JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST -3 EXAMINATIONS-2022
B.Tech-VII Semester (CS/IT/ECE/Civil/BT)

COURSE CODE (CREDITS): 18B11WPH731(3)
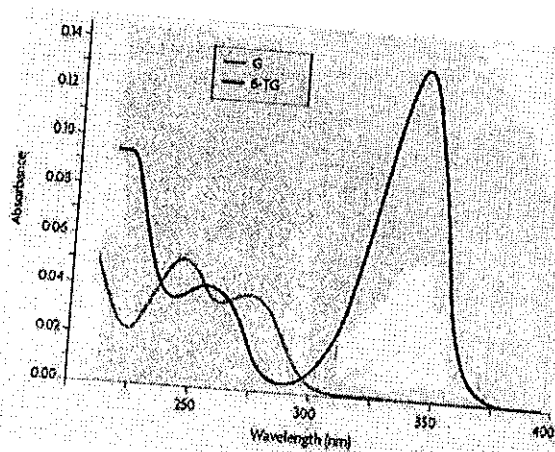
COURSE NAME: Nanotechnology

COURSE INSTRUCTORS: Dr. Ragini Raj Singh

MAX. MARKS: 35

MAX. TIME: 2 Hours

Note: All questions are compulsory. Marks are indicated against each question in square brackets.

Q1. Consider the spectrum below.

[CO:3; Marks: 3.5]

a. What region of the spectra is being studied? *0.5*

b. Are G and 6-TG atoms or molecules? How can you tell? *0.5*

c. What is the λmax of "G"? What is the λmax of "6-TG"? *0.5*

d. If G has a concentration of 0.25 mM, what is its absorptivity at 250 nm? b=1.00 cm *1*
0.2 mM^{-1}·cm-1 or 200 M^{-1}·cm^{-1}

e. If 6-TG has a concentration of 0.40 mM, what is its absorptivity at 250 nm? b=1.00 cm *1*
0.1 mM^{-1}·cm^{-1} or 100 M^{-1}·cm^{-1}.

Q.2. A solution of thickness 2 cm transmits 40% incident light. Calculate the concentration of the solution, given that ε= 6000 dm^3/mol/cm.

[CO: 3; Marks: 2]

Q.3. (a) A molecule phosphoresces with a single peak wavelength of 550 nm. The single fluorescence peak is at 500 nm. The absorption peak is at 425 nm. Sketch a rough Jablonski diagram based on this information, labelling transitions and calculating differences in each energy state in nm and cm^{-1}.

[CO: 2, 3; Marks: 2]

(b) You have been given a report on luminescence measurements for an important molecule. The report describes the fluorescence of the molecule with a peak at 675 nm, absorption peak at 455 nm, and phosphorescence peak at 560 nm. What is wrong with this information?

[CO: 2,3; Marks: 1]

Q.4. The fundamental vibrational transition (v →0 to v →1) for CO is 2170.2 cm^{-1}. Treat CO as a harmonic oscillator, and determine the harmonic force constant k in g/s^2. (Given atomic mass for C= 12 amu, for O=15.9949 amu)

[CO: 3,4; Marks:2.5]

Q.5. In a diffractometer experiment a specimen of thorium (Th) is irradiated with tungsten (W) L$_\alpha$ radiation. Calculate the angle, θ, of the 4th reflection.

[CO: 3,4; Marks: 3]

Q.6. What is homogeneous and heterogeneous nucleation in the process of nanoparticle synthesis? Discuss the homogeneous condensation with detailed equations and supporting graph.

[CO: 1, 2; Marks: **5**]

Q.7. How X-ray diffraction analysis makes us capable to find out the nanoparticle size and the strain produced in the system. Give all the explanation with required equations. [CO: 3, 4; Marks: **4**]

Q.8. How many types of signals we receive in SEM analysis? Also discuss the sample beam interactions. Which factors effect emission of SE signals from the specimen surface. [CO: 3; Marks: **4**]

Q.9. X-ray Photoelectron Spectroscopy (XPS) is one of a number of surface analytical techniques that bombard the sample with photons, electrons or ions in order to excite the emission of photons, electrons or ions. In view of this discuss all the basic concepts of the XPS with the help of necessary diagrams.

[CO: 3, 4; Marks: **4**]

Q.10. "Not all transitions that are possible are observed in the UV spectroscopy. What are the selections rules which describes certain quantum mechanical constraints for an electron to transition.

[CO: 1, 3; Marks: **4**]