

2016

M.Sc.

2nd Semester Examination

MICROBIOLOGY

PAPER—MCB-203

Full Marks : 40

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

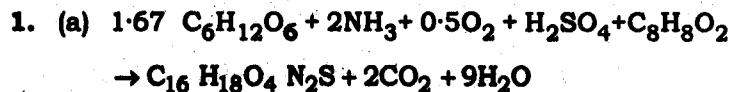
Illustrate the answers wherever necessary.

Answer any two questions from each group.

Group — A

[Marks : 20]

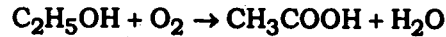
Answer any two questions.



where $\text{C}_6\text{H}_{12}\text{O}_6$ = Glucose ; $\text{C}_{16} \text{H}_{18}\text{O}_4 \text{N}_2\text{S}$ = Penicillin,
 $\text{C}_8\text{H}_8\text{O}_2$ = phenyl acetic acid. Calculate the maximum theoretical yield of Penicillin from glucose after the batch fermentation, if it was recorded that 36% of glucose was utilized for cell growth and 2% glucose was utilized for cell maintenance activities.

(Turn Over)

- (b) In a steady- state reaction vessel it was found that



Ethanol was fed at the rate of 9.2g/min and O_2 was maintained at constant level of 250mol/litre throughout the reaction. What will be the time required for a production target of 92,000 litres.

5+5

2. $\frac{dx}{dt} = \mu x \dots \dots \dots \text{eq (1)}$

[Where x = cell number or mass, t = time, μ = Specific growth rate constant]

- (a) Identify the mathematical equation for which phase it belongs to and integrate the equation to find out the value of both μ and x .

[Hints = Phase : Bacterial population in a closed system]

- (b) Write the mathematical equation for death phase growth pattern of bacterial cultivation.
- (c) The following data were collected using a culture of *Bacillus subtilis* during growth in a minimal medium containing salicylate as sole source of carbon and energy. Using these data, calculate the specific growth rate for the exponential phase.

Time (h)	Culturable cell count (cfu/ml)
0	3.3×10^3
1.3	3.3×10^3
2.3	3.3×10^3
3.3	3.3×10^3
4.3	2.5×10^5
5.3	2.5×10^7
6.3	8.2×10^7
7.3	4.3×10^8
8.3	7.3×10^8
9.3	9.0×10^8
10.3	8.0×10^8
11.3	1.0×10^9
12.3	1.2×10^9
13.3	1.5×10^9

4+2+4

3. Answer any five questions :

5×2

(a) Evaluate $\lim_{x \rightarrow 3} \frac{x-3}{\sqrt{x-2} - \sqrt{4-x}}$

(b) Discuss the continuity of the function $f(x)$ at the points

$$x=0 \text{ and } x=1 \text{ where } f(x) = \begin{cases} 1+x & ; x \leq 0 \\ x & ; 0 < x < 1 \\ 2-x & ; 1 \leq x < 2 \end{cases}$$

(c) Show that $\lim_{x \rightarrow 0} \left(\frac{1}{\sin x} - \frac{1}{x} \right) = 0$.

(d) Find $\frac{dy}{dx}$, where $y = \sqrt{e^{\sin(\log(x^2+7)^5)}}$.

(e) Find the nature of the extreme points of the function
 $f(x) = x^5 - 5x^4 + 5x^3 - 1$.

(f) Evaluate $\lim_{n \rightarrow \infty} \left\{ \frac{10}{n+1} + \frac{10}{n+2} + \dots + \frac{10}{n+n} \right\}$.

(g) Integrate $\int \sqrt{x} \left(x^5 + \frac{10}{x} \right) dx$.

(h) Integrate $\int \frac{2x}{1+x^2} dx$.

(i) Find the area of the segment cut off from the parabola
 $x^2 = 8y$ by the line $y = x$.

Group — B**[Marks : 20]**

Answer any two questions.

4. (a) What is mean deviation? What is the significance of co-efficient of variation? 1+1

- (b) 22% of a group of 70 male and 20% of a group of 110 female were suffering in dengue. Find out the mean percentage of dengue sufferers by combining both group.

2

- (c) To study effect of a drug on growth performance a researcher categorized male albino rats as follows:

Length (mm) :	156-160	161-165	166-170	171-175	176-180
No.of rats :	4	14	25	10	7

Calculate the mean, median, standard deviation and standard error from the set of data. 6

5. (a) Explain nominal and ordinal variable with example.

1+1

- (b) What is skewed distribution? Classify it. 1+1

- (c) Body length of fishes of a species was measured from two ponds : A and B as follows (in cm) :

Pond A	20	24	21	26	22	20	24	30	21	26
Pond B	12	10	8	10	5	14	14	14	10	6

is the mean difference in body length of fishes in the two ponds differ significantly?

Given $t_{(0.05) 18} = 2.101$ 6

6. (a) What is ANOVA? 2
- (b) State the significance of correlation. 2
- (c) Find whether or not the following phenotype distribution in a sample of 96 flies from a particular fruitfly population has a goodness of fit with the Mendelian 9:3:3:1 distribution. 6

Phenotype	Gray body red eye	Black body red eye	Gray body scarlet eye	Black body scarlet eye
Frequency	58	16	15	5

Given $\chi^2_{(0.05) 3} = 7.82$
