JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY
T3 Examination May 2019
B.Tech (Biotech/ Bioinformatics) (IInd Semester)

Course Code: 18B11PH212

Course Name: Bioinstrumentation Techniques

Course Credit: 04

Max. Marks: 35

Max. Time: 2 Hrs.

Note: All questions are compulsory. Carrying of mobile phone during examination will be treated as case of unfair means. Marks are indicated below each question

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Q.1. An electron of energy 20 eV comes into collision wirh a hydrogen atom in its ground state. The atoms excited into a higher state and electron is scattered with a reduced velocity. The atom subsequently returns to its ground state with the emission of photon of wavelength 1.212×10^{-7} m. Determine the velocity of the scattered electron. [CO1, 2]2

Q.2. Consider the de-Broglie wavelength of an electron and a proton which wavelength is smaller if the two particles have (a) the same speed, (b) the same momentum and (c) the same energy. [CO1, 2]3

Q.3. The fundamental vibrational transition from $v=0$ 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. [m_C=12 amu, m_O=15.9949 amu, 1 amu= 1.66×10^{-24} g] [CO3-5]3

Q.4. A diatomic molecule HX (X is unknown atom) has a harmonic vibrational force constant k= 9.68×10^5 g/s2. The harmonic vibrational frequency in wavenumbers is 4143.3 cm^{-1}. [CO3-5] 3

(a) What is the reduced mass of the molecule?

(b) Which atom corresponds to X?

Q.5. Using spectroscopic constants from vibrational spectroscopy determine for NaF; [CO3-5] 5

(a) The ground state energy in cm-1 assuming a harmonic and then assuming an anharmonic oscillator.

(b) The v=6 energy in cm-1 assuming a harmonic and then assuming an anharmonic oscillator.

(c) Compare the harmonic and anharmonic oscillator results from parts (a) and (b)

Q.6. (a) Discuss the quantum and classical theory of Raman scattering. Discuss polarizability ellipsoid and deduce the equation which givesterms for stokes and antistokes Raman in oscillating electric field.

[CO3-5] 3

(b) Graphically represent the different modes of a liner molecule and discuss whether the modes are Raman active and Raman inactive and why? [CO3-5] 2

Q.7. (a) Explain the basics of Mass-spectrometery by considering an example of amino acid. Also discuss the basic instrumentation from heat chamber to detection. [CO3-5] **3**

(b) Discuss the chemical method, fast ion bombardment method and MALDI method for ionization of the molecule along with their suitability to different kinds of molecules? [CO2-4] **3**

Q.8. What information can be deduced by FTIR spsectroscopy from biological samples? [CO2-4] **3**

Q.9 (a) Classify chromatography according to mobile phase, packing of the stationary phase and the force of separation? [CO4-5] **3**

(b) Discuss ion exchange chromatography in detail. [CO4-5] **2**