**DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE**
**Regular/Supplementary Winter Examination – 2024**

**Course: B. Tech** **Branch: Common to all branches** **Semester: III**

**Subject Code & Name:** **Engineering Mathematics - III** (BTBS301/BTES301/BTLOG301)

**Max Marks: 60** **Date: 05/02/2025** **Duration: 3 Hr.**

***Instructions to the Students:***

1. *Each question carries 12 marks.*
2. *Question No. 1 will be compulsory and include objective-type questions.*
3. *Candidates are required to attempt any four questions from Question No. 2 to Question No. 6.*
4. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
5. *Use of non-programmable scientific calculators is allowed.*
6. *Assume suitable data wherever necessary and mention it clearly.*

| | | | | | (Level/CO) | Marks |
|---|---|---|---|---|---|---|
| **Q. 1** | **Objective type questions. (Compulsory Question)** | | | | | **12** |
| 1 | If $\mathbf{L\{f(t)\}} = \frac{e^{-as}}{s^3}$ then $\mathbf{L\{f(3t)\}}$ is equal to | | | | **Understand CO1** | 1 |
| | a. $\frac{e^{-s}}{\left(\frac{s}{a}\right)^3}$ | b. $\frac{e^{-s}}{\left(\frac{s}{3}\right)^3}$ | c. $\frac{27\, e^{\frac{-as}{3}}}{s^3}$ | d. None | | |
| 2 | Laplace transform of the function $\boldsymbol{f(t) = e^{-3t}\cos 4t}$ is, | | | | **Understand CO1** | 1 |
| | a. $\frac{s+3}{s^2+16}$ | b. $\frac{s+3}{s^2+3}$ | c. $\frac{s+3}{s^2+6s+25}$ | d. None | | |
| 3 | Laplace transform of the function $\boldsymbol{f(t) = t\sin hat}$ is, | | | | **Understand CO1** | 1 |
| | a. $\frac{2as}{(s^2-a^2)^2}$ | b. $\frac{2s}{(s^2-a^2)^2}$ | c. $\frac{2as}{s^2-a^2}$ | d. None | | |
| 4 | Inverse Laplace transform of the function $\boldsymbol{f(t) = \frac{15}{s^2+4s+13}}$ is, | | | | **Understand CO2** | 1 |
| | a. $\boldsymbol{e^{-2t}\sin 3t}$ | b. $\boldsymbol{5\, e^{-2t}\sin 3t}$ | c. $\boldsymbol{e^{-t}\sin 3t}$ | d. None | | |
| 5 | Inverse Laplace transform of the function $\boldsymbol{f(t) = \frac{1}{\sqrt{s+4}}}$ is | | | | **Understand CO2** | 1 |
| | a. $\boldsymbol{e^{-4t}\frac{1}{\sqrt{\pi t}}}$ | b. $\boldsymbol{e^{-t}\frac{1}{\sqrt{\pi t}}}$ | c. $\boldsymbol{e^{-4t}\frac{1}{\sqrt{t}}}$ | d. None | | |
| 6 | The inverse Laplace transform of the function $\boldsymbol{f(t) = \frac{1}{s^2+9}}$ is | | | | **Understand CO2** | 1 |
| | a. $\boldsymbol{\frac{1}{9}sin3t}$ | b. $\boldsymbol{\frac{1}{3}sin3t}$ | c. $\boldsymbol{sin3t}$ | d. None | | |
| 7 | The Fourier cosine transform of $\boldsymbol{e^{-x}}$ is | | | | **Understand CO3** | 1 |
| | a. $\frac{s}{s^2+1}$ | b. $\frac{1}{s^2+1}$ | c. $\frac{s}{s^2-1}$ | d. None | | |
| 8 | The Fourier sine transform of $\boldsymbol{e^{-ax}}$ is | | | | **Understand CO3** | 1 |
| | a. $\frac{a}{a^2+s^2}$ | b. $\frac{a}{a^2-s^2}$ | c. $\frac{s}{a^2+s^2}$ | d. None | | |
| 9 | The partial differential equation obtained by eliminating $a$ & $b$ from $\boldsymbol{z = ax + by + ab}$ is | | | | **Understand CO4** | 1 |
