BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI

FIRST SEMESTER 2017-2018

BIO G525, ENVIRONMENTAL BIOTECHNOLOGY AND WASTE MANAGEMENT

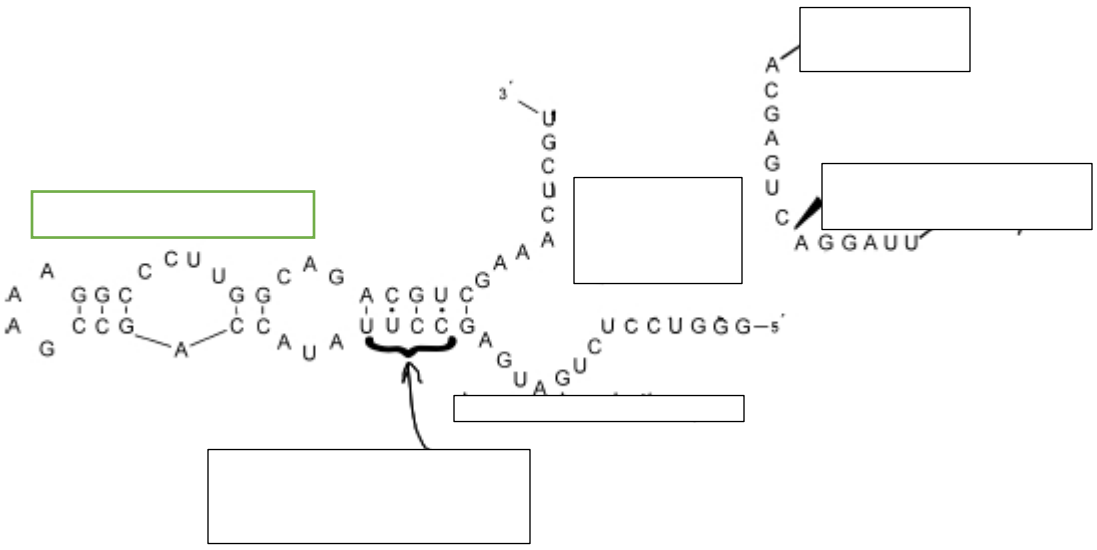
Mid-Semester Make up test (Closed Book)

Duration: 90 Min. **Date: 02/10/2017** **Total marks: 35**

1. A) List four methods that you could use to prove that the bacteria present in the soil sample have capability to degrade BTEX compounds.

   B) The addition of a non-ionic surfactant into the groundwater injected into a soil column (foc 2%, porosity 0.3, 5% saturated with PCB NAPL) failed to increase the biodegradation removal of PCBs from the column (compared to a control without surfactant addition). List 3 possible causes for the lack of enhanced PCB biodegradation. [8+2]

2. Shown below is a version of a diagram describing the creation of a biosensor for the small molecule drug theophylline. In the presence of theophylline, the biosensor produces an increased fluorescent signal. The system is comprised of the following components: Theophylline aptamer; hammerhead ribozyme with a specific cleavage site; an attached dabcyl (a fluorescence quencher); an attached fluorescein molecule (a fluorophore); a communications module. Label the diagram with these components and briefly explain how it works, using arrows on the diagram to help. [5]



3. A) Describe and graphically represent phosphorous and BOD profile through a waste water treatment plant.
   B) Describe the possible impact of nitrification on biological phosphorous removal. [8]

4. Give category-wise treatment and disposal methodology for biomedical waste. [5]

5. You've discovered a novel species of fish in a deep-sea methane (CH_4) seep. This fish completely lacks a digestive tract, including both gullet and anus (the mouth opens to the gills but no further). However, it gets along just fine, swimming around in methane-infused water. You hypothesize that it is absorbing both methane and oxygen from the water by its gills, and living by methane oxidation. Recognizing that the fish also needs an organic nitrogen source, which would normally be acquired in the diet, you further hypothesize that the fish is fixing nitrogen from the ammonia also present in small amounts in the seep

environment. You dissect one of these fish, and discover a grossly enlarged liver filling the space where the GI tract normally would be. Microscopic examination of the cells of this organ shows distinct spherical and rod-shaped bacterial endosymbionts, and a rod-shaped bacterial symbiont in the interstitial spaces. (1) How would you identify these apparent symbionts, and (2) how would you determine which (if any) of these are carrying out methane oxidation and/or fixing nitrogen? [4+3]