### Instructions:
1. All questions are compulsory.
2. Answer each next main question on a new page.
3. Illustrate your answers with neat sketches wherever necessary.
4. Figures to the right indicate full marks.
5. Assume suitable data, if necessary.
6. Use of Non-programmable Electronic Pocket Calculator is permissible.

<table>
<thead>
<tr>
<th>Marks</th>
<th>22103</th>
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<tbody>
<tr>
<td>3 Hours/70 Marks</td>
<td>Seat No.</td>
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</table>

1. Attempt any five of the following:
   a) Evaluate \( \log_3 81 \).
   b) Show that the points \((8, 1), (3, -4)\) and \((2, -5)\) are collinear using determinant.
   c) Without using calculator find the value of \(\sin(105^\circ)\).
   d) Find the area of a rhombus whose diagonals are of lengths 10 cm and 8.2 cm.
   e) If the volume of a sphere is \(\frac{4\pi}{3}\) \(\text{cm}^3\). Find its surface area.
   f) Find the range and coefficient of range of the data:
      50, 90, 120, 40, 180, 200, 80.
   g) If the coefficient of variation of certain data is 5 and mean is 60. Find the standard deviation.

2. Attempt any three of the following:
   a) If \( A = \begin{bmatrix} 2 & 1 \\ 0 & 3 \end{bmatrix} \) and \( B = \begin{bmatrix} 1 & 2 \\ 3 & -2 \end{bmatrix} \) whether \( AB \) is singular or non-singular matrix?
   b) Resolve into partial fractions \( \frac{x + 3}{(x - 1)(x + 1)(x + 5)} \).
   c) Using Cramer’s rule solve \( x - y - 2z = 1; 2x + 3y + 4z = 4; 3x - 2y - 6z = 5 \).
   d) Compute the standard deviation for 15, 22, 27, 11, 9, 21, 14, 9.
3. Attempt **any three** of the following:

   a) If \( \tan (x + y) = \frac{3}{4} \) and \( \tan (x - y) = \frac{8}{15} \). Prove that \( 2x = \frac{77}{36} \).

   b) If \( A = 30^\circ \), verify that
      
      i) \( \sin 2A = 2 \sin A \cos A \)
      
      ii) \( \cos 2A = \frac{1 - \tan^2 A}{1 + \tan^2 A} \).

   c) Prove that \( \cos 20 \cos 40 \cos 60 \cos 80 = \frac{1}{16} \).

   d) Prove that \( \cos^{-1} \left( \frac{4}{5} \right) + \cos^{-1} \left( \frac{12}{13} \right) - \cos^{-1} \left( \frac{33}{65} \right) \).

4. Attempt **any three** of the following:

   a) If \( A = \begin{bmatrix} 2 & 5 & 6 \\ 0 & 1 & 2 \end{bmatrix} \) \( B = \begin{bmatrix} 6 & 1 \\ 0 & 4 \\ 5 & 7 \end{bmatrix} \). Verify that \((AB)^T = B^T A^T\).

   b) Resolve into partial fraction \( \frac{x^2 - x + 3}{(x - 2)(x^2 + 1)} \).

   c) Prove that \( \sin (A + B) \sin (A - B) = \sin^2 A - \sin^2 B \).

   d) If \( \sin A = \frac{1}{2} \) find the value of \( \sin 3A \).

   e) Prove that \( \frac{\sin 4A + \sin 5A + \sin 6A}{\cos 4A + \cos 5A + \cos 6A} = \tan 5A \).

5. Attempt **any two** of the following:

   a) i) Find the equation of straight line passes through the points \( (3, 5) \) and \( (4, 6) \).
      
      ii) Find the distance between the parallel lines \( 3x - y + 7 = 0 \) and \( 3x - y + 16 = 0 \).

   b) i) Find the acute angle between the lines \( 2x + 3y + 5 = 0 \) and \( x - 2y - 4 = 0 \).
      
      ii) Find the equation of the line through the point of intersection of lines, \( 4x + 3y = 8 \); and \( x + y = 1 \) and parallel to the line \( 5x - 7y = 3 \).

   c) i) The area of a rectangular courtyard is 3000 sq.m. Its sides are in the ratio 6 : 5. Find the perimeter of courtyard.
      
      ii) A circus tent is cylindrical to a height of 3m and conical above it. If its diameter is 105 m and slant height of cone is 5m, calculate the area of total canvas required.
6. Attempt any two:
   
a) Using matrix inversion method, solve \( x + y + z = 3; x + 2y + 3z = 4; x + 4y + 9z = 6. \)

b) Find mean, standard deviation and coefficient of variance of the following:

<table>
<thead>
<tr>
<th>Class</th>
<th>0 – 10</th>
<th>10 – 20</th>
<th>20 – 30</th>
<th>30 – 40</th>
<th>40 – 50</th>
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<tbody>
<tr>
<td>Frequency</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>3</td>
<td>1</td>
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</tbody>
</table>

c) i) Calculate the range and coefficient of range for the following data:

<table>
<thead>
<tr>
<th>Class</th>
<th>21 – 25</th>
<th>26 – 30</th>
<th>31 – 35</th>
<th>36 – 40</th>
<th>41 – 45</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>4</td>
<td>16</td>
<td>38</td>
<td>12</td>
<td>10</td>
</tr>
</tbody>
</table>

ii) The two sets of observations are given below. Which of them is more consistent?
   
<table>
<thead>
<tr>
<th>Set I</th>
<th>Set II</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \bar{x} = 82.5 )</td>
<td>( \bar{x} = 48.75 )</td>
</tr>
<tr>
<td>( \sigma = 7.3 )</td>
<td>( \sigma = 8.35 )</td>
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</tbody>
</table>