



Department of Biosciences and Bioengineering, IIT Guwahati

Instructions:

Answer all the questions. Answers must be specific and concise. Ambiguous and verbose answers will carry no marks even if the answer is identified somewhere in the write-up.

Questions are self-explanatory; hence no queries are responded during the exam time.

Each of the questions carries 3 marks. Total marks 30.

1. Draw the general configuration of BioFET device indicating clearly its parts with proper labels.
2. (a) Mention the 3 main stages involved in the CRISPR-Cas immune response. (b) Mention the role of the tracrRNA in the CRISPR-Cas system. (c) State without elaboration how CRISPR-Cas complex identifies the target DNA?
3. (a) Define exciton in quantum dots. (b) State the difference between small and large quantum dots of the same materials in terms of fluorescence lifetime and give the reason. (c) What are the major advantages of quantum dots over traditional organic fluorophores?
4. Show schematically the SELEX process with proper labels in steps for selecting an aptamer against a target.
5. (a) State two advantages of isothermal nucleic acid amplification technique over PCR for developing biosensors for point of care applications. (b) Interpret "Ligate and light" involved in some Molecular Beacon-based biosensing application.
6. Show schematically the photolithography for creating microfluidic channels on a chromatographic paper. All steps must show clearly with proper labels.
7. Depict through a diagram for detecting viral RNA following SHERLOCK CRISPR method.
8. Draw the current versus voltage curve for characterization of a biofuel cell and indicate different overpotential regions in the diagram.
9. (a) State the thumb rule for time to reach the equilibrium of interaction between the bait ligand and prey analyte in SPR. (b) Why very high affinity interactions are not suitable for SPR analysis? (c) List the critical steps involved in performing a typical dual-colour DNA microarray analysis.
10. The ars operon has 5 genes, arsRDABG that involved in the efflux of toxic As(III) from the cells. (a) Identify the structural genes and regulatory genes that constitute the ars operon and (b) state the function of the proteins corresponding to each of the five genes.

*****END*****