential within the boundaries [6]

$V = \infty, 0 < x$
$= 0, 0 < x < L$
$= \infty, 0 > x$

is described the wave function ψ (x). Find the Eigen values and Sketch the Eigen functions.

b) Define ensemble. Differentiate between canonical and grand canonical ensembles. [4]

12. a) Show that the number of Frenkel defects in a crystal of N atoms is $n = (N N')^{1/2} \exp(-E_f/k_B T)$. Where E_f is the energy of formation of Frenkel defect and 'N'is the number of interstitial sites in the crystal. [6]

b) What is effect of isotopic mass on the critical temperature (T_c) of a superconductor? If T_c of ^{208}Pb is 7.2 K and the Tc of its isotope ^{210}Pb. [4]

13. a) Explain the Fermi Energy level in N-type and P-type semiconductors. Obtain expression for conductivity of intrinsic and extrinsic semiconductor in terms of mobility. [7]

b) Calculate resistance of Ge of 1 × 2 × 3 cm^3 having conductivity of 1.25 × 10^{-2} mho. [3]

14. a) What does root mean square (RMS) means? What do AC meters really show? Is it RMS of peak voltage? What does 6 V AC really means? [6]

b) A radio is tuned to (resonance) a particular station. If the antenna circuit contains R = 5Ω, L = 5 mH, and C = 5 pF. Find the frequency of the station. [4]

Contd... 2

15. a) Discuss the applications of ultrasonic waves using *i)* cavitation and *ii)* non-destructive testing. [6]

    b) Explain how reverberation of hall is affected by *i)* size and *ii)* nature of its wall surface. [4]

16. a) Explain with neat diagram the Powder x-ray diffraction to evaluate lattice parameter. [6]

    b) Compute the de Broglie wavelength of *i)* a 46gm of golf ball moving with a velocity of of 30 m/s and *ii)* an electron moving with a velocity of 10^7 m/s. By comparing the wavelengths with their respective dimensions of the objects (ball and electron) briefly explain which one will exhibit the wave nature. [4]

17. Answer any ***two*** of the following:

    a) Neatly draw the energy band diagrams for metals, insulators, intrinsic and extrinsic semiconductors. Indicate the energy levels of valancy band, conduction band, Fermi level and the impurity levels wherever is appropriate. [5]

    b) Distinguish between resistive impedance and reactive impedance. What is the effect of a reactive impedance on the current and voltage in an AC circuit and in a DC circuit? [5]

    c) Explain coefficient of sound absorption and illustrate a method to determine it. [5]