

# CBCS SCHEME

USN

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BMATE301/BEE301



**Third Semester B.E/B.Tech. Degree Examination, June/July 2026**

## Engineering Mathematics for EEE

Max. Marks:100

- Note:** 1. Answer any FIVE full questions, choosing ONE full question from each module.  
 2. M : Marks , L: Bloom's level, C: Course outcomes.  
 3. Use of VTU mathematics handbook, statistical table handbook is permitted.

| Module – 1 |     |                                                                                                                                                                                                                                                                                                                                                                                                                               | M          | L   | C   |     |     |    |     |    |    |     |     |            |    |     |     |     |    |    |     |    |     |    |   |    |     |
|------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----|-----|-----|-----|----|-----|----|----|-----|-----|------------|----|-----|-----|-----|----|----|-----|----|-----|----|---|----|-----|
| 1          | a.  | Solve : $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$ .                                                                                                                                                                                                                                                                                                                                                                               | 6          | L3  | CO1 |     |     |    |     |    |    |     |     |            |    |     |     |     |    |    |     |    |     |    |   |    |     |
|            | b.  | Solve : $\frac{d^2y}{dx^2} - 4y = \cosh(2x - 1) + 3^x$ .                                                                                                                                                                                                                                                                                                                                                                      | 7          | L3  | CO1 |     |     |    |     |    |    |     |     |            |    |     |     |     |    |    |     |    |     |    |   |    |     |
|            | c.  | Solve : $x^2y'' - 3xy' + 4y = (1 + x)^2$ .                                                                                                                                                                                                                                                                                                                                                                                    | 7          | L3  | CO1 |     |     |    |     |    |    |     |     |            |    |     |     |     |    |    |     |    |     |    |   |    |     |
| OR         |     |                                                                                                                                                                                                                                                                                                                                                                                                                               |            |     |     |     |     |    |     |    |    |     |     |            |    |     |     |     |    |    |     |    |     |    |   |    |     |
| 2          | a.  | Solve : $(D^2 + 3D + 2)y = 4 \cos^2 x$ .                                                                                                                                                                                                                                                                                                                                                                                      | 6          | L3  | CO1 |     |     |    |     |    |    |     |     |            |    |     |     |     |    |    |     |    |     |    |   |    |     |
|            | b.  | Solve : $(1 + x)^2 y'' + (1 + x)y' + y = \sin 2 [\log (1 + x)]$ .                                                                                                                                                                                                                                                                                                                                                             | 7          | L3  | CO1 |     |     |    |     |    |    |     |     |            |    |     |     |     |    |    |     |    |     |    |   |    |     |
|            | c.  | A voltage $E e^{-at}$ is applied at $t = 0$ to circuit of inductance L and resistance R. show that current at any time 't' is $\frac{E}{R - aL} \left[ e^{-at} - e^{-\frac{R}{L}t} \right]$ given that the current is initially zero when $t = 0$ .                                                                                                                                                                           | 7          | L3  | CO1 |     |     |    |     |    |    |     |     |            |    |     |     |     |    |    |     |    |     |    |   |    |     |
| Module – 2 |     |                                                                                                                                                                                                                                                                                                                                                                                                                               |            |     |     |     |     |    |     |    |    |     |     |            |    |     |     |     |    |    |     |    |     |    |   |    |     |
| 3          | a.  | Fit a straight line $y = ax + b$ for the following data :<br><table><tr><td>x</td><td>1</td><td>3</td><td>4</td><td>6</td><td>8</td><td>9</td><td>11</td><td>14</td></tr><tr><td>y</td><td>1</td><td>2</td><td>4</td><td>4</td><td>5</td><td>7</td><td>8</td><td>9</td></tr></table>                                                                                                                                          | x          | 1   | 3   | 4   | 6   | 8  | 9   | 11 | 14 | y   | 1   | 2          | 4  | 4   | 5   | 7   | 8  | 9  | 6   | L2 | CO2 |    |   |    |     |
| x          | 1   | 3                                                                                                                                                                                                                                                                                                                                                                                                                             | 4          | 6   | 8   | 9   | 11  | 14 |     |    |    |     |     |            |    |     |     |     |    |    |     |    |     |    |   |    |     |
| y          | 1   | 2                                                                                                                                                                                                                                                                                                                                                                                                                             | 4          | 4   | 5   | 7   | 8   | 9  |     |    |    |     |     |            |    |     |     |     |    |    |     |    |     |    |   |    |     |
|            | b.  | Fit a second degree parabola to the following data :<br><table><tr><td>x</td><td>1</td><td>1.5</td><td>2</td><td>2.5</td><td>3</td><td>3.5</td><td>4</td></tr><tr><td>y</td><td>1.1</td><td>1.3</td><td>1.6</td><td>2</td><td>2.7</td><td>3.4</td><td>4.1</td></tr></table>                                                                                                                                                   | x          | 1   | 1.5 | 2   | 2.5 | 3  | 3.5 | 4  | y  | 1.1 | 1.3 | 1.6        | 2  | 2.7 | 3.4 | 4.1 | 7  | L2 | CO2 |    |     |    |   |    |     |
| x          | 1   | 1.5                                                                                                                                                                                                                                                                                                                                                                                                                           | 2          | 2.5 | 3   | 3.5 | 4   |    |     |    |    |     |     |            |    |     |     |     |    |    |     |    |     |    |   |    |     |
| y          | 1.1 | 1.3                                                                                                                                                                                                                                                                                                                                                                                                                           | 1.6        | 2   | 2.7 | 3.4 | 4.1 |    |     |    |    |     |     |            |    |     |     |     |    |    |     |    |     |    |   |    |     |
|            | c.  | Ten students got the following percentage of marks in two subjects x and y compute their rank correlation coefficient.<br><table><tr><td>Marks in x</td><td>78</td><td>36</td><td>98</td><td>25</td><td>75</td><td>82</td><td>90</td><td>62</td><td>65</td><td>39</td></tr><tr><td>Marks in y</td><td>84</td><td>51</td><td>91</td><td>60</td><td>68</td><td>62</td><td>86</td><td>58</td><td>53</td><td>47</td></tr></table> | Marks in x | 78  | 36  | 98  | 25  | 75 | 82  | 90 | 62 | 65  | 39  | Marks in y | 84 | 51  | 91  | 60  | 68 | 62 | 86  | 58 | 53  | 47 | 7 | L3 | CO2 |
| Marks in x | 78  | 36                                                                                                                                                                                                                                                                                                                                                                                                                            | 98         | 25  | 75  | 82  | 90  | 62 | 65  | 39 |    |     |     |            |    |     |     |     |    |    |     |    |     |    |   |    |     |
| Marks in y | 84  | 51                                                                                                                                                                                                                                                                                                                                                                                                                            | 91         | 60  | 68  | 62  | 86  | 58 | 53  | 47 |    |     |     |            |    |     |     |     |    |    |     |    |     |    |   |    |     |