| | a. $z = xp + yq - pq$ | b. $z = xp + yq + pq$ | c. $z = xp - yq - pq$ | d. None | | |
| 10 | The Lagrange's linear partial differential equation is of the form | | | | **Understand C04** | 1 |
| | a. $Pp - Qq = R$ | b. $Pp + Qq = 0$ | c. $Pp + Qq = R$ | d. None | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 11 | If $f(Z) = u + iv$ in Polar form is analytic then $\frac{\partial u}{\partial r}$ is equal to | | | | **Understand CO5** | 1 |
| | a. $\frac{\partial v}{\partial \theta}$ | b. $r\frac{\partial v}{\partial \theta}$ | c. $\frac{1}{r}\frac{\partial v}{\partial \theta}$ | d. None | | |
| 12 | If $f(z)$ is an analytic function with constant modulus, then $f(z)$ is a | | | | **Understand CO5** | 1 |
| | a. constant function | b. harmonic function | c. Orthogonal | d. None | | |
| **Q. 2** | **Solve the following.** | | | | | **12** |
| **A)** | Find the Laplace Transform of $F(t) = \frac{e^t - \cos t}{t}$ | | | | **Apply/CO1** | **6** |
| **B)** | Find the Laplace transform of $\int_0^t t\, e^{-t} \sin 4t\, dt$ | | | | **Apply/CO1** | **6** |
| **Q.3** | **Solve the following.** | | | | | **12** |
| **A)** | Using Partial Fraction method, find the inverse Laplace Transforms $\frac{5s+3}{(s-1)(s^2+2s+5)}$ | | | | **Apply/CO2** | **6** |
| **B)** | Solve $\frac{dy}{dt} + 2y = e^{-3t}, y(0) = 1$ | | | | **Apply/CO2** | **6** |
| **Q. 4** | **Solve any TWO of the following.** | | | | | **12** |
| **A)** | Find the Fourier transform of $f(x) = \begin{cases} 1, & \text{for } \lvert x\rvert < 1 \\ 0, & \text{for } \lvert x\rvert > 1 \end{cases}$. Hence evaluate that $\int_0^\infty \frac{\sin x}{x} dx$. | | | | **Apply/CO3** | **6** |
| **B)** | Find the Fourier cosine transform of $f(x) = \frac{1}{1+x^2}$. Hence derive the Fourier sine transform of $\phi(x) = \frac{x}{1+x^2}$. | | | | **Apply/CO3** | **6** |
| **C)** | Using Parseval's identity, show that $\int_0^\infty \frac{t^2}{(4+t^2)(9+t^2)} dt = \frac{\pi}{10}$. | | | | **Apply/CO3** | **6** |
| **Q.5** | **Solve any TWO of the following.** | | | | | **12** |
| **A)** | Partial differential equation by eliminating the arbitrary function $z = x + y + f(xy)$ | | | | **Understand CO4** | **6** |
| **B)** | Solve $p(tanx) + q(tany) = tanz$ | | | | **Apply /CO4** | **6** |
| **C)** | Use the method of separation of variables to solve the equation $\frac{\partial^2 u}{\partial x^2} - 2\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 0$. | | | | **Apply /CO4** | **6** |
| **Q. 6** | **Solve any TWO of the following.** | | | | | **12** |
| **A)** | Find the analytic function whose imaginary part is $\frac{1}{2}\log(x^2 + y^2)$ | | | | **Apply/CO5** | **6** |
| **B)** | Show that function $v = sinhx\ cosy$ is harmonic function. Also find its harmonic conjugate function. | | | | **Remember CO5** | **6** |
| **C)** | Apply Cauchy's integral Formula to evaluate $\oint_c \frac{sin^2 z}{(z-\frac{\pi}{6})^2} dz$ where $C: \lvert z\rvert = 1$ | | | | **Apply/CO5** | **6** |
| | ******End****** | | | | | |