PG/IIS/MCB-203/11(IX)

M.Sc. 2nd Semester Examination, 2011

MICROBIOLOGY

PAPER—IX

Full Marks : 40

Time : 2 hours

The figures in the right-hand margin indicate marks

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

Illustrate the answers wherever necessary

GROUP – A

[*Marks* : 20]

1. Answer any *five* questions : 3 × 5

(*a*) Evaluate

$$\lim_{x \to 3} \frac{x^3 - 27}{x^2 - 9}$$

(*b*) Evaluate

$$\lim_{x \to h} \frac{x^{3/7} - h^{3/7}}{x^{2/3} - h^{2/5}}.$$

(*c*) Examine the continuity of the function $f(x)$ at $x = 1$.
Where

$$\begin{aligned} f(x) &= x^2 + 1 \quad , x > 1 \\ &= 2 \quad x = 1 \\ &= 2x \quad x < 1. \end{aligned}$$

(*d*) Show that $f(x)$ is continuous at $x = 0$. Where

$$f(x) = 3 + 2x \quad -3/2 \le x < 0$$

$$= 3 - 2x \quad 0 \le x < 3/2$$

(*e*) Find $\frac{dy}{dx}$, where $y = e^x \tan x$.

(*f*) Find $\frac{dy}{dx}$, where $y = \frac{x \sin x + \cos x}{x \cos x - \sin x}$.

(*g*) Integrate

$$\int \frac{2e^{4x} - 3e^{2x} + 4}{e^{3x}} dx.$$

(*h*) Integrate

$$\int \frac{(x-2)^3}{x^6}\,dx.$$

(*i*) Integrate

$$\int \frac{dx}{1-\sin x}\,dx.$$

(*j*) Discuss the geometrical interpretation of the derivative of a curve $y = f(x)$ at any point $x = C$.

2. Answer any *one* question : 5 × 1

(*a*) Let the growth of a micro-organism satisfy the differential equation

$$\frac{dx}{dt} = \kappa x - \beta x^2 \quad \text{where } \kappa > 0,\ \beta > 0$$

and $x(0) = x_0$, the initial population of the micro-organism and $x(t)$ be the population at time t. Find the population at any time t.

(*b*) Let $y = 2x^4 - \frac{4}{\sqrt[4]{x^3}} + \frac{3x^2}{3\sqrt{x}} - 5 + 3^{x+1}$

Find $\frac{dy}{dx}$ at $x = 5$.

GROUP – B

(*Statistics*)

[*Marks* : 20]

Answer any *two* questions

3. (*a*) Frequency distribution of number of peas per pod for 198 pods is given below :

Number of peas :	1	2	3	4	5	6	7
Frequency :	4	33	76	50	26	8	1

Calculate mean and variance of the number of peas. 4

(*b*) A group of 5 patients treated with medicine *A* weigh 42, 39, 48, 60, 41 kg; a second group of 7 patients from the same hospital treated with medicine *B* weigh 38, 42, 56, 64, 68, 69, 62 kg. Do you agree with the claim that medicine *B* increases the weight significantly?

Given $t_{10,\ 0\cdot05} = 1\cdot812$. 6

4. (*a*) What is a discrete random variable? What is meant by the probability distribution of a discrete random variable? 1 + 2

(*b*) Define 'Poisson distribution'. 2

(*c*) Four unbiased coins are tossed simultaneously. What is the probability of getting two heads? 5

5. (*a*) What is meant by a test of a null hypothesis? What are Type-I and Type-II errors in testing of hypothesis? 1 + 2

(*b*) The following data relates to the stature (x) and sitting height (y), both in cm. for each of 10 people of a particular Indian caste.

x	y
166·0	83·6
164·1	81·3
164·4	85·4
168·8	83·9
165·2	81·1
170·0	84·9
163·5	81·1
169·4	84·9
159·1	79·6
155·3	80·1

Obtain the linear regression equation of y on x. 7