1 of 3

OR

|   |    |                                                                                                                                                                                                                                                                                                                                                        |    |    |     |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |     |    |    |    |   |    |     |
|---|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|----|----|----|---|----|-----|
| 4 | a. | In a partially destroyed lab record, only the lines of regression of y on x and x on y are available as $4x - 5y + 33 = 0$ and $20x - 9y = 107$ respectively calculate the coefficient of correlation between x and y.                                                                                                                                 | 6  | L3 | CO2 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |     |    |    |    |   |    |     |
|   | b. | Obtain the lines of regression and hence find the coefficient of correlation for the data :<br><table><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>y</td><td>9</td><td>8</td><td>10</td><td>12</td><td>11</td><td>13</td><td>14</td></tr></table>                                                  | x  | 1  | 2   | 3  | 4  | 5  | 6  | 7  | y  | 9  | 8  | 10 | 12 | 11 | 13 | 14 | 7  | L3 | CO2 |    |    |    |   |    |     |
| x | 1  | 2                                                                                                                                                                                                                                                                                                                                                      | 3  | 4  | 5   | 6  | 7  |    |    |    |    |    |    |    |    |    |    |    |    |    |     |    |    |    |   |    |     |
| y | 9  | 8                                                                                                                                                                                                                                                                                                                                                      | 10 | 12 | 11  | 13 | 14 |    |    |    |    |    |    |    |    |    |    |    |    |    |     |    |    |    |   |    |     |
|   | c. | Compute the rank correlation coefficient for the following data :<br><table><tr><td>x</td><td>68</td><td>64</td><td>75</td><td>50</td><td>64</td><td>80</td><td>75</td><td>40</td><td>55</td><td>64</td></tr><tr><td>y</td><td>62</td><td>58</td><td>68</td><td>45</td><td>81</td><td>60</td><td>68</td><td>48</td><td>50</td><td>70</td></tr></table> | x  | 68 | 64  | 75 | 50 | 64 | 80 | 75 | 40 | 55 | 64 | y  | 62 | 58 | 68 | 45 | 81 | 60 | 68  | 48 | 50 | 70 | 7 | L3 | CO2 |
| x | 68 | 64                                                                                                                                                                                                                                                                                                                                                     | 75 | 50 | 64  | 80 | 75 | 40 | 55 | 64 |    |    |    |    |    |    |    |    |    |    |     |    |    |    |   |    |     |
| y | 62 | 58                                                                                                                                                                                                                                                                                                                                                     | 68 | 45 | 81  | 60 | 68 | 48 | 50 | 70 |    |    |    |    |    |    |    |    |    |    |     |    |    |    |   |    |     |

