

Winter Examination – 2022

Course: - B. Tech.

Branch: - Common for All branches

Semester:- III

Subject Code & Name: BTBS301

Engineering Mathematics-III

Max. Marks: - 60

Date: - 09/03/2023

Duration: - 3-Hrs

Instructions to the Students:

1. All the questions are compulsory.
2. 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.
3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly.

	(Level/CO)	Marks
Q.1 Solve Any Three of the following.		12
A) Find Laplace Transform of $e^{-3t} \sin^2 t$	L3/CO1	4
B) Find Laplace Transform of $f(t) = \begin{cases} 1 & 0 < t < 1 \\ 0 & 1 < t < 2 \end{cases}$ where $f(t)$ is periodic function of period 2.	L3/CO1	4
C) Evaluate using Laplace Transform.: $\int_0^{\infty} \frac{\cos 4t - \cos 3t}{t} dt$	L3/CO1	4
D) Find Laplace Transform of $(1 + 2t - 3t^2 + 4t^3)H(t - 2)$	L3/CO1	4

Q2 Solve Any Three of the following. 12

A) Find the inverse Laplace transformation of the function. $\log\left(1 + \frac{a^2}{s^2}\right)$ L3/CO2 4

B) By using convolution theorem find $L^{-1}\left[\frac{s}{(s^2+4)(s^2+9)}\right]$ L3/CO2 4

C) Find the inverse Laplace transformation of the function. $\frac{5s^2-15s-11}{(s+1)(s-2)^2}$ L3/CO2 4

D) Solve using Laplace transformation

$y'' + 3y' + 2y = t\delta(t - 1)$ for which $y(0) = y'(0) = 0$ L3/CO2 4

Q.3 Solve Any Three of the following.

- A) Using Parseval's identity prove that $\int_0^{\infty} \frac{x^2}{(x^2+1)^2} dx = \frac{\pi}{4}$ L3/CO3 4
- B) Find the Fourier transform of $f(x) = \begin{cases} 1-x^2, & |x| \leq 1 \\ 0, & |x| > 1 \end{cases}$ L3/CO3 4
- C) Find the Fourier Sine transform e^{-ax} , $a > 0$ L3/CO3 4
- D) Find the Fourier cosine transform of the function $f(y) = \begin{cases} \cos y, & 0 < y < a \\ 0, & y > a \end{cases}$ L3/CO3 4

Q.4 Solve Any Three of the following.

- A) Form the partial differential equation by eliminating arbitrary constants from $(x-a)^2 + (y-b)^2 = z^2 \cot^2 \alpha$ L3/CO4 4
- B) Solve the Partial differential equation $x(y-z)p + y(z-x)q = z(x-y)$ L3/CO4 4
- C) Use the method of separation of variables to solve $\frac{\partial u}{\partial x} = 2 \frac{\partial u}{\partial t} + u$ given that $u(x, 0) = 6e^{-3x}$ L3/CO4 4

D) A bar with insulated at its ends is initially at temperature 0°C throughout. The end $x = 0$ is kept at 0°C for all times and the heat is suddenly applied so that $\frac{\partial u}{\partial x} = 10$ at $x = t$ for all time. Find the temperature function $u(x, t)$ L3/CO4 4

Q.5 Solve Any Three of the following.

- A) Determine k such that the function $f(z) = e^x \cos y + ie^x \sin ky$ is analytic. L3/CO5 4
- B) Show that $u = x^2 - y^2 - 2xy - 2x + 3y$ is a harmonic function and L3/CO5 4
hence determine the analytic function $f(z)$ in terms of z .
- C) Determine the pole of the function $f(z) = \frac{z^2-1}{z(z+1)(z-3)}$ and also find the residue at each pole & sum of all residues. L3/CO5 4
- D) Evaluate $\oint_C \frac{\sin \pi z^2 + 2z}{(z-1)^2(z-2)} dz$, Where C is the circle $|z| = 4$ L3/CO5 4

*** End ***