

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATIONS- 2023

PhD-I Semester (PMS)

COURSE CODE (CREDITS): 13P1WPH112 (3)

MAX. MARKS: 35

COURSE NAME: Materials Characterization

COURSE INSTRUCTORS: SKT

MAX. TIME: 2 Hours

Note: (a) All questions are compulsory. (b) Marks are indicated against each question in square brackets (c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

1. How you will differentiate Frenkel and Wannier excitons from emission and absorption spectra and within the crystal. Give your answer in terms of crystal structure and transition probability [5]
2. What is the difference between FTIR spectroscopy and Raman spectroscopy, although in both the spectra, experimental data is plotted as Intensity Vs wave number, draw the electronic state, vibrational state and rotational states to explain your answer. [5]
3. Graphically explain the absorption, luminescence, and excitation spectra. How you will obtain optical band gap from absorption and luminescence spectra for direct and indirect band gap materials. [5]
4. How a surface profile of a thin film is obtained from SEM, TEM, AFM and STM (abbreviation are standard), point out the basic difference of TEM and STM. [5]
5. Draw the energy level diagram of free excitons, bound excitons, and photons. Based on energy level diagram what are the possibility of exciton-photon (polaritons) interaction [5]
6. Write the short notes on following.
 - (a) Radiative and non-radiative equations
 - (b) Spectral profile of absorption, emission and excitation
 - (c) Effect of slit width on emission and absorption
 - (d) Rate equation for radiative and non radiative emissions
 - (e) Tauc plot for direct and indirect band gap materials[2x5=10]