

01-12-2022

K. J. Somaiya Institute of Engineering and Information Technology, Sion, Mumbai-22  
(Autonomous College Affiliated to University of Mumbai)

Subject Code: ITC301

Subject Name: Application of Mathematics in Engineering-I

Nov – Dec 2022

B.Tech Program: IT/COMP/AIDS

Examination: SY Semester: III

Course Code: ITC301/CEC301/AIC301 and

Course Name: Application of Mathematics in Engineering-I

Duration: 2.5 Hours

Max. Marks: 60

## Instructions:

- (1) All questions are compulsory.
- (2) Draw neat diagrams wherever applicable.
- (3) Assume suitable data, if necessary.

|       |  | Max. Marks | C<br>O | BT level |
|-------|--|------------|--------|----------|
| Q 1   | Solve any six questions out of eight   | 12         |        |          |
| i)    | Find Laplace transform of $f(t) = e^{-3t} + \sin 2t \sin 3t$ .   |            | 1      | 3        |
| ii)   | Find inverse Laplace transform of $f(s) = \frac{s}{s^2+4s+5}$  |            | 2      | 3        |
| iii)  | Obtain inverse Laplace transform of $f(s) = \frac{s}{(s+a)(s+b)}$  |            | 2      | 3        |
| iv)   | Show that function $f(z) = \log z$ is analytic.  |            | 4      | 3        |
| v)    | Is $f(z) = \frac{z}{\bar{z}}$ is an analytic function?   |            | 4      | 3        |
| vi)   | Find Fourier sine transform of $f(x) = \cosh ax + \sinh ax, a>0, x>0$ .                                      |            | 3      | 3        |
| vii)  | A continuous random variable has following distribution function $f(x) = kx^2, 0 \leq x \leq 2$ . Find $k$ . |            | 6      | 3        |
| viii) | The equation of two regression lines are $3x + 2y = 26, 6x + y = 31$ . Find mean of $x$ and $y$ .            |            | 5      | 3        |
| Q.2   | Solve any four questions out of six.   | 16         |        |          |
| i)    | Find inverse Laplace transform of $f(s) = \frac{s}{(s^2+a^2)^2}$ using convolution theorem.                  |            | 2      | 3        |
| ii)   | Find the analytic function whose imaginary part is $e^{-x}(y \sin y + x \cos x)$ .                           |            | 4      | 3        |

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|      |  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |
|------|--|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|
| iii) | Find the equation of line of regression of x on y for the following data<br><table border="1"> <tr> <td>x</td> <td>5</td> <td>6</td> <td>7</td> <td>8</td> <td>9</td> <td>10</td> <td>11</td> </tr> <tr> <td>y</td> <td>11</td> <td>14</td> <td>14</td> <td>15</td> <td>12</td> <td>17</td> <td>16</td> </tr> </table> | x  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | y  | 11 | 14 | 14 | 15 | 12 | 17 | 16 | 5 | 3 |
| x    | 5  | 6  | 7  | 8  | 9  | 10 | 11 |    |    |    |    |    |    |    |    |    |    |   |   |
| y    | 11   | 14 | 14 | 15 | 12 | 17 | 16 |    |    |    |    |    |    |    |    |    |    |   |   |
| iv)  | Evaluate $\int_0^{\infty} e^{-3t} t \sin t dt$ .   | 1  | 3  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |
| v)   | Find Fourier series of $f(x) = x^2$ in $(0, 2\pi)$ .   | 3  | 3  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |
| vi)  | Obtain the rank correlation coefficient from the following data.<br><table border="1"> <tr> <td>x</td> <td>10</td> <td>12</td> <td>18</td> <td>18</td> <td>15</td> <td>40</td> </tr> <tr> <td>y</td> <td>12</td> <td>18</td> <td>25</td> <td>25</td> <td>50</td> <td>25</td> </tr> </table>                            | x  | 10 | 12 | 18 | 18 | 15 | 40 | y  | 12 | 18 | 25 | 25 | 50 | 25 | 5  | 3  |   |   |
| x    | 10   | 12 | 18 | 18 | 15 | 40 |    |    |    |    |    |    |    |    |    |    |    |   |   |
| y    | 12   | 18 | 25 | 25 | 50 | 25 |    |    |    |    |    |    |    |    |    |    |    |   |   |
| Q.3  | Solve any two.   | 16 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |
| i)   | (i) Show that $\int_0^{\infty} \frac{\sin t}{t} dt = \frac{\pi}{2}$ .<br>(ii) Find inverse Laplace of $\log \frac{(s+a)}{(s+b)}$   | 1  | 3  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |
| ii)  | Find Fourier series of $f(x) = \begin{cases} \pi x, & 0 \leq x \leq 1 \\ \pi(2-x), & 1 \leq x \leq 2. \end{cases}$   | 3  | 3  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |
| iii) | A continuous random variable has probability density function $f(x) = k(x - x^2)$ , $0 \leq x \leq 1$ . Find k, mean and variance.   | 6  | 3  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |
| Q.4  | Solve any two.   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |
| i)   | Find Inverse Laplace Transform of $\frac{s^2+2s+3}{(s^2+2s+5)(s^2+2s+2)}$  | 2  | 3  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |
| ii)  | Show that $u = \sin x \cosh y + 2 \cos x \sinh y + x^2 - y^2 + 4xy$ is harmonic function and find corresponding harmonic conjugate.  | 4  | 3  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |
| iii) | Fit a second degree curve for the following data,<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> <td>7</td> </tr> <tr> <td>y</td> <td>-5</td> <td>-2</td> <td>5</td> <td>16</td> <td>31</td> <td>50</td> <td>73</td> </tr> </table>                           | x  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | y  | -5 | -2 | 5  | 16 | 31 | 50 | 73 | 5 |   |
| x    | 1  | 2  | 3  | 4  | 5  | 6  | 7  |    |    |    |    |    |    |    |    |    |    |   |   |
| y    | -5   | -2 | 5  | 16 | 31 | 50 | 73 |    |    |    |    |    |    |    |    |    |    |   |   |

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