

University of Mumbai
Examination 2020

Program: Information Technology
Curriculum Scheme: Rev2019
Examination: SE Semester III

Course Code: _____ and Course Name: Engineering Mathematics

Time: 2 hour

Max. Marks: 80

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| Q1. | Choose the correct option for following questions. All the Questions are compulsory and carry equal marks |
| 1. | Find the Laplace transform of $f(t)$, $f(t)=a$, $0 < t < b$ and $f(t)=0$, $t > b$ |
| Option A: | $\frac{ab}{s}(1 - e^{-bt})$ |
| Option B: | $\frac{b}{s}(1 - e^{-bt})$ |
| Option C: | $\frac{a}{s}(1 - e^{-bt})$ |
| Option D: | $\frac{-a}{s}(1 - e^{-bt})$ |
| 2. | Find the Laplace transform of $4t^2 + \sin 3t + e^{2t}$ |
| Option A: | $\frac{9}{s^3} + \frac{3}{s^2 + 3^2} + \frac{1}{s - 2}$ |
| Option B: | $\frac{8}{s^3} + \frac{8}{s^2 + 3^2} + \frac{1}{s - 2}$ |
| Option C: | $\frac{8}{s^3} + \frac{3}{s^2 + 3^2} + \frac{4}{s - 2}$ |
| Option D: | $\frac{8}{s^3} + \frac{3}{s^2 + 3^2} + \frac{1}{s - 2}$ |
| 3. | Find the Laplace transform of $e^{4t} \cdot \sin^3 t$ |
| Option A: | $\frac{6}{(s^2 - 8s + 17)(s^2 - 8s + 25)}$ |
| Option B: | $\frac{64}{(s^2 - 8s + 17)(s^2 - 8s + 25)}$ |
| Option C: | $\frac{6}{(s^2 - 8s + 17)(s^2 - 8s + 20)}$ |
| Option D: | $\frac{6}{(s^2 - 7s + 17)(s^2 - 8s + 25)}$ |
| 4. | Find the Inverse Laplace transform $\frac{1}{s(s+a)}$ |
| Option A: | $\frac{1 - e^{-at}}{ab}$ |
| Option B: | $\frac{1 - e^{-at}}{a}$ |
| Option C: | $\frac{1 - e^{-t}}{a}$ |

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| Option D: | $\frac{1 - e^{at}}{a}$ | | | | | | | | | | | | |
| 5. | Find $L^{-1}\left[\frac{1}{s(s^2+4)}\right]$ | | | | | | | | | | | | |
| Option A: | $\frac{1}{4}(1 - \cos 2t)$ | | | | | | | | | | | | |
| Option B: | $\frac{1}{45}(1 - \sin 2t)$ | | | | | | | | | | | | |
| Option C: | $\frac{1}{4}(1 - \cot 2t)$ | | | | | | | | | | | | |
| Option D: | $\frac{1}{4}(1 - \tan 2t)$ | | | | | | | | | | | | |
| 6. | The equations of the two lines of regression are $5x - y = 22$ and $64x - 45y = 24$. Find x and y. | | | | | | | | | | | | |
| Option A: | $x = 6, y = 8$ | | | | | | | | | | | | |
| Option B: | $x = 3, y = 8$ | | | | | | | | | | | | |
| Option C: | $x = 4, y = 8$ | | | | | | | | | | | | |
| Option D: | $x = 6, y = 5$ | | | | | | | | | | | | |
| 7. | Given $N = 5, \sum d_i^2 = 8$. Find the rank correlation coefficient R. | | | | | | | | | | | | |
| Option A: | $R = 0.6$ | | | | | | | | | | | | |
| Option B: | $R = 0.5$ | | | | | | | | | | | | |
| Option C: | $R = 0.4$ | | | | | | | | | | | | |
| Option D: | $R = 0.3$ | | | | | | | | | | | | |
| 8. | Given $\sum d_x d_y = 186, \sum d_x = 11, \sum d_y = 7, N = 10, \sum d_x^2 = 215, \sum d_y^2 = 163$ Find the correlation coefficient r. | | | | | | | | | | | | |
| Option A: | 0.99 | | | | | | | | | | | | |
| Option B: | 0.88 | | | | | | | | | | | | |
| Option C: | 0.77 | | | | | | | | | | | | |
| Option D: | 0.55 | | | | | | | | | | | | |
| 9. | <p>Calculate the correlation coefficient for the following data</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>X</td> <td>3</td> <td>5</td> <td>4</td> <td>6</td> <td>2</td> </tr> <tr> <td>Y</td> <td>3</td> <td>4</td> <td>5</td> <td>2</td> <td>6</td> </tr> </table> | X | 3 | 5 | 4 | 6 | 2 | Y | 3 | 4 | 5 | 2 | 6 |
| X | 3 | 5 | 4 | 6 | 2 | | | | | | | | |
| Y | 3 | 4 | 5 | 2 | 6 | | | | | | | | |
| Option A: | 1 | | | | | | | | | | | | |
| Option B: | -.5 | | | | | | | | | | | | |
| Option C: | .7 | | | | | | | | | | | | |
| Option D: | .9 | | | | | | | | | | | | |
| 10. | A function satisfy the Laplace equation is known as | | | | | | | | | | | | |
| Option A: | Analytic function | | | | | | | | | | | | |
| Option B: | harmonic | | | | | | | | | | | | |
| Option C: | holomorphic | | | | | | | | | | | | |
| Option D: | Non holomorphic | | | | | | | | | | | | |
| 11. | Find the value of n for $x \cos x$ in $(-\pi, \pi)$ | | | | | | | | | | | | |
| Option A: | 1/n | | | | | | | | | | | | |

