

**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI**  
**First Semester 2023-2024 Comprehensive Examination**  
**BIO G525, Environmental Biotechnology & Waste Management**

**OPEN BOOK**

**Duration: 2.0 h**

**Date: 21-12-2023**

**Total marks: 25**

Q1. A known HIV positive patient is admitted in an isolation ward after an abdominal surgery following an accident. The resident doctor who changed his dressing the next day found it to be soaked in blood. What is the right method of choice of discarding the dressing? Give justification. [2 M]

Q2. As a potential new method for glucose monitoring, a group of scientists developed a Surface Plasmon Resonance device. For this device, bacterially-derived glucose/galactose-binding protein (GGBP), a known receptor for glucose, was covalently attached to the SPR surface by replacing specific amino acids in the structure by cysteine (R group=  $\text{CH}_2\text{SH}$ ) through genetic mutation. [2 M]

(a) Illustrate the general reaction employed to bind the GGBP to the SPR surface.

(b) Is this device a biosensor? Justify.

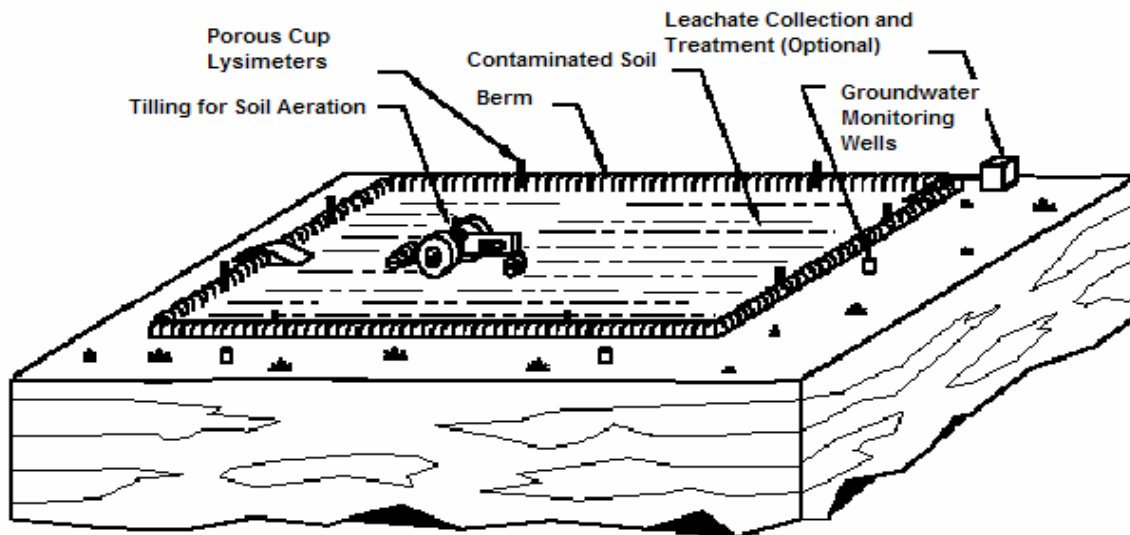
(c) What constitutes the detection element, analyte and transducer?

(d) Provide one key drawback to the proposed SPR sensor for blood glucose monitoring.

Q3. Compare the advantages and disadvantages of first, second, third and fourth generation biofuels. [2 M]

Q4. How can nanotechnology influence energy generation? What will be its impact on environment and economy? Explain with example. [2 M]

Q5. What process is illustrated in the following figure? Explain its application. [2 M]



