DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

End Semester Examination – Winter 2018

Course: S.Y.B. Tech (All Branches) **Semester:** III

Subject Name: Engineering Mathematics-III **Subject Code:** BTBSC301

Max Marks:60 **Date:**30/11/2018 **Duration:** 03 Hrs

Instructions to the Students:

1. *Attempt **Any Five** questions of the following .All questions carry equal marks.*
2. *Use of non-programmable scientific calculators is allowed.*
3. *Figures to the right indicate full **Marks**.*

Q. 1. a) Show that,

$$\int_0^\infty \frac{\sin at}{t}\,dt = \frac{\pi}{2}.$$ **[4]**

b) Find the Laplace transform of

$$\int_0^t \frac{e^{-3u}\sin 2u}{u}\,du.$$ **[4]**

c) Find the Laplace transform of the function

$$f(t) = \begin{cases} 2 & ,0 < t < \pi \\ 0 & ,\pi < t < 2\pi \\ \sin t & ,\quad t > 2\pi \end{cases}$$ **[4]**

Q.2 . a) Find the inverse Laplace transform of $\cot^{-1}\left(\frac{s+3}{2}\right)$. **[4]**

b) By convolution theorem, find inverse Laplace transform of

$$\frac{s}{(s^2+1)(s^2+4)}.$$ **[4]**

c) By Laplace transform method, solve the following simultaneous equations **[4]**

$$\frac{dx}{dt} - y = e^t \;;\; \frac{dy}{dt} + x = \sin t\;;\; given\ that\ x(0) = 1\,, y(0) = 0.$$

Q. 3. a) Find the Fourier transform of

$$f(x) = \begin{cases} 1 - x^2\,, & |x| \le 1 \\ 0 & ,\ |x| > 1. \end{cases}$$ **[4]**

b) Find the Fourier sine transform of $e^{-|x|}$, and hence show that

$$\int_0^\infty \frac{x\sin mx}{1+x^2}\,dx = \frac{\pi e^{-m}}{2}\,,\quad m > 0.$$ **[4]**

c) Using Parseval's Identity , prove that

$$\int_0^{\infty} \frac{t^2}{(t^2+1)^2}\, dt = \frac{\pi}{4}\,. \qquad [4]$$

Q.4. a) Solve the partial differential equation

$$(x^2 - yz)p + (y^2 - zx)q = z^2 - xy. \qquad [4]$$

b) Use method of separation of variables to solve the equation

$$\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u\,;\, given\ that\ u(x,0) = 6e^{-3x}. \qquad [4]$$

c) Find the temperature in bar of length $2\ units$ whose ends are kept at zero temperature and lateral surface insulated if initial temperature is **[4]**

$$\sin\left(\frac{\pi x}{2}\right) + 3\sin\left(\frac{5\pi x}{2}\right).$$

Q. 5. a) If $f(z)$ is analytic function with constant modulus, show that $f(z)$ is constant . **[4]**

b) If the stream function of an electrostatic field is $\psi = 3xy^2 - x^3$, find the potential function ϕ, where $f(z) = \phi + i\psi$. **[4]**

c) Prove that the inversion transformation maps a circle in the z-plane into a circle in w-plane or to a straight line if the circle in the z-plane passes through the origin . **[4]**

Q.6. a) Evaluate $\oint_c \frac{e^z}{(z-2)} dz$, where c is the circle $|z| = 3$. **[4]**

b) Evaluate $\oint_c \tan z\, dz$, where c is the circle $|z| = 2$. **[4]**

c) Evaluate , using Cauchy's integral formula : **[4]**

1) $\oint_c \frac{\cos(\pi z)}{(z^2-1)} dz$ around a rectangle with vertices $2 \pm i\,, -2 \pm i$.

2) $\oint_c \frac{\sin^2 z}{(z-\frac{\pi}{6})^3} dz$, where C is the circle $|z| = 1$.