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| Option B: | 0 |
| Option C: | 2/n |
| Option D: | 4 |
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| 12. | In Fourier integral an is zero when function is |
| Option A: | Even |
| Option B: | Odd |
| Option C: | Real |
| Option D: | Neither even nor odd |
| | |
| 13. | If f(x) is odd function then Fourier integral f(x) reduced to |
| Option A: | Cosine |
| Option B: | Sine |
| Option C: | Cosine and sine |
| Option D: | 0 |
| | |
| 14. | What are periodic signals? |
| Option A: | The signals which change with time |
| Option B: | The signals which change with frequency |
| Option C: | The signal that repeats itself in time |
| Option D: | The signals that repeat itself over a fixed frequency |
| | |
| 15. | Find the Laplace transform of $\sin 5t$ |
| Option A: | $\frac{5}{s^2 + 5^2}$ |
| Option B: | $\frac{s}{s^2 + 5^2}$ |
| Option C: | $\frac{5}{s^2 - 5^2}$ |
| Option D: | $\frac{s}{s^2 - 5^2}$ |
| | |
| 16. | Construct an analytic function whose real part is $e^x \cos y$ |
| Option A: | $f(z) = \int e^z . dz = ea^z + c$ |
| Option B: | $f(z) = \int e^z . dz = a^z + c$ |
| Option C: | $f(z) = \int e^z . dz = e^{az} + c$ |
| Option D: | $f(z) = \int e^z . dz = e^z + c$ |
| | |
| 17. | Construct an analytic function whose imaginary part is $e^{-x}(y \cos y - x \sin y)$ |
| Option A: | $z e^{z^2} + c$ |
| Option B: | $z e^z + c$ |
| Option C: | $z e^{az} + c$ |
| Option D: | $z e^{bz} + c$ |
| | |
| 18. | Construct an analytic function whose imaginary part is $\tan^{-1} \frac{y}{x}$ |
| Option A: | $\tan z + c$ |
| Option B: | $\sec z + c$ |

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| Option C: | $e^x z + c$ |
| Option D: | $\log z + c$ |
| 19. | Construct an analytic function whose real part is $x^4 - 6x^2y^2 + y^4$ |
| Option A: | $z^4 + c$ |
| Option B: | $ez^4 + c$ |
| Option C: | $e^4 + c$ |
| Option D: | $x^4 + c$ |
| 20. | Given $N = 10, \sum d_i^2 = 96$. Find the rank correlation coefficient R. |
| Option A: | R = 0.41 |
| Option B: | $R = 0.51$ |
| Option C: | $R = 0.25$ |
| Option D: | $R = 0.35$ |

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|-------------------------|---|---------------------|----|----|----|----|----|----|----|---|----|----|----|----|----|----|----|--|
| Q2 (20 Marks) | Solve any Four out of Six | 5 marks each | | | | | | | | | | | | | | | | |
| A | Find the Laplace transform of $\frac{1}{t} e^{-t} \sin t$ | | | | | | | | | | | | | | | | | |
| B | Find the inverse Laplace transform of $\frac{1}{\sqrt{2s+1}}$ | | | | | | | | | | | | | | | | | |
| C | Show that the function, $f(z) = \sinh z$ is analytic and find $f'(z)$ in terms of z. | | | | | | | | | | | | | | | | | |
| D | Find the Fourier series for $f(x) = x$ in $(0, 2\pi)$. | | | | | | | | | | | | | | | | | |
| E | Find the equation of line of regression y on x for the following data | | | | | | | | | | | | | | | | | |
| | <table border="1" style="margin-left: auto; margin-right: auto;"> <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 | |
| X | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | | | | | | | | | | |
| Y | 11 | 14 | 14 | 15 | 12 | 17 | 16 | | | | | | | | | | | |
| F | Calculate the coefficient of correlation | | | | | | | | | | | | | | | | | |
| | <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>x</td> <td>2</td> <td>3</td> <td>4</td> <td>7</td> <td>4</td> </tr> <tr> <td>y</td> <td>8</td> <td>7</td> <td>3</td> <td>1</td> <td>1</td> </tr> </table> | x | 2 | 3 | 4 | 7 | 4 | y | 8 | 7 | 3 | 1 | 1 | | | | | |
| x | 2 | 3 | 4 | 7 | 4 | | | | | | | | | | | | | |
| y | 8 | 7 | 3 | 1 | 1 | | | | | | | | | | | | | |

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| Q3 (20 Marks) | Solve any Four out of Six | 5 marks each |
| A | Find the Laplace transform of $\cos t \cos 2t \cos 3t$ | |
| B | Find the inverse Laplace transform of $\frac{s+2}{s^2(s+3)}$ | |
| C | Determine whether the function $f(z) = x^2 - y^2 + 2ixy$ is analytic and if so Find its derivative. | |
| D | Find the Fourier series for $f(x) = e^{- x }$ in $(-\pi, \pi)$. | |
| E | Find the equation of line of regression y on x for the following data | |

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|---|--|----|----|----|----|----|----|----|----|----|----|
| | X | 10 | 12 | 13 | 16 | 17 | 20 | 25 | | | |
| | Y | 19 | 22 | 24 | 27 | 29 | 33 | 37 | | | |
| F | Calculate the spearman rank coefficient of correlation | | | | | | | | | | |
| | X | 85 | 74 | 85 | 50 | 65 | 78 | 74 | 60 | 74 | 90 |
| | Y | 78 | 91 | 78 | 58 | 60 | 72 | 80 | 55 | 68 | 70 |