2012

M.Sc.

2nd Semester Examination

MICROBIOLOGY

PAPER—IX (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.

Answer any *two* questions from each group.

Group—A

[Marks : 20]

Answer any *two* questions.

1. Answer any *five* questions : 3×5

(a) Evaluate $\lim_{x \to 0} \frac{\sqrt{1+4x} - \sqrt{1-5x}}{x}$

(b) Evaluate $\lim_{x \to 0} \frac{e^{px} - e^{-qx}}{x} = p + q$

(c) Examine the continuity of f(x) at $x = 1$ where, $f(x) = 2x + 1 \quad x \leq 1$
$= 3 - x \quad x > 1.$

(d) Show that f(x) is continuous at $x = 1$ where, $f(x) = 2x + 1 \quad x > 1$
$= 3 \quad x = 1$
$= 4^{x-1} \quad x < 1.$

(e) Find $\frac{dy}{dx}$ where, $y = 2x^4 - \frac{4}{x^{3/4}} + \frac{3x^2}{x^{1/3}} - 5.$

(f) Find $\frac{dy}{dx}$ where, $y = \frac{\sin x}{\log x}$.

(g) Integrate $\int \sqrt{x}\left(x^5 + \frac{3}{x}\right) dx.$

(h) Integrate $\int \frac{dx}{1 - \sin x}$.

(i) Find the derivatives of $(1+x)(1+2x)(1+3x)$.

(j) Find the range of x where f(x) decreases as x increases $f(x) = 2x^3 - 9x^2 + 12x - 3$.

2. Answer any *one* question

(a) Let the growth of a micro-organism satisfy the differential equation $\frac{dx}{dt} = (K(C) - D)\, x(t)$ and $x(0) = x_0$, where x(t) be the population of micro-organism per unit volume in the medium at time t, c is the

concentration of the nutrient in the medium and D is the dilution rate. Show that when K(C) > D then the population of micro-organism increases with time, K(C) < D then the population decreases with time and K(C) = D the population remains same as its initial population x_0 . Show it graphically.

(b) (i) Prove that $\lim_{x \to 4} \frac{\sqrt{x} - 2}{x - 4} = \frac{1}{4}$. 2

(ii) Find the value of $\frac{d}{dx} = \left(\frac{\text{Sin } x}{x}\right)$ at $x = 2$. 3

Group—B

(Statistics)

[Marks : 20]

Answer any *two* questions.

3. (a) What is a random experiment? 2

(b) Define binomial distribution. 2

(c) Find the correlation coefficient between the heights of fathers and daughters both from the following family members.

Height of father (in cm) :	64	65	66	67	68	69	70
Height of daughter (in cm) :	66	67	68	69	70	71	72

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4. (a) Define correlation coefficient and state its important properties. 2+2

(b) The following results were obtained from records of age (x) and systolic blood pressure (y) of a group of 10 teacher of a particular college.

Variable	Age (x)	Blood Pressure (y)
Mean	53	142
Variance	130	165

Find the appropriate regression equation. 6

5. (a) Define null and alternative hypothesis. 2

(b) What do you mean by the test of a statistical hypothesis ? 1

(c) Ten students were given intensive coaching in statistics. The scores obtained in 1st and 5th test are given below :

Sl. No. :	1	2	3	4	5	6	7	8	9	10
Marks in 1st	50	52	53	60	65	67	48	69	72	80
Marks in 5th	65	55	65	65	60	67	49	82	74	86

Does the score from 1st test to 5th test show an improvement ? Test at 5% level of significance.

Given that $t_{0\cdot05,\ 9} = 1\cdot833$. 7