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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E.

Semester: III

Branch: Biotechnology

Duration: 3 hrs.

Course Code: 23BT3PCMBG / 22BT3PCMBG

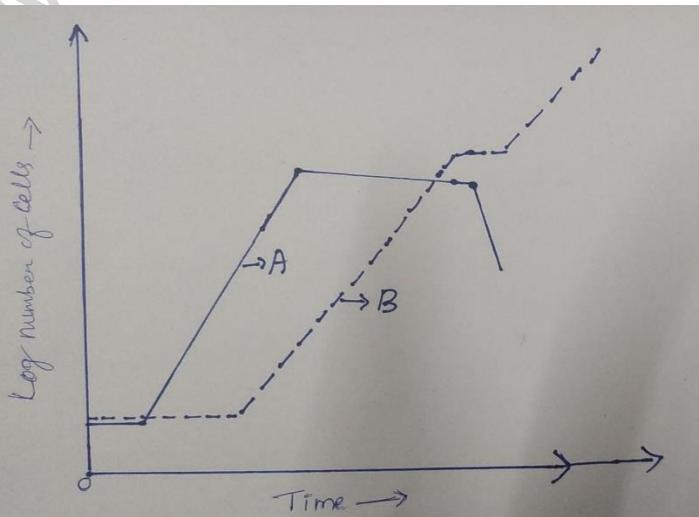
Max Marks: 100

Course: Microbiology

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I			CO	PO	Marks
1	a)	<p>Assume that a bacterial suspension was taken to visualise the ultrastructure of the cell under TEM. The intact and whole cells were subjected as specimen on the stage. The examination of the cells revealed just the outer morphological features and could not find the cytoplasmic details.</p> <ol style="list-style-type: none"> Cite the reason for unable to view the details of the cell and also provide the best solution to overcome the same. Give the schematic representation of TEM instrument. 	CO1	PO 1,2	10
	b)	<p>Diagrammatically represent DNA homology experiment. Assume that the two bacteria <i>P.aeruginosa</i> and <i>P.florescens</i> labelled with fluorochromes red and blue respectively. When these two organisms subjected to homology experiment it resulted in following observations.</p> <ul style="list-style-type: none"> ➤ Red florescence alone : 5% ➤ Blue florescence alone: 5% ➤ Red and blue in combination: 90% <ol style="list-style-type: none"> Generate the relationship between two organisms. <p>Justify if there is a close or far relationship.</p>	CO2	PO2	5
	c)	Who is the father of ancient microbiology? Highlight his major contributions to the field of microbiology.	CO1	PO1	5
OR					
2	a)	<p>A bacterial suspension consisting small bacilli were observed under the oil immersion objective of the light microscope. The violet light radiations are used for illuminating the sample. Further study aimed at studying the morphological features of <i>P. florescens</i>.</p> <ol style="list-style-type: none"> Calculate the limit of resolution in light microscope used Mention the ideal microscope with principle to visualize the <i>P. florescens</i>. 	CO2	PO1, 2	10

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

	b)	<p>A sample was collected from a hot spring soil which is thought to be consisting of various <i>Bacillus sp</i>. The cells were known to be consisting of sub terminal endospores in them. The objective of the study is to know briefly the morphology of cell and distinguishing feature.</p> <ol style="list-style-type: none"> Mention an ideal microscope (within light microscope) to be used for the given samples. Discuss the principle involved in the microscopic technique employed. 	CO1	PO1, 2	5
	c)	Microorganisms exhibit diversity among themselves in morphological and metabolic characteristics. Justify.	CO1	PO1	5
	UNIT - II				
3	a)	<p>Tabulate the differences between SPC and DMC with respect to their working principle, technique and merits and demerits over each other. Give the proper reasoning for the following incorrect observations made with respect to quantitative determination of microbial growth.</p> <ol style="list-style-type: none"> The number of colonies counted on a standard petriplate (10^{-2} dilution) were 950 which is further used to calculate CFU. Number of bacterial cells counted through DMC were 1 lac/mL. When same sample was accurately and finely diluted, spread very uniformly on an agar plate using appropriate lower dilutions the CFU obtained were 0.6 lac/mL. 	CO2	PO2	10
	b)	Classify the rod shaped bacteria into various types based on the arrangements. Provide suitable examples under each group.	CO2	PO1	5
	c)	A human intestinal specimen consists of plenty of bacteria which includes both Gm+ve and Gm-ve ones. The purpose is to study only the Gm-ve coliforms and to distinguish <i>E.coli</i> from other coliforms. Develop a suitable laboratory media that can function as both selective and differential as well.	CO2	PO2	5
	OR				
4	a)	<p>Consider the following plot and answer the following questions</p> 	CO2	PO2, 3	2+4+4 =10

