CLASS:	M.Tech	SEMESTER: II	
BRANCH:	BIOTECHNOLOGY	SESSION: SP/19	

SUBJECT: BE508 BIOPHYSICS

TIME: 3 Hours   FULL MARKS: 50

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) Construct two-dimensional steady state diffusion equation and solve it. Correlate it with Brownian motion.   [5]

Q.1(b) Develop a mathematical expression for molecular Force-Fields. What is Verlet and Leapfrog algorithms for molecular dynamics?   [5]

Q.2(a) Compose the Svedberg equation for unhydrated molecule. A protein is centrifuged at a rotor speed of 16,000 rpm to equilibrium at 4°C in a dilute aqueous buffer (assume the density is the same as that of water). The measured absorbance profile over part of the cell (assume that the absorbance is suitably blanked, so that A ∝ [protein]) over part of the cell is tabulated on the next page. If the partial specific volume of the protein is 0.880 cm^3 g^{-1}, what is the molecular weight of the protein?   [5]

r (cm)	7.00	7.05	7.10	7.15	7.20	7.25	7.30	7.35
A_{230}	0.283	0.381	0.482	0.578	0.852	0.985	1.27	1.900

Q.2(b) Analyze and express the methodology for following techniques,
FRET, MALDI-Quadrapole and COSY   [5]

Q.3(a) Express the 2ϴ method (powder method) for X- ray diffraction crystallography. Compose and sketch the methodology of FACS.   [5]

Q.3(b) Summarize and depict briefly the following bio-techniques with possible application,
Non-contact mode AFM, Optical tweezers and confocal microscopy   [5]

Q.4(a) Synthesize the Poisson-Boltzmann equation. Construct the Goldman-Hodgkin-Katz voltage equation for membrane potential. Compose equilibrium membrane potential based on above equation for following ions distribution (5 mM potassium outside, 140 mM inside, 12 mM sodium inside and 140 mM outside).   [5]

Q.4(b) Compare Electro osmosis and Electrophoresis. Design and compose single-electrode based circuit diagram for voltage clamp and current clamp technique. Draw the I-V graph for above two methods.   [5]

Q.5(a) Hypothesize and combine the flow electric signal across heart and ECG waveform generation. Design different leads system to measure Electrocardiogram.   [5]

Q.5(b) Paraphrase and summarize the a) Electroencephalography and b) nuclear medicine with scintigraphy.   [5]

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