BITS PILANI-DUBAI CAMPUS
II YEAR BIOTECH SECOND SEMESTER , 2013-2014
COMPREHENSIVE EXAMINATION (Closed book)

Course Title :Biophysics **Course No:BIOT F215**
Date:27.05.2014 **Total Marks:40**
Time: 3 Hrs **Weightage : 40%**

1.Answer all questions sequentially.
2.Useful data : $c = 3 \times 10^8$ m/s , h= 6.626×10^{-34} J s , 1 amu = 1.660×10^{-27} Kg,
R= 0.0821 liter·atm/mol·K

1.(i) A sample of orange juice has an equilibrium hydrogen ion concentration of 2.9×10^{-4} M. Calculate the pH of this solution .
(ii) Amino acid with an amide on the side chain does not produce basic solution. Why?
(iii) Describe the experiment used to determine the hydrogen bond energy of biomolecules in water.
(iv) Write the expression for Lennard Jones potential.
(v) Arginine vasopressin is a pituitary hormone. It helps to regulate the amount of water in the body by reducing the flow of urine from kidneys. An aqueous solution containing 31.6 mg of vasopressin in 100 mL of solution had an osmotic pressure of 4.70 mm Hg at 25°C. Calculate the molecular weight of the hormone.

[1+1+2+1+1.5M]

2. (i) The force constant of $^{12}C\ ^{16}O$ is 1800 Nm^{-1}. Calculate the vibrational frequency in cm^{-1}.
(ii) Explain the beta sheet structure of proteins.
(iii) Describe the tertiary structure of myoglobin molecule. Give any one example for the major interaction involved in the tertiary structure of proteins.
(iv) Explain the factors that stabilize the quaternary structure of proteins.
(v) Give the significance of dihedral symmetry in protein structure along with one example.

[2+2+2+1.5+1M]

3.(i) Explain the term Donnan equilibrium .Calculate the R_G for a freely jointed randomly coiled polymer chain if the number of monomeric units are 3500 and the bond distance is 134 pm.
(ii) Describe the structural features of RNA tertiary structure.
(iii) Explain the various phases exhibited by lipids based on temperature.
(iv) Write the expression for the total potential energy V_{total} in a macromolecular system.
(v) What is meant by simulated annealing?

[2+2+1.5+1+1M]

4.(i) With a neat diagram describe the powder crystal method used to study the diffraction of the crystal.

(ii) X-rays of wavelength 2.63 Å were used to analyze a crystal. If the spacing between the crystal plane is 491 pm, calculate the angle for second - order diffraction.

(iii) Write the principle involved in atomic force microscopy technique along with a neat diagram of the apparatus

(iv) Explain the instrumentation involved in NMR spectroscopy with a block diagram. Based on NMR predict the splitting patterns for the molecule 1,1,2-tribromoethane.

(v) Write any two applications of CD spectra with reference to biomolecules.

[2+1+2+3+1M]

5.(i) Write a note on (a) Magnetic beads and (b) Optical tweezers .

(ii) Explain the spin glass model theory of protein folding.

(iii) Write the interactions disrupted in proteins while denaturation is carried out by salts of heavy metal.

(iv) Describe the theory of fluorescence.

(v) List the forces and factors governing the aggregation in bilayer and monolayer.

[3+1.5+1+1.5+1.5M]

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BITS PILANI-DUBAI,INTERNATIONAL ACADEMIC CITY ,DUBAI
II YEAR BIOTECH SECOND SEMESTER,2013-2014
TEST- 2 (Open book)

Course Title :Biophysics | **Course No:BIOT F215**
Date:29.04.2014 | **Total Marks:20**
Time: 50 min | **Weightage : 20%**
Answer all questions sequentially

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1. A solution is prepared by dissolving 1.08 g of human serum albumin, a protein from blood plasma, in 50 cm^3 of aqueous solution. The solution has an osmotic pressure of 6.85 mm Hg at 25° C . What is the molar mass of albumin ? **(3M)**

2. A 70% alcohol solution is used as a disinfectant on the skin. Justify. **(2M)**

3. X -rays of wavelength 0.140 nm are reflected from a certain crystal and the first-order maximum occurs at an angle of 14.4°. What value does this give for the interplanar spacing of this crystal? **(2M)**

