

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

**Total Marks: 20**

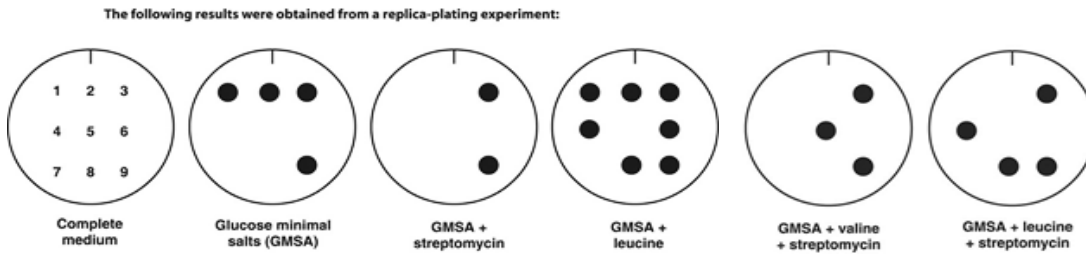
**Max. Time: 30 minutes**

**Date: 07.12.16**

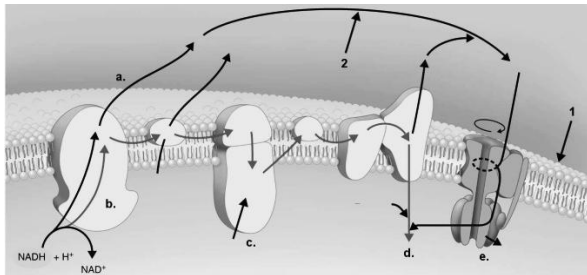
1. The exam is divided into Part-A (Closed-book type) and Part-B (Open-book type). You are now having Part-A of the question paper.
2. Answer this part of the exam in the space provided.
3. You have a maximum of 30 minutes to answer Part-A, but you can turn in the paper any time after 15 minutes to the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



**Ans:**

**Q3.** Write answer of the following in minimum possible words. [1x5=5]

**(i)** What are nitrifying bacteria?

**Ans:**

**(ii)** What is composite transposon?

**Ans:**

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

**Ans:**

**(iv)** What is plasma gas sterilization?

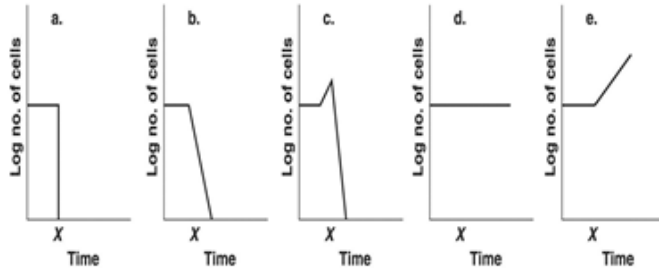
**Ans:**

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

**Ans:**

**Q4.** Which graph in following Figure best depicts the effect of placing the culture in an autoclave for 15 minutes at time  $x$ ?

[1]



**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)	

**Q7.** Write components to be engineered in primary, secondary and tertiary synthetic microbiology? [2]

**Ans:** Primary:

Secondary:

Tertiary:

**Q8. (i)** Differentiate F and F' factor. [1]

**Ans:**

**(ii)** Mutant of which enzyme confer resistance to quinolone in bacteria? [1]

**Ans:**

**(iii)** Which kind of antimicrobial compound is known to have oligodynamic action? [1]

**Ans:**

**(iv)** Salami is a \_\_\_\_\_(Hint:food) [1]

**Ans:**

**(v)** ONPG and MUG are used to detect \_\_\_\_\_in water sample. [1]

**Ans:**

\*\*\*\*\*All the best\*\*\*\*\*



**Q3.** Answer the following questions with appropriate justification.

[2x8= 16]

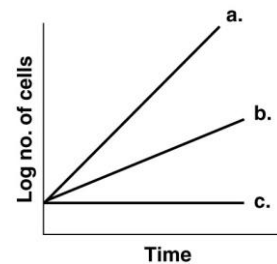
- (a) Although nitrate is the preferred nitrogen source for the plants, it has some disadvantages. What are they? Explain based on its chemical nature.
- (b) In microbiology laboratory, you were instructed to grow *E. coli* with constant shaking. Why? Write answer based on the concept of microbial metabolism. 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-air-oven 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:

- (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?

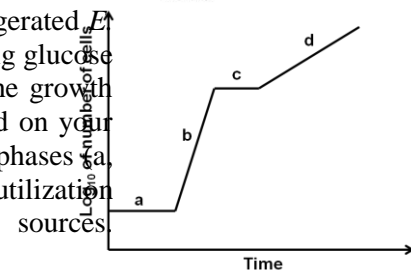
Give proper justification for each case.

[4]



**Q5.** During an experiment in lab, Shahid took inoculum from a refrigerated *E. coli* culture and inoculated in the minimal nutrient medium containing glucose 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 (a, b, c & d) and explain the reason behind each phase considering the utilization of given carbon sources.

[5]



**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]

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All the best