STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086
(For candidates admitted during the academic year 2025 – 26)

B. Sc. DEGREE EXAMINATION, APRIL 2026
BRANCH III - PHYSICS
SECOND SEMESTER

COURSE : ELECTIVE
PAPER : MATHEMATICS FOR PHYSICS – II
SUBJECT CODE : 25MT/ME/MP23
TIME : 3 HOURS MAX. MARKS : 100

<table>
<tr><th>Q. No.</th><th>SECTION A ($2 \times 5 = 10$)
Answer ANY TWO questions</th><th>CO</th><th>KL</th></tr>
<tr><td>1.</td><td>Find $L(cos^2 3t)$.</td><td>1</td><td>1</td></tr>
<tr><td>2.</td><td>Find $L^{-1}\left[\frac{s}{(s+2)^2}\right]$.</td><td>1</td><td>1</td></tr>
<tr><td>3.</td><td>Express $f(x) = x$ $(-\pi < x < \pi)$ as a Fourier series with period 2π.</td><td>1</td><td>1</td></tr>
<tr><th>Q. No.</th><th>SECTION B ($2 \times 5 = 10$)
Answer ANY TWO questions</th><th>CO</th><th>KL</th></tr>
<tr><td>4.</td><td>Following are the rank obtained by 10 students in two subjects namely, Mathematics and Statistics. To what extent is the knowledge of the students in two subjects related?
<table>
<tr><td>Math</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr>
<tr><td>Stats</td><td>2</td><td>4</td><td>1</td><td>5</td><td>3</td><td>9</td><td>7</td><td>10</td><td>6</td><td>8</td></tr>
</table></td><td>2</td><td>2</td></tr>
<tr><td>5.</td><td>Give any five differences between correlation and regression.</td><td>2</td><td>2</td></tr>
<tr><td>6.</td><td>Given the following data, find the regression equation of Y on X for the following data:
<table>
<tr><td></td><td>X</td><td>Y</td></tr>
<tr><td>Average</td><td>7.6</td><td>14.8</td></tr>
<tr><td>Standard Deviation</td><td>3.6</td><td>2.5</td></tr>
<tr><td>r</td><td colspan="2">0.99</td></tr>
</table></td><td>2</td><td>2</td></tr>
<tr><th>Q. No.</th><th>SECTION C ($2 \times 10 = 20$)
Answer ANY TWO questions</th><th>CO</th><th>KL</th></tr>
<tr><td>7.</td><td>Find the Laplace transform of $f(t) = \begin{cases} \sin t, 0 < t < \pi \\ 0, \quad t > \pi \end{cases}$.</td><td>3</td><td>3</td></tr>
<tr><td>8.</td><td>Find $L^{-1}\left(\frac{s-3}{s^2+4s+13}\right)$.</td><td>3</td><td>3</td></tr>
<tr><td>9.</td><td>Calculate the regression equation of X on Y for the following data:
<table>
<tr><td>X</td><td>10</td><td>12</td><td>13</td><td>17</td><td>18</td></tr>
<tr><td>Y</td><td>5</td><td>6</td><td>7</td><td>9</td><td>13</td></tr>
</table></td><td>3</td><td>3</td></tr>
</table>

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<table>
<tr><th>Q. No.</th><th>SECTION D ($2 \times 20 = 40$)
Answer ANY TWO questions</th><th>CO</th><th>KL</th></tr>
<tr><td>10.</td><td>a) Find $L(e^{-t}\cos t)$.
b) Show that $x^2 = \frac{\pi^2}{3} + 4\sum_{n=1}^{\infty}(-1)^n \frac{\cos nx}{n^2}$ in the interval $(-\pi \le x \le \pi)$.
(5+15)</td><td>4</td><td>4</td></tr>
<tr><td>11.</td><td>Using Laplace transforms, solve $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 4$ subject to $y = 2$ and $\frac{dy}{dx} = 3$ when $x = 0$.</td><td>4</td><td>4</td></tr>
<tr><td>12.</td><td>Calculate the Pearson’s coefficient of correlation from the following data by taking 100 and 50 as the assumed averages of X and Y respectively:
<table>
<tr><td>X</td><td>104</td><td>111</td><td>104</td><td>114</td><td>118</td><td>117</td><td>105</td><td>108</td><td>106</td><td>100</td><td>104</td><td>105</td></tr>
<tr><td>Y</td><td>57</td><td>55</td><td>47</td><td>45</td><td>45</td><td>50</td><td>64</td><td>63</td><td>66</td><td>62</td><td>69</td><td>61</td></tr>
</table></td><td>4</td><td>4</td></tr>
<tr><th>Q. No.</th><th>SECTION E ($2 \times 10 = 20$)
Answer ANY TWO questions</th><th>CO</th><th>KL</th></tr>
<tr><td>13.</td><td>From the following data, calculate the rank correlation coefficient after making adjustment for tied ranks.
<table>
<tr><td>X</td><td>48</td><td>33</td><td>40</td><td>9</td><td>16</td><td>16</td><td>65</td><td>24</td><td>16</td><td>57</td></tr>
<tr><td>Y</td><td>13</td><td>13</td><td>24</td><td>6</td><td>15</td><td>4</td><td>20</td><td>9</td><td>6</td><td>19</td></tr>
</table></td><td>5</td><td>5</td></tr>
<tr><td>14.</td><td>Determine the equation of a straight line (Y on X) which best fits the data:
<table>
<tr><td>X</td><td>10</td><td>12</td><td>13</td><td>16</td><td>17</td><td>20</td><td>25</td></tr>
<tr><td>Y</td><td>10</td><td>22</td><td>24</td><td>27</td><td>29</td><td>33</td><td>37</td></tr>
</table></td><td>5</td><td>5</td></tr>
<tr><td>15.</td><td>Find a sine series for $f(x) = c$ in the range 0 to π.</td><td>5</td><td>5</td></tr>
</table>