BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
ADVANCED & APPLIED MICROBIOLOGY (BIO G523)
FIRST SEMESTER 2016-17 MID SEMESTER EXAM

Total Marks: 60 **Max time: 90 minutes** **Date: 08.10.16**

Note: Answer briefly, to the point and in the format asked.

Write answers of section A and B separately.

Section-A

Q1. Answer the following in minimum words. **[2×6=12]**

i. How does name of *Streptococcus* itself gives an idea about its morphological features?
ii. Out of RFLP of 16S rRNA gene and BOX-PCR, which technique will have higher resolution and why?
iii. What is difference between piezophiles and piezotoerant microorganism?
iv. What is difference between species richness and abundance?
v. What does biocontrol agent mean?
vi. Write briefly about the genera which are primary producers (2-3) of the ocean.

Q2. Answer the following questions in point wise manner. **[2.5×4=10]**

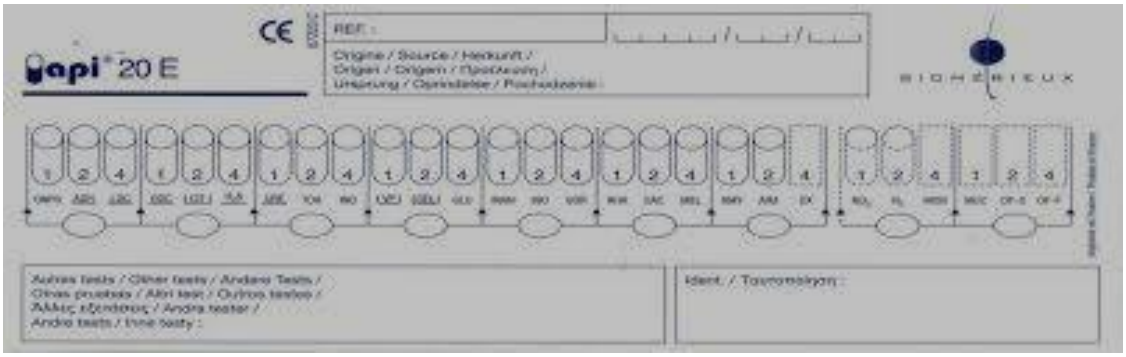
i. How does conventional method of BIOLOG identification system differ from its GEN III identification system?
ii. Why is biofilm favored over planktonic life style?
iii. How can bacteria protect plant from pathogens?
iv. How do AM fungi help host plant in N nutrition?

Q3. Answer the following experimental method-based questions. **[3×4=12]**

i. A research scholar amplifies 16S rRNA genes using DNA template of (a) species A, (b) species B, and (c) a mixture of 4 different bacterial species. By mistake he forgot to label the tube. Is it possible to identify the sample having rRNA gene of mixed population employing gel electrophoresis method? If yes, how? If No, why?
ii. John is trying to study cultivable bacteria of human gut. However, he is getting fewer colonies in terms of morphotypes, though he supposes to get diverse bacterial colonies. Suggest a strategy which can help him get more types of bacterial colonies.
iii. Knowing that nitrogen fixation process is more efficient in microaerobic conditions, how will you isolate diazotrophic bacteria from rhizospheric soil sample?
iv. What would be the code for identifying a bacterial isolate if the bacterium was found to be positive for β-galactosidase enzyme, lysine decarboxylase, Ornithine decarboxylase, Indole, utilization of glucose, mannose, sorbitol, rhamnose, sucrose, melibiose, and arabinose. Arrangement of the test from left right is as follows:

ONPG, ADH, LDC: ODC, CIT, H2S: URE, TDA, IND: VP, GEL ,GLU: MAN, INO, SOR: RHA,SAC,MEL: AMY, ARA, ODI.

Fill the blank space (circle) and write an appropriate code. Once you identify the code, what would be next step to identify test organism.



Q4. (i) You are asked by your mentor to look for novel genes encoding lipase from oceanic bacteria. Understanding the fact that most of the bacteria are not cultivable, what would be your approach to attain the objective? Describe the function-based method in detail. **[5]**
(ii) Write infection process of rhizobia in legume plants in flow chart. **[3]**

Section-B

Q1. (i) Although quorum-sensing (QS) is reported to have a role in biofilm formation, clinical isolates from chronic biofilm-associated infections of staphylococci are QS mutants. Considering two types of virulence states, chronic and acute, can you provide explanation with proper justification for this puzzle? **[3 M]**

(ii) Some bacteria exhibit transient expression of particular traits. What type/s of quorum sensing circuits are involved in regulating such traits? Briefly explain the circuit. [**3 M]**

Q2. Table given shows the characters exhibited by bacterial species 1, 2 and 3. Using this table calculate the simple matching and Jaccard coefficients. Which coefficient is better among the two? Draw inference from the evaluated coefficients. **[5M]**

Character	Bact.1	Bact. 2	Bact. 3
• Large, vacuolar cells	-	+	+
• Nitrate reduction	+	+	-
• Tween 20 hydrolysis	-	+	+
• Growth at 37°C	+	-	-
Utilization of:			
• L-(-)-Arabinose	-	-	-
• Calcium lactate	+	-	+
• D-(-)-Fructose	+	+	-
• D- (-)-Galactose	-	-	-
• Inulin	+	+	-
• Sodium citrate	-	+	+
• Sodium glutamate	+	-	+
• Sodium malonate	-	-	-

Q3. Explain schematically different possible social interactions among free-living bacteria of one single community. **[2M]**

Q4. As per the theory of natural selection each organism behaves in ways that increase its ***own*** chances of survival and reproduction, **not of others**. However, some organisms behave altruistically reducing its own fitness, hence should be at a selective disadvantage over the above mentioned selfish individuals.

A. How do you explain existence of this behavior? **[2 M]**
B. An altruist population can be outcompeted by a cheater population who incurs benefit of the behaviour without themselves participating in it. How in nature such cheats are kept in check? **[3 M]**

----------All the best----------