JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST -3 EXAMINATION-2022
M.Sc-III Semester (Microbiology)

Course Code (Credits): 21MS2MB312 (3)   Max. Marks: 35
Course Name: Biosensor: principle &Applications
Course Instructors: Dr. Abhishek   Max. Time: 2 Hours

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

1. Is it possible to determine the presence of pesticide in a sample using Butyryl cholin esterase? If yes, then write down the sequence of reaction to detect pesticide by this enzyme in the biosensor also explain what types of pesticides can be detected by cholin esterase enzyme? [5]

2. Food processing industry faces various challenges; one of the foremost challenges is the need of quick and cost effective methods to detect the presence of allergenic components and pathogens in the food. Biosensors can overcome the above problems by offering rapid, non-destructive and affordable methods for pathogen detections. Which type of Biosensor you will prefer to develop for food contaminations and why? Also illustrate the design and development of selected biosensor to detect the pathogen in food sample. [5]

3. Consider the electron spin possibilities for the ground and excited state. Do you think these different spin states have different energies? Which one do you expect to be lower in energy? If the spin state is defined as (2S + 1) where S represents the total electronic spin for the system, try to come up with names for the ground and possible excited states for the system that are based on their spin state. Also explain why is phosphorescence emission weak in most substances? [5]

4. Heavy metals cause various fatal diseases in humans. Heavy metals (Hg,Pb,As etc) from factory wastewater can contaminate drinking water and crops. Inductively coupled plasma-mass spectrometry (ICP-MS) and atomic absorption spectrometry (AAS) are commonly used to analyze heavy metal contents; however, these methods require pre-treatment processes and are expensive and complex. To overcome these limitations instrument-free nanoparticles-based strategies are emerging, illustrate the various steps and strategies in the designing of instrument-free nanosensor for heavy metal detections. [5]

5. Rapid, inexpensive, and sensitive detection of bacterial pathogens is an important goal for several aspects of human health and safety. Present strategies with all the important steps for rapid colorimetric detection of bacterial species through the capture of gold nanoparticles by chimeric phages-M13 [5]

6. Calculate the electrode potential at a copper electrode dipped in a 0.01M solution of copper sulphate at 25^0C. The standard potential of Cu^{2+}/Cu system is 0.34 volt at 298 K. also write down the important difference between first, second and third generation of glucose electrochemical biosensor [5]

7. A serum protein consist of 586 amino acid residue, is labelled by a donor (D) or an acceptor (A) choromophore so that we can calculate the energy transfer between the Donor and Acceptor molecule, which will be useful in conformational studies of protein. We find that's that the average energy transfers efficiencies are 50% in the native conformation of protein. If the R0 is 50 A^o, what is the distance between labelled amino acid residue (Donar and acceptor) in Protein? [5]