[No. of Printed Pages .: 02]

SEAT No._____ SARDAR PATEL UNIVERSITY

[2163]

M.Sc. (Physics) (III[rd] –Semester) Examination

Day & Date :Monday, 29/10/2018

Time: 02:00 p.m. to 05:00 p.m.

Subject Code: PS03EPHY02

Title: MAGNETIC AND OPTICAL PROPERTIES OF CONDENSED MATTER

Instruction:

Figure to the right indicate marks. Total Marks : 70

Q.1 Write answer of all questions by showing your choice against the question number. [8]

(i) In the luminescent material, the emission of the radiation is in the _____region.
(a) visible (b) infrared (c) gamma ray (d) X-ray

(ii) $^1P_1$ represents the _____state in the luminescent material.
(a)ground (b) meta-stable (c) excited (d) none of these

(iii) In Mossbauer effect, the recoilless emission of gamma rays takes place because lattice vibrations are _____.
(a) smaller than nuclear life time (b) larger than nuclear life time
(c) equal to nuclear life time (d) zero

(iv) To perform Mossbauer experiment, 10^{-6} to 10^{-10} sec is the _____time To be spent by nucleus in excited state.
(a) relaxation (b) half life (c) life (d) response

(v) _____equation is used to determine the response time of photoconductive material.
(a) $t_0 = \frac{\sigma}{e\mu L}$ (b) $t_0 = \sqrt{\frac{\sigma}{e\mu L}}$ (c) $t_0 = \frac{\sigma}{\mu L}$ (d) $t_0 = \sqrt{\frac{\sigma}{\mu L}}$

(vi) Dielectric constant ($\in$) of a material can be calculated by :
(a) $\in = (C_{medium} / C_{vacuum})^{1/2}$ (b) $\in = 1/(C_{medium} / C_{vacuum})$
(c) $\in = C_{vacuum} / C_{medium}$ (d) $\in = C_{medium} / C_{vacuum}$

(vii) In a magnetic field, if nucleus have two energy levels corresponding to m_I, then I = _____
(a) 0 (b) 1 (c) 1/2 (d) 2

(viii) In the magnetic resonance studies of the solids, the motion of spin or of the surroundings gives information in form of changes in the _____.
(a) line width (b) fine structure of the absorption
(c) change in position of the resonance line (d) extra spectral line

[Continue on Page No.: 02]

(P.T.O)

Q.2 Attempt any Seven of the followings: [14]

(i) How the radiationless transition is possible in phosphors?
(ii) Describe the excitation process involved by the diffusion of an exciton in luminescent material.
(iii) Can germanium or silicon be used as luminescent material? Justify.
(iv) Explain natural broadening of line width in Mossbauer spectroscopy.
(v) Describe R.W. Wood's experiment to observe resonance fluorescence.
(vi) Explain free carrier absorption in semiconductor.
(vii) What is skin depth? Obtain the equation to determine skin depth in metallic material.
(viii) Describe the applications of nuclear magnetic resonance.
(ix) Discuss hyperfine splitting in brief.

Q.3(a) Discuss the absorption and emission spectra obtained from the pure and thallium doped KCl luminescent crystal using necessary diagram. Also mention its requirements. [6]

Q.3(b) Explain the term : thermoluminescence, glow curve and power decay law. [6]

OR

Q.3(b) Define electroluminescence. Describe in detail the Gudden – Pohl effect and Descriau effect in phosphors. [6]

Q.4(a) What is Mossbauer effect? Explain the mechanism of Mossbauer effect and Mention important applications of this effect. [6]

Q.4(b) Describe in detail three different methods attempt to observe resonance fluorescence. [6]

OR

Q.4(b) Explain the following: (i) Mossbauer effect and lattice dynamics (ii)Magnetic hyperfine interactions [6]

Q.5(a) Define photoconductivity. Obtain the expression for total photoconductivity using semiconducting material. [6]

Q.5(b) What is non-polar solid? Obtain the expression for complex dielectric constant of non-polar solids. [6]

OR

Q.5(b) Distinguish between semiconductor and insulator. Discuss important insulating materials with suitable examples. [6]

Q.6(a) What is resonance? Explain the nuclear quadrupole resonance in detail. [6]

Q.6(b) Write a short note on electron paramagnetic resonance. [6]

OR

Q.6(b) What is saturation magnetization? How saturation magnetization depends on temperature? Discuss it in detail. [6]

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