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SARDAR PATEL UNIVERSITY
M.Sc. (PHYSICS) (IIIrd – Semester) Examination

Day & Date: Wednesday & 27/03/2019

Time: 10:00 AM to 01:00 PM

Title: MAGNETIC AND OPTICAL PROPERTIES IN CONDENSED MATTER

Course Code: PS03EPHY02

Instruction: Figures to the right indicate marks.

Total Marks: 70

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

- (1) Excitation may be achieved by bombardment with electrons is called _____ luminescence.
 (a) Electro (b) cathodo (c) thermo (d) chemi
- (2) The equation $I(t) = I_0 \exp\left(-\frac{t}{\tau}\right)$ is used to calculate the intensity of the luminescent material for _____.
 (a) Temperature dependent exponential decay (b) temperature independent exponential decay
 (c) power decay law (d) concentration dependence
- (3) Using R.W. Wood experiment, Bunsen flame contain _____ to obtain bright yellow patch on screen
 (a) KCl (b) NaCl (c) MgCl (d) FeCl₂
- (4) In Mossbauer experiment the energy of the gamma ray should lie between _____ keV.
 (a) 10 – 200 (b) 300 -400 (c) 500 – 600 (d) 700 - 800
- (5) The electrical conductivity of the perfect dielectric materials is almost _____.
 (a) $-\infty$ (b) 0 (c) ∞ (d) 1
- (6) Dielectric constant of Mica varies in between _____.
 (a) 5 and 7.5 (b) 5 and 7
 (c) 5.5 and 7.5 (d) 5.5 and 7
- (7) Magnons are quantized spin waves of _____ type.
 (a) Longitudinal (b) Transverse
 (c) standing (d) none of them
- (8) In magnetite, Fe₃O₄ sample which ions moments cancels out within itself;
 (a) O²⁻ (b) Fe²⁺
 (c) Fe³⁺ (d) none of them

Q.2 Attempt any Seven of the followings:

[14]

- (1) What is luminescence? Define photoluminescence and chemiluminescence.
- (2) How radiationless transition is possible in phosphors?
- (3) Explain Gudden-Pohl effect in luminescent material.
- (4) Mention factors affecting to broadening the spectral line in Mossbauer spectroscopy.

- (5) Describe two methods for measurements of dielectric constant.
- (6) Explain "skin depth" ' δ ' of a metal in propagation of light in conducting media.
- (7) In ferromagnetic ordering discuss Curie point and mean field approximation.
- (8) Explain in brief damped oscillatory solutions of Bloch's equations of motion.
- (9) Describe "Knight shift" for NMR.

Q.3(a) Can absorption and emission spectra of pure KCl crystal and thallium doped KCl crystal remain same? Why? Explain it in detail using suitable diagrams. [6]

Q.3(b) Describe the power decay law for luminescent material. Define thermoluminescence and glow curve and obtain the expression of variation of intensity with temperatures for this material. [6]

OR

Q.3(b) Explain the applications of the luminescent material in detail. [6]

Q.4(a) What is Mossbauer effect? Give the detail about mechanism of Mossbauer effect and also mention requirements of this effect. [6]

Q.4(b) Obtain the expression of Debye-Waller factor and show its temperature dependence also. [6]

OR

Q.4(b) Explain magnetic hyperfine interactions and quadrupole interaction in detail. [6]

Q.5(a) Describe in detail different light absorption processes. [6]

Q.5(b) Write a short note on photoconductivity. [6]

OR

Q.5(b) What is dielectric loss and loss angle? Show that the energy absorbed by the medium is directly proportional to the imaginary part of complex dielectric constant. [6]

Q.6(a) Explain the term magnons in ferromagnet. Derive the dispersion relation. [6]

Q.6(b) Explain antiferromagnetic order in detail with the help of suitable example. [6]

OR

Q.6(b) Define resonance. Explain nuclear quadrupole resonance and ferromagnetic resonance in detail. [6]

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