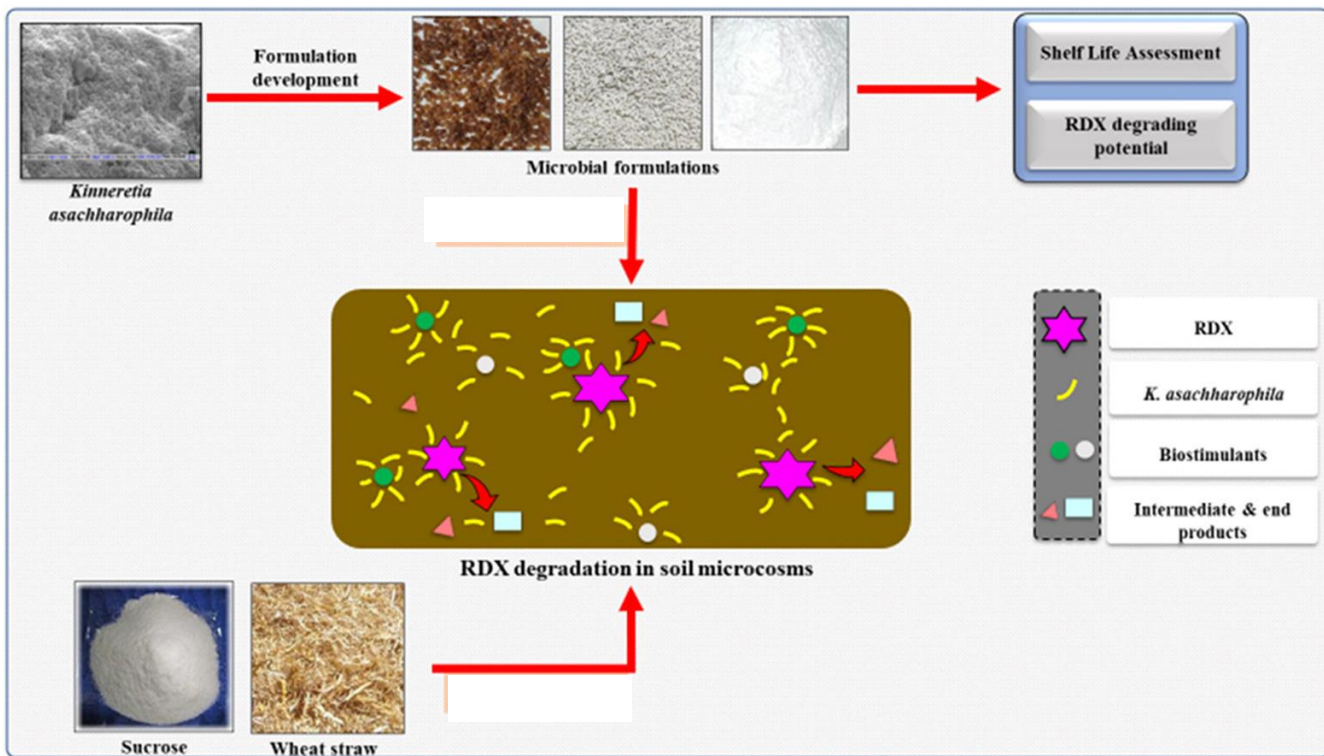
Q6. Why are Halo-organic compounds very stable and persist for long time in the environment? [2 M]

Q7. A) Phytoremediation is an interim solution. Justify.

B) What are the factors which indicate that a particular site of land is suitable for phytoremediation. [2 M]

Q8. Define a microbial biosensor. Explain the fabrication of a microbial biosensor with the help of an example. [2 M]

Q9. Write Principle, experiment, observation and discussion based on the following graphical representation. [2 M]



Q10. A senior medical practitioner tries to invent new vaccine for cancer cure, he injects himself cancer cells to see its impact on human blood chemistry and then through his own blood samples will further progress to synthesize vaccine for prevention of occurrence of fatal cancer. How do you consider his action? Give rationale for your answer. [2 M]

Q11. A) Nitrogen and Phosphorus can be removed from the waste water by constructed wetland approach. Justify [2.5 M]

B) Can Nitrogen removal and enhanced biological phosphorus removal coexist? Comment. [2.5 M]

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**CLOSED BOOK**

**Duration: 1.0 h**

**Date: 21-12-2023**

**Total marks: 15**

Each question carries 2.5 marks

Q1. You are the CMO of a hospital. You would like to organize an immunization camp for children in a village. Assuming that children to be immunized are healthy in all respects and are free from any infections, what BMW management practices would you follow to successfully carryout your assignment?

Q2 Are biofuels obtained from plant derived oils a) environmentally friendly? b) CO<sub>2</sub> neutral? Justify giving at least 3 important reasons.

Q3. Nano filtration (NF) is a pressure-driven membrane separation technique and is rapidly advancing in the area of water purification and wastewater treatment due to its unique charge-based repulsion property and high rate of permeation. Nanomaterials can play an important role in the fabrication of the NF membranes, as they can be synthesized cost effectively and can be made flexible. The pore sizes of the NF membranes are so small (typically in the range of 1–5 nm). How can you integrate the described process and material in sewage water treatment with a BOD around 200 mg/l?

Q4. With respect to desulphurization of coal and crude oil, which of the two pathways, Kodama pathway or 4 S pathway is beneficial? Why? Write the two pathways giving the major intermediates and type of chemical reactions.

Q5. What are the major ethical issues encountered in stem cell therapy and gene therapy?

Q6. Write the reactions for direct and indirect bioleaching of copper from chalcopyrite ore.