2015
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 all questions.

1. Answer any two questions : 2x3

(a) Evaluate \( \lim_{x \to 2} \frac{x - \sqrt{3x - 2}}{x^2 - 4} \)

(b) Evaluate \( \lim_{x \to \pi} \frac{1 + \cos x}{(x - \pi)^2} \)
2

(c) Let \( f(x) = x^2 + 1 \) when, \( x > 1 \)
\[ = 2 \quad \text{when, } x = 1 \]
\[ = 2x \quad \text{when, } x < 1 \]

Test whether \( f(x) \) is continuous at \( x = 1 \) or not.

2. Answer any three questions:

(a) Find \( \frac{dy}{dx} \), when \( y = \frac{x \sin x + \cos x}{x \cos x - \sin x} \).

(b) Find \( \frac{dy}{dx} \), when \( y = \cot^{-1} \frac{b - ax}{a + bx} \).

(c) Find \( \frac{dy}{dx} \), when \( y = \sqrt{x \sec x \tan x} \).

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

(e) Integrate \( \int \frac{dx}{(2x - 3)\sqrt{3x + 2}} \).

(f) Integrate \( \int \frac{dx}{\sqrt{ax + b + \sqrt{ax - b}}} \).

3. Mathematical model of the bacterial growth curve for the first phase is given by

\( b(t) = 5000 \ t^2 \), where \( t \) in hour
Find the bacterial growth
(a) at t = 4 hours
(b) between t = 2 hours to t = 5 hours.

Group — B

[Marks: 20]

Answer any two questions:

4. (a) What do you mean by random sampling with replacement and without replacement?

(b) A researcher during his experiments categorised the experimental rats as follows:

Weight (gm): 51-53 54-56 57-59 60-62 63-65 66-68 69-71

No of rats: 5 7 14 28 15 8 3

Calculate the mean, median, standard deviation and variance from the set of data. 2+8

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

(b) Define correlation coefficient.

(c) Particulars regarding a test exam given below:

<table>
<thead>
<tr>
<th></th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of candidates appeared</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Mean score</td>
<td>40.3</td>
<td>37.5</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>8.15</td>
<td>5.35</td>
</tr>
</tbody>
</table>

Is there a significant difference between the mean score of boys and girls?

Given that $t_{0.05}(30) = 2.042$ 3+2+5
4. (a) What do you mean by normal distribution?
(b) What is one tail and two tail t-test?
(c) The achievement test score of 10 high school students before and after intensive practice are given below.

<table>
<thead>
<tr>
<th>Individuals</th>
<th>Before Practice</th>
<th>After Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>72</td>
<td>120</td>
</tr>
<tr>
<td>2</td>
<td>67</td>
<td>81</td>
</tr>
<tr>
<td>3</td>
<td>90</td>
<td>110</td>
</tr>
<tr>
<td>4</td>
<td>97</td>
<td>103</td>
</tr>
<tr>
<td>5</td>
<td>84</td>
<td>109</td>
</tr>
<tr>
<td>6</td>
<td>92</td>
<td>137</td>
</tr>
<tr>
<td>7</td>
<td>65</td>
<td>115</td>
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<tr>
<td>8</td>
<td>75</td>
<td>82</td>
</tr>
<tr>
<td>9</td>
<td>80</td>
<td>110</td>
</tr>
<tr>
<td>10</td>
<td>69</td>
<td>89</td>
</tr>
</tbody>
</table>

Does practice make a significant difference in achievement test score?

Given that $t_{0.001 \, (9)} = 4.781$