*** End ***

	DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE End Semester Examination – Winter 2019		
	Course: B. Tech in	**Sem: III**	
	Subject Name: Engineering Mathematics-III (BTBSC301)	**Marks: 60**	
	Date: 10/12/2019	**Duration: 3 Hr.**	

Instructions to the Students:

1. *Solve **ANY FIVE** questions out of the following.*
2. *The level 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	**Attempt the following.**		**12**
A)	Find $L\left\{cosht\int_0^t e^u \, coshu \, du\right\}$.	**Analysis**	**4**
B)	If $f(t) = \begin{cases} t, & 0 < t < \pi \\ \pi - t, & \pi < t < 2\pi \end{cases}$ is a periodic function with period 2π. Find $L\{f(t)\}$.	**Analysis**	**4**
C)	Using Laplace transform evaluate $\int_0^\infty e^{-at}\, \frac{sin^2 t}{t}\, dt$	**Evaluation**	**4**
Q. 2	**Attempt any three of the following.**		**12**
A)	Using convolution theorem find $L^{-1}\left\{\frac{1}{s(s+1)(s+2)}\right\}$	**Application**	**4**
B)	Find $L^{-1}\{\bar{f}(s)\}$, where $\bar{f}(s) = \log\left(\frac{s^2+1}{s(s+1)}\right)$	**Analysis**	**4**
C)	Using Laplace transform solve $y'' + 2y' + 5y = e^{-t}\sin t\,;\ y(0) = 0,$ $y'(0) = 1$	**Application**	**4**
D)	Find $L^{-1}\left\{\frac{s^2+2s-4}{(s-5)(s^2+9)}\right\}$	**Analysis**	**4**
Q. 3	**Attempt any three of the following.**		12

A)	Express the function $f(x) = \begin{cases} \sin x, & 0 \le x \le \pi \\ 0, & x > \pi \end{cases}$ as a Fourier sine integral and hence evaluate that $\int_0^{\infty} \frac{\sin\lambda x \sin\lambda\pi}{1-\lambda^2} \, d\lambda$.	**Evaluation**	**4**
B)	Using Parseval's identity for cosine transform, evaluate $\int_0^{\infty} \frac{dx}{(x^2+a^2)(x^2+b^2)}$.	**Application**	**4**
C)	Find the Fourier sine transform of $f(x) = \begin{cases} x, & 0 \le x \le 1 \\ 2-x, & 1 \le x \le 2. \\ 0, & x > 2 \end{cases}$	**Analysis**	**4**
D)	If $F_s\{f(x)\} = \frac{e^{-as}}{s}$, then find $f(x)$. Hence obtain the inverse Fourier sine transform of $\frac{1}{s}$.	**Analysis**	**4**
Q. 4	**Attempt any three of the following.**		**12**
A)	Form the partial differential equation by eliminating arbitrary function f from $f(x^2+y^2+z^2, 3x+5y+7z) = 0$	**Synthesis**	**4**
B)	Solve $pz - qz = z^2 + (x+y)^2$	**Application**	**4**
C)	Determine the solution of one dimensional heat equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ where the boundary conditions are $u(0,t) = 0$, $u(l,t) = 0$ $(t > 0)$ and the initial condition $u(x,0) = x$; l being the length of the bar.	**Analysis**	**4**
D	Use the method of separation of variables to solve the equation $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$, given that $u(x,0) = 6e^{-3x}$	**Application**	**4**
Q. 5	**Attempt the following.**		**12**
A)	Determine the analytic function $f(z)$ in terms of z whose real part is $\frac{\sin 2x}{\cosh 2y - \cos 2x}$	**Analysis**	**4**
B)	Prove that $u = x^2 - y^2 - 2xy - 2x + 3y$ is harmonic. Find a function v such that $f(z) = u + iv$ is analytic.	**Analysis**	**4**
C)	Find the bilinear transformation which maps the points $z = 0, -1, -i$ onto the points $w = i, 0, \infty$. Also, find the image of the unit circle $\|z\| = 1$.	**Analysis**	**4**
Q. 6	**Attempt the following.**		**12**

A)	Use Cauchy's integral formula to evaluate $\oint_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)(z-2)}\, dz$, where C is the circle $\lvert z \rvert = 3$.	**Evaluation**	**4**
B)	Find the poles of function $\frac{z^2-2z}{(z+1)^2(z^2+4)}$. Also find the residue at each pole.	**Analysis**	**4**
C)	Evaluate $\oint_C \frac{e^z}{cos\pi z}\, dz$, where C is the unit circle $\lvert z \rvert = 1$.	**Evaluation**	**4**
	*** **Paper End** ***		

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE
End Semester Examination – May 2019

Course: B. Tech **Sem: III**

Subject Name: Engineering Mathematics-III **Subject Code: BTBSC301**