## Module – 3

|           |     |                                                                                                                                                                                                                                                                                                                                                                      |           |     |      |     |     |     |     |     |     |   |     |     |     |     |      |   |     |     |   |    |     |
|-----------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----|------|-----|-----|-----|-----|-----|-----|---|-----|-----|-----|-----|------|---|-----|-----|---|----|-----|
| 5         | a.  | Obtain the Fourier series of $f(x) = \frac{\pi - x}{2}$ in $0 < x < 2\pi$ . Hence deduce that<br>$\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots$                                                                                                                                                                                               | 6         | L2  | CO3  |     |     |     |     |     |     |   |     |     |     |     |      |   |     |     |   |    |     |
|           | b.  | Find the Cosine half range series for $f(x) = x(\ell - x)$ , $0 \leq x \leq \ell$ .                                                                                                                                                                                                                                                                                  | 7         | L2  | CO3  |     |     |     |     |     |     |   |     |     |     |     |      |   |     |     |   |    |     |
|           | c.  | Obtain the Fourier series of y upto the second harmonics for the following data:<br><table border="1"><tr><td><math>x^\circ</math></td><td>45</td><td>90</td><td>135</td><td>180</td><td>225</td><td>270</td><td>315</td><td>360</td></tr><tr><td>y</td><td>4.0</td><td>3.8</td><td>2.4</td><td>2.0</td><td>-1.5</td><td>0</td><td>2.8</td><td>3.4</td></tr></table> | $x^\circ$ | 45  | 90   | 135 | 180 | 225 | 270 | 315 | 360 | y | 4.0 | 3.8 | 2.4 | 2.0 | -1.5 | 0 | 2.8 | 3.4 | 7 | L3 | CO3 |
| $x^\circ$ | 45  | 90                                                                                                                                                                                                                                                                                                                                                                   | 135       | 180 | 225  | 270 | 315 | 360 |     |     |     |   |     |     |     |     |      |   |     |     |   |    |     |
| y         | 4.0 | 3.8                                                                                                                                                                                                                                                                                                                                                                  | 2.4       | 2.0 | -1.5 | 0   | 2.8 | 3.4 |     |     |     |   |     |     |     |     |      |   |     |     |   |    |     |

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|   |    |                                                                                                                                                                                                                                                                                  |    |    |     |   |   |   |   |   |   |   |    |   |   |   |   |    |     |
|---|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|-----|---|---|---|---|---|---|---|----|---|---|---|---|----|-----|
| 6 | a. | Obtain the Fourier series to represent $f(x) = x - x^2$ in $-1 < x < 1$ .                                                                                                                                                                                                        | 6  | L2 | CO3 |   |   |   |   |   |   |   |    |   |   |   |   |    |     |
|   | b. | Obtain the sine half range series of $f(x) = \begin{cases} \frac{1}{4} - x & \text{in } 0 < x < \frac{1}{2} \\ x - \frac{3}{4} & \text{in } \frac{1}{2} < x < 1 \end{cases}$ .                                                                                                   | 7  | L3 | CO3 |   |   |   |   |   |   |   |    |   |   |   |   |    |     |
|   | c. | Express y as a Fourier series upto the third harmonics given the following values :<br><table border="1"><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>y</td><td>4</td><td>8</td><td>15</td><td>7</td><td>6</td><td>2</td></tr></table> | x  | 0  | 1   | 2 | 3 | 4 | 5 | y | 4 | 8 | 15 | 7 | 6 | 2 | 7 | L3 | CO3 |
| x | 0  | 1                                                                                                                                                                                                                                                                                | 2  | 3  | 4   | 5 |   |   |   |   |   |   |    |   |   |   |   |    |     |
| y | 4  | 8                                                                                                                                                                                                                                                                                | 15 | 7  | 6   | 2 |   |   |   |   |   |   |    |   |   |   |   |    |     |

## Module – 4

|   |    |                                                                                                                                                                                                 |   |    |     |
|---|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----|-----|
| 7 | a. | Find the Fourier transform of $f(x) = e^{- x }$ .                                                                                                                                               | 6 | L3 | CO4 |
|   | b. | If $f(x) = \begin{cases} 1 - x^2, &  x  < 1 \\ 0, &  x  \geq 1 \end{cases}$ Find the Fourier transform of $f(x)$ and hence find the value of $\int_0^\infty \frac{x \cos x - \sin x}{x^3} dx$ . | 7 | L3 | CO4 |
|   | c. | Find the Z-transform of $\sin(3n + 5)$ .                                                                                                                                                        | 7 | L3 | CO4 |