4. You are working for Intech company and your job is to harden titanium by the diffusion of carbon.The concentration of carbon at 1 mm into the surface of the titanium slab is 0.25 kg/m^3 and at 3 mm the concentration is 0.68 kg/m^3. The temperature of the carburizing environment is 925°C and the rate at which carbon is entering this 2 mm thick region is 1.27×10^{-9} $Kg/(m^2 . s)$. Calculate the diffusion coefficient for this particular treatment. **(3M)**

5. How will the concentration of amphiphile affect the size of small micelles ? **(2M)**

6. Write the principle behind the production of X-rays. **(2M)**

7. Schematically represent the potential energies for rotations about the dihedral angle for a single bond and a double bond. **(2M)**

8. Explain the terms (i) Simulated annealing (ii) R_c for a freely jointed randomly coiled polymer chain. **(2M)**

9. Mention the two main predictions of spin-glass model theory of protein folding. **(2M)**

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BITS PILANI-DUBAI CAMPUS
II YEAR BIOTECH SECOND SEMESTER,2013-2014
TEST- 1 (Closed book)

Course Title :Biophysics | **Course No:BIOT F215**
Date:4.03.2014 | **Total Marks:25**
Time: 50 min | **Weightage : 25%**
Answer all questions sequentially

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1. It is incorrect to break up hydrogen bond length to the hydrogen bond radii. Why? **(2M)**

2. Explain Tanford's approach used in the thermodynamic characterization of polarity of amino acid. **(3M)**

3. Given the following peptide: Val-Ser-Cys-Tyr-Leu **(2M)**
   Identify the polar amino acids , the non-polar amino acids , the amino acids that contain sulfur and the aromatic amino acids.

4. What form of aspartic acid would you expect to predominate at pH < 2, pH = 7 and pH > 10 ? **(3M)**

5. Write a note on origin of hydrophobic effect . **(2M)**

6. Explain the α-helix structure (secondary structure) of proteins. **(4M)**

7. Differentiate the torsion angle and dihedral angle with a representation. **(3M)**

8. Write the significance of cyclic symmetry in protein structure with an example. **(2M)**

9. Mention any four hydrogen bond donors and acceptors frequently observed in biomoleules. **(2M)**

10. Solvation of amino acid in water and octanol do not make drastic differences in energetics.Justify. **(2M)**

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BITS, PILANI – DUBAI CAMPUS

SECOND SEMESTER 2013 – 2014

Course Code: BIOT F215 | **SECOND YEAR** | Date:13.05.2014
Course Title:Biophysics | QUIZ-2 | Max Marks:7
Duration : 20 minutes | | Weightage: 7%

Name: ..... **ID No:** ..... **Sec / Prog:** .....

Instructions: (if any) Over writing will be taken as wrong answer

1.List all the possible electronic transitions for fluorine molecule. **(1M)**

2.Give the gross and specific selection rule for a vibrational transition taking place in the simple harmonic oscillator. **(1M)**

3. Give any two reasons for using TMS as the reference compound in NMR spectra. **(1M)**

4. What is meant by PEM used in the instrumentation of CD spectra ? Give its function. **(1M)**

5. Write any one analytical application of fluorescence spectroscopy. **(1M)**

6. Define the term spin- spin coupling with reference to NMR spectrum. **(1M)**

7. Write the expression used for calculating molar ellipticity in CD specta. **(1M)**

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BITS, PILANI – DUBAI CAMPUS

SECOND SEMESTER 2013 – 2014

Course Code: BIOT F215 | SECOND YEAR | Date:25.3.2014
Course Title:Biophysics | Max Marks: 8
Duration : 20 minutes | Weightage: 8%

Name: ..... **ID No:** ..... **Sec / Prog:** .....

Instructions: (if any) Over writing will be taken as wrong answer

1. Calculate the number of vibrational modes for ethene molecule. **(1M)**

2. Which gives rise to the net dipole moment in proteins? **(1M)**

3. A segment of DNA has 120 adenine and 100 cytosine bases .Calculate the total number of nucleotides present in the segment. **(1M)**

4. Mention the nucleotides of DNA. **(1M)**

5. Write any one example illustrating the electrostatic interaction involved in the tertiary structure of proteins. **(1M)**

6. Give the structural features of myoglobin molecule – the oxygen carrier in muscle. (any 4 points). **(1M)**

7. Schematically illustrate the phosphodiester bond. **(1M)**

8. Write the hydrogen bond donors and hydrogen bond acceptors involved in the nucleic acid structure. **(1M)**

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