		<ol style="list-style-type: none"> i. Name the above plot and label the relevant positions suitably. ii. Infer the differences between the curves A and B. iii. Which of the graphical pattern is more significant with respect to industrial applications? Justify. 			
	b)	Out of pour plate method and streak plate method, which method do you think ideal for getting pure culture of microorganisms? Justify your decision suitably.	CO3	PO2	5
	c)	Explain the various types of bacteria based on oxygen requirement for growth and development.	CO1	PO1	5
	UNIT - III				
5	a)	<p>Consider the following two scenarios with respect to genetic transfer in bacteria and answer the questions.</p> <p>Scenario 1: <i>Bacillus subtilis</i> A321 is known to serve as donor bacterium which had a special feature of synthesizing all the amino acids. The organism was mixed with <i>Bacillus subtilis</i> NB26 which is not able to grow in medium deficient in certain growth factors. Upon incubation for 24hr, more than 95% of <i>Bacillus subtilis</i> NB26 cells could grow in deficient medium and also could become donor cell so that it could physically interact with other cells..</p> <p>Scenario 2: In an environment <i>Escherichia coli</i> is known to be sensitive for certain extreme environmental conditions but had an inherent capacity to resist antibiotic penicillin. On the other hand <i>Clostridium botulinum</i> is known to be resistant for conditions but sensitive to antibiotic penicillin. Temperature treatment at 80 °C killed all <i>E.coli</i> cells and fragmented the nucleic acids but the cells of <i>Clostridium botulinum</i> were intact. After 24 hr, treatment with penicillin resulted in 5% of the cells able to form the colonies.</p> <ol style="list-style-type: none"> I. Mention the specific genetic recombination process responsible in the above cases. II. Interpret the reasons for the differences in percentage of recipient cells getting converted. III. Discuss the significance of such processes in a microbial community. 	CO2	PO1, 2	2+6+2 =10
	b)	End product of glycolysis could be diverted into different products by the group of lactic acid bacteria. Justify	CO3	PO2	5
	c)	Highlight the biological importance of HMP shunt pathway.	CO3	PO2	5
	OR				
6	a)	<p>A microbial consortia was provided with Glucose-6-Phosphate as initial carbon source. After 24 hr of incubation, the culture broth was centrifuged to separate the cells and cells were lysed. The cell extract was analysed for chemical composition and it was revealed that it contained abundant amounts of 4 and 5 carbon sugar phosphates.</p> <ol style="list-style-type: none"> i. Which metabolic pathway might the microbial consortia catalysed and name the types of microbes? 	CO3	PO2	10

		ii. Give the diagrammatic representation of the metabolic pathway and the role of important metabolites.															
	b)	How lysogenic cycle is different from lytic cycle. Discuss with examples.	CO2	PO1, 2	5												
	c)	Distinguish primary metabolites from secondary metabolites with suitable examples.	CO3	PO1, 2	5												
	UNIT - IV																
7	a)	With a neat and labeled diagram describe the instrument employed in moist heat sterilisation. Mention the precautions to be taken and a method to test the efficiency of moist heat sterilization.	CO2	PO2	10												
	b)	The bacteria <i>E.coli</i> are treated with different sterilisation methods to kill them to certain extent. The corresponding D values are given for the same.	CO2	PO2	5												
		<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Organism</th> <th>Sterilization method</th> <th>D value</th> </tr> </thead> <tbody> <tr> <td rowspan="4"><i>E.coli</i></td> <td>Ethanol at 85%</td> <td>15</td> </tr> <tr> <td>Dry heat of 180 °C</td> <td>65</td> </tr> <tr> <td>Freezing temperature of -50 °C</td> <td>50</td> </tr> <tr> <td>Moist heat</td> <td>20</td> </tr> </tbody> </table> <p>i. Write the definition of D value and infer the relation of D value with the agent of the sterilization. ii. Out of the given sterilisation methods which of them is very efficient? Justify with suitable reason.</p>	Organism	Sterilization method	D value	<i>E.coli</i>	Ethanol at 85%	15	Dry heat of 180 °C	65	Freezing temperature of -50 °C	50	Moist heat	20			
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	c)	Differentiate Microbiostatic vs Microbicidal chemicals. Discuss the same with relevant examples.	CO2	PO2	5												
		OR															
8	a)	<p>Two different cultures (culture A and B) of the bacteria were treated separately with same antibiotic and similar concentration. The cultures were incubated for 48 hr and later cultured on nutrient agar plate. The culture A formed viable colonies while no colonies observed for culture B. With further investigation it was seen that culture B had peptidoglycan units in free form while the culture A had peptidoglycan in interconnected network.</p> <p>i. Identify the suitable antibiotic in the above scenario and name the organism producing the same. ii. Infer the differences between in the response of cultures A and B towards antibiotic (give the diagrammatic representation wherever applicable).</p>	CO2	PO1, 2	10												
	b)	Discuss the types, mechanism and applications of alcohols used as sterilizing agents.	CO2	PO1, 2	5												
	c)	“A typical LAF has various sterilizing mechanisms to create an aseptic environment”. Justify and provide reason for the requirement of aseptic environment in LAF.	CO2	PO1, 2	5												

UNIT - V					
	9	a)	With a neat diagram, describe the mechanism of action of Cry endotoxins on lepidopteran insects. Discuss the present status of Bt crops with respect to India.	CO3	PO2 10
		b)	Comment on microbial diversity in an aquatic environment.	CO3	PO2 5
		c)	Write the carbon cycle and mention the importance of microorganisms in it.	CO3	PO2 5
OR					
	10	a)	Various bacteria and fungi function as microbial inoculants for plants for improving nutrient uptake. Explain the different classes and their importance.	CO3	PO1, 2 10
		b)	What is VAM fungi, Write the structure and explain the different components in it.	CO3	PO1, 2 5
		c)	Various microbes and their products can be used as source of food. Justify with suitable examples.	CO3	PO1, 2 5