## OR

|   |    |                                                                                        |   |    |     |
|---|----|----------------------------------------------------------------------------------------|---|----|-----|
| 8 | a. | Find the Fourier sine and cosine transforms of $f(x) = e^{-\alpha x}$ , $\alpha > 0$ . | 6 | L2 | CO4 |
|   | b. | Find the inverse Z-transform of $\frac{z}{(z-1)(z-2)}$ .                               | 7 | L3 | CO4 |
|   | c. | Solve by using Z-transform $y_{n+2} - 4y_n = 0$ , given that $y_0 = 0$ , $y_1 = 2$ .   | 7 | L3 | CO4 |

## Module – 5

|      |    |                                                                                                                                                                                                                                                                                                                                                                                                                           |    |    |     |                |                 |                     |   |   |   |      |   |   |    |    |    |                |                 |                     |   |    |     |
|------|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|-----|----------------|-----------------|---------------------|---|---|---|------|---|---|----|----|----|----------------|-----------------|---------------------|---|----|-----|
| 9    | a. | <p>A random variable X has the following probability function for various values of x</p> <table border="1"><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>P(x)</td><td>0</td><td>K</td><td>2K</td><td>2K</td><td>3K</td><td>K<sup>2</sup></td><td>2K<sup>2</sup></td><td>7K<sup>2</sup> + k</td></tr></table> <p>Find K, evaluate P(x &lt; 6), P(x ≥ 6).</p> | x  | 0  | 1   | 2              | 3               | 4                   | 5 | 6 | 7 | P(x) | 0 | K | 2K | 2K | 3K | K <sup>2</sup> | 2K <sup>2</sup> | 7K <sup>2</sup> + k | 6 | L3 | CO5 |
| x    | 0  | 1                                                                                                                                                                                                                                                                                                                                                                                                                         | 2  | 3  | 4   | 5              | 6               | 7                   |   |   |   |      |   |   |    |    |    |                |                 |                     |   |    |     |
| P(x) | 0  | K                                                                                                                                                                                                                                                                                                                                                                                                                         | 2K | 2K | 3K  | K <sup>2</sup> | 2K <sup>2</sup> | 7K <sup>2</sup> + k |   |   |   |      |   |   |    |    |    |                |                 |                     |   |    |     |
|      | b. | Derive mean and standard deviation of the binomial distribution.                                                                                                                                                                                                                                                                                                                                                          | 7  | L3 | CO5 |                |                 |                     |   |   |   |      |   |   |    |    |    |                |                 |                     |   |    |     |
|      | c. | <p>In a certain factory turning out razor blades, there is a small probability of 1/500 for any blade to be defective the blades are supplied in packets of 10. Use Poisson distribution to calculate the approximate number of packets containing :</p> <p>i) No defective</p> <p>ii) One defective</p> <p>iii) Two defective blades in a consignment of 10000 packets.</p>                                              | 7  | L3 | CO5 |                |                 |                     |   |   |   |      |   |   |    |    |    |                |                 |                     |   |    |     |

## OR

|    |    |                                                                                                                                                                                                                                                                                                                                                         |    |    |     |    |   |   |   |   |    |    |    |    |    |    |   |    |     |
|----|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|-----|----|---|---|---|---|----|----|----|----|----|----|---|----|-----|
| 10 | a. | If x is normally distributed with mean 12 and S.D. 4, find the following :<br>i) $P(x \geq 20)$ ii) $P(x \leq 20)$ .                                                                                                                                                                                                                                    | 6  | L3 | CO5 |    |   |   |   |   |    |    |    |    |    |    |   |    |     |
|    | b. | In a sample of 500 men it was found that 60% of them had over weight. What can be infer about the proportion of people having over weight in the population.                                                                                                                                                                                            | 7  | L3 | CO5 |    |   |   |   |   |    |    |    |    |    |    |   |    |     |
|    | c. | A dice is thrown 264 times and the number appearing on the face (x) follows frequency distribution :<br><table border="1"><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>y</td><td>40</td><td>32</td><td>28</td><td>58</td><td>54</td><td>60</td></tr></table><br>Calculate the value of $\psi^2$ (Chi square). | x  | 1  | 2   | 3  | 4 | 5 | 6 | y | 40 | 32 | 28 | 58 | 54 | 60 | 7 | L3 | CO5 |
| x  | 1  | 2                                                                                                                                                                                                                                                                                                                                                       | 3  | 4  | 5   | 6  |   |   |   |   |    |    |    |    |    |    |   |    |     |
| y  | 40 | 32                                                                                                                                                                                                                                                                                                                                                      | 28 | 58 | 54  | 60 |   |   |   |   |    |    |    |    |    |    |   |    |     |

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