BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI **MICROBIOLOGY (BIO F212)** FIRST SEMESTER 2016-17 **COMPREHENSIVE EXAMINATION (Part-A)**

Total Marks: 20

Max. Time: 30 minutes

Date: 07.12.16

- 1. The exam is divided into Part-A (Closed-book type) and Part-B (Open-book type). You are now having Part-A of the question paper.
- 2. Answer this part of the exam in the space provided.
- 3. You have a maximum of 30 minutes to answer Part-A, but you can turn in the paper any time after 15 minutes to the invigilator to collect Part-B.

NAME: ID No.:

Q1. Based on following figures obtained in an experiment after replica plating, which colonies are streptomycin-resistant and leucine-requiring? Encircle the colony number. [1]



Q2. Identify molecules 'd' and 'e' in figure given below:



Q3. Write answer of the following in minimum possible words.

[1x5=5]

[1]

(i) What are nitrifying bacteria?

Ans:

(ii) What is composite transposon?

Ans:

(iii) Despite being oxygen-sensitive, why is nitrogenase of Azoarcus not affected?

Ans:

(iv) What is plasma gas sterilization?

Ans:

(v) Which cycle (C, N, S, or P) does not have gaseous intermediate? Ans:





Q5. Based on the following statements, identify and write most appropriate answer.

[5]

	Statement	Answer		
i	Light driven pump in some halophiles which produces ATP			
ii	Plasmid which can integrate in chromosome			
iii	First synthetic antimicrobial compound			
iv	Protein which binds to oxygen in nodules of legume plants			
V	Name of phase during which active growth takes place (do not write			
	log or exponential phase)			
07	. Write components to be engineered in primary, secondary	and tertiary	synthetic	
mic	crobiology?	5	[2]	
An	s: Primary: Secondary:			
	Tertiary:			
Q8. (i) Differentiate F and F' factor. [1]				
An	s:			
(ii) Mutant of which enzyme confer resistance to quinolone in bacteria? [1]				
An	s:			
(iii) Which kind of antimicrobial compound is known to have oligodynamic action? [1]				
An	s:			
(iv)	Salami is a(Hint:food)		[1]	
An	s:			
(v) ONPG and MUG are used to detectin water sample. [1]				
Ans: ************************************				

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI FIRST SEMESTER 2016-17 MICROBIOLOGY (BIO F212) COMPREHENSIVE EXAMINATION (PART-B, OPEN BOOK)

Total 1	Marks: 60	Max. Time: 150 minutes	Date: 07.12.16		
Note:	1. Start answering every question from a fresh page				
	2. Answer all parts of	wer all parts of the same question together, in sequence.			
	3. Answer briefly and t	o the point. No marks will be given wi	thout justification.		
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Q1. (a) You isolated three bacteria 'A', 'B' and 'C' from an environmental sample and optimized their growth conditions. Bacterium A does not grow in aerobic condition and lack EMP pathway, but it can grow in iron mines and have an alternative glycolytic pathway. Bacterium B has glycolytic pathway and can grow in nitrogen rich environment, but does not survive in aerobic conditions. Bacterium C is a facultative anaerobic having functional EMP. All three bacteria are inoculated in a tank containing organic matter waste with enough nitrate and iron content. With reference to energy yield: (i) Which of the bacteria will have highest growth rate?

(ii) What will be the sequence of enrichment of each bacterium? Which alternative glycolytic pathway is referred in the question? Justify. [4]

(b) How would you detect a mutant strain where the mutation has induced the loss of surface capsule? Answer this based on colony morphology. [2]

(c) Design an experiment for isolation of an arginine auxotroph resistant to penicillin. What is the basic difference between your experiment and the principle applied in Ames test? Why are the nutritional auxotrophs required in order to perform Ames test? [3]

(d) List the nature and function of each regulatory component in the given figure a. Explain the figures (circuit and graph) based on the expression pattern of genes and nature of regulatory components. [5]



Q2. (a) You have been given a food sample to sterilize which is supposed to have 10^8 numbers of bacterial cells. It is estimated that after each **0.235 min** of autoclaving at 121 °C, 1/10th of the bacterial population is killed. How much time will it take to kill all microbe in the sample? What term is used for the value given in **Bold**? When the same sample is autoclaved at 116 °C, 2.3 min is required to kill same fraction of microbial population. Based on above information, calculate the Z value of the treatment.

[3]

(b) A microbiologist is troubleshooting a batch of home-brewed ale that did not ferment properly. She noticed that the alcohol content was only 2%, which is well below the desired level. Microscopic examination showed that yeast were healthy and numerous. Chemical analysis of the beer showed low levels of sugar, high levels of CO_2 , and large amounts of protein in the liquid. What did the microbiologist conclude as the probable cause of the beer not coming out properly? Justify your answer.

Q3. Answer the following questions with appropriate justification.

[2x8 = 16]

(a) Although nitrate is the preferred nitrogen source for the plants, it has some disadvantages. What are they? Explain based on its chemical nature.

(b) In microbiology laboratory, you were instructed to grow *E. coli* with constant shaking. Why? Write answer based on the concept of microbial metabolism. Given that the number of glucose molecules in the medium is 20000, will there be any difference in energy output in terms of ATP under shaking and non-shaking conditions? Show the no. of ATP generated under these two conditions.

(c) Differentiate between bacterial & cyanobacterial photosynthesis in terms of electron transfer in light reaction.

(d) In pharmaceutical industries, it is preferred to use bioindicator instead of autoclaving tape to validate autoclaving. Why?

(e) Despite the fact that the steam sterilization is more effective than dry heat treatment, why is hot-airoven recommended to sterilize metals and glassware?

(f) The discoverer of Teixobactin, a recently discovered drug, claims that it is difficult to obtain resistance to this antibiotic in gram-positive bacteria. What is the basis of this claim?

(g) During a visit to wastewater treatment plant you notice that after physical removal of particulate wastes and subsequent purification in secondary treatment by biological methods, water is released directly in water bodies. Being aware with environmental concerns, what additional treatments do you think to be conducted before releasing water? Write biological approaches for this additional treatment.

(h) Discuss functional detail of differentiated bacterial cells formed during beneficial plant-bacteria interaction.

Q4. In the given figure, which line best illustrate the growth of: Log no. of cells (i) A facultative anaerobe in the absence of O_2 ? (ii) An obligate anaerobe in the presence of O_2 ? (iii) A facultative anaerobe incubated aerobically? (iv) An obligate aerobe incubated anaerobically? C Give proper justification for each case. [4] Time Q5. During an experiment in lab, Shahid took inoculum from a refrigerated *P coli* culture and inoculated in the minimal nutrient medium containing glucos and lactose as carbon sources under aerated conditions at 37°C. The growth curve made from this culture is shown in the adjacent graph. Based on your knowledge of Microbiology and Biochemistry courses, identify the phases ξ_a b, c & d) and explain the reason behind each phase considering the utilization of given carbon sources [5] Time

Q6. (a) Prophage can be considered analogous to plasmid. Based on what you have learnt in this course, discuss the similarities and differences between prophage and plasmid. [4]

(b) The sequence of promoter of early phage genes is different than that of late phage genes. Explain how this benefits the phage. [4]

(c) Many scientists believe that virus may be "gene on the loose" and viroids are primitive viruses. How viroid remain stable outside host cells? [3]

(d) In humans, diseases caused by members of the Eucarya are more difficult to treat as compared to those caused by the Bacteria. Why? Explain. [4]
