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. Use of Non-programmable Electronic Pocket Calculator is permissible.
6. Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any five of the following:
   a) Evaluate $\log_3{81}$.
   b) Find the area of the triangle whose vertices are (4, 3) (1, 4) and (2, 3).
   c) Find the value of $\sin(15^\circ)$ using compound angles.
   d) Find the area of rhombus whose diagonals are 6 cm and 9 cm.
   e) The length, breadth and height of a cuboid are 8 cm, 11 cm and 15 cm respectively. Find the total surface area.
   f) Find the range of the data:
      
      14, 18, 22, 35, 42, 44, 8, 7, 5 and 2.
   g) If mean is 34.5 and standard deviation is 5 find the coefficient of variance.

P.T.O.
2. Attempt any three of the following :

\[
A = \begin{bmatrix}
0 & 1 & -1 \\
4 & -3 & 4 \\
3 & -3 & 4
\end{bmatrix}
\]

a) If prove that \(A^2 = I\).

b) Resolve into partial fractions : \(\frac{x^2 + 23x}{(x + 3)(x^2 + 1)}\).

c) Solve the following equations by Cramer’s rule :

\[
\begin{align*}
x + y + z &= 2 \\
y + z &= 1 \\
x + z &= 3
\end{align*}
\]

d) Find mean of the following data :

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

3. Attempt any three of the following :

a) If \(\tan A = \frac{1}{2}, \tan B = \frac{1}{3}\), find the value of \(\tan (A + B)\).

b) Prove : \(\tan \left( \frac{\pi}{4} + A \right) = \frac{\cos A + \sin A}{\cos A - \sin A}\).

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

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

4. Attempt any three of the following :

\[
A = \begin{bmatrix}
2 & 4 & 4 \\
4 & 2 & 4 \\
4 & 4 & 2
\end{bmatrix}
\]

a) If \(A = \begin{bmatrix}
2 & 4 & 4 \\
4 & 2 & 4 \\
4 & 4 & 2
\end{bmatrix}\) show that \(A^2 - 8A\) is a scalar matrix.
b) Resolve into partial fraction: \(\frac{3x-1}{(x-4)(x+1)(x-1)}\).

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

d) Prove: \(\sin A \cdot \sin(60-A) \cdot \sin(60+A) = \frac{1}{4} \sin 3A\).

e) Prove: \(\tan^{-1}\left(\frac{1}{7}\right) + \tan^{-1}\left(\frac{1}{13}\right) = \cos^{-1}\left(\frac{9}{2}\right)\).

5. Attempt any two of the following:

a) Attempt the following:
   i) Find the equation of straight line passes through the points \((-4, 6)\) and \((8, -3)\).
   ii) Find the equation of line passing through the point \((2, 5)\) and through the intersection of the lines \(x + y = 0\) and \(2x - y = 9\).

b) Attempt the following:
   i) Find the acute angle between the lines \(3x + 2y + 4 = 0\) and \(2x - 3y - 7 = 0\).
   ii) Find the distance between the lines \(3x + 2y = 5\) and \(6x + 4y = 6\).

c) Attempt the following:
   i) A square grassy plot is of side 100 metre. It has a gravel path 10 metres wide all round it on the inside. Find the area of path.
   ii) The volume of cube is 1000 cm\(^3\). Find its total surface area.

6. Attempt any two of the following:

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

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

b) Attempt the following:
   i) Find mean for the following data:

<table>
<thead>
<tr>
<th>Class-Interval</th>
<th>10 – 20</th>
<th>20 – 30</th>
<th>30 – 40</th>
<th>40 – 50</th>
<th>50 – 60</th>
<th>60 – 70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>4</td>
<td>6</td>
<td>10</td>
<td>18</td>
<td>9</td>
<td>3</td>
</tr>
</tbody>
</table>
ii) The two sets of observation are given below:

<table>
<thead>
<tr>
<th></th>
<th>Set – I</th>
<th>Set – II</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \bar{x} )</td>
<td>82.5</td>
<td>48.75</td>
</tr>
<tr>
<td>( \sigma )</td>
<td>7.3</td>
<td>8.35</td>
</tr>
</tbody>
</table>

Which of the two sets is more consistent?

c) Solve the following equations by matrix inversion method:
\[
\begin{align*}
  x + 3y + 2z &= 6 \\
  3x - 2y + 5z &= 5 \\
  2x - 3y + 6z &= 7.
\end{align*}
\]