2013

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) Integrate $\int \sin 3x \sin 4x \, dx$.

   (b) Find $\frac{dy}{dx}$ when $y = \frac{\sin x}{e^{4x}}$.

   (c) Find $\frac{dy}{dx}$
   where $y = 3 \sec\theta - 4 \csc\theta + 5 \cos\theta - 3^{\theta+1}$.

(Turn Over)

(d) Evaluate $\lim\limits_{x \to 0} \dfrac{\sin x(1 - \cos x)}{x^3} = \dfrac{1}{2}$.

(e) Evaluate $\lim\limits_{x \to 0} \dfrac{5^x - 4^x}{x} = \log_e\left(\dfrac{5}{4}\right)$.

(f) Find range of values of x for which the function $f(x) = x^3 - 6x^2 - 36x + 7$ increase with x.

(g) Show that $f(x)$ is continuous at $x = 1$.
where $f(x) = x^2 + 1$ $x > 1$
            $= 2$ $x = 1$
            $= 2x$ $x < 1$.

(h) Show that $f(x)$ is not continuous at $x = 0$.
where $f(x) = 3 + 2x$ $x < 0$
            $= -3 - 2x$ $x \geq 0$.

(i) Integrate $\int \dfrac{dx}{x \log x}$.

(j) Show that $f(x) = |x|$ is continuous at $x = 0$.

2. Answer any *one* question : 5×1

(a) Let the growth of a micro-organism satisfy the differential equation $\dfrac{dp}{dt} = kP - qP$, $x > 0$, where $P(t)$ be the population of bacteria at time t, q is called the dilution rate and defined by $q = Q/V$, where V is the volume of nutrient liquid medium of a growth chamber. Q is the rate of volume per unit time supplied to the chamber. Find the population of micro-organism at time t. Show that if $q > k$ the population of micro-organism will be declined to zero and also if $q < k$ the population of micro-organism will increase to infinity when $t \to \infty$.

(b) Discuss the geometrical interpolation of $\frac{dy}{dx}$ and also discuss when $\frac{dy}{dx} > 0$ and $\frac{dy}{dx} < 0$.

Group—B

(Statistics)

[Marks : 20]

Answer any *two* questions.

1. (a) What is a random variable, and what are its expectation and variance ?

(b) The following are 12 determinations of the melting point of a compound (in degree centigrade) made by an analyst, the true melting point being 165°C. Would you conclude that his determinations from these data are free from bias ?

164·4, 169·7, 163·9, 162·1, 160·9, 160·8,

161·4, 162·2, 168·5, 163·4, 162·9, 167·7.

Given that $t_{0.025, 11} = 2\cdot201$. 3+7

(Turn Over)

2. The following table show the marks obtained by 10 undergraduate students in Microbiology Honours in a College Test and in the subsequent University Examination :

Serial	Marks obtained	
	in College Test	in University Examination
1	183	433
2	175	393
3	134	270
4	170	364
5	183	399
6	167	360
7	120	368
8	175	358
9	126	262
10	187	376

(a) Calculate the corrleation coefficient between the marks in the College Test and marks in the University Examination.

(b) Also, find the linear regression equation of y (marks in the University Examination) on x (marks in the College Test).   4+6

3. (a) Define the terms : regression and correlation coefficient.

(b) What purpose will be served by the simple correlation coefficient ? Interpret the cases $r = 0$ and $r = \pm 1$.
                                                                                        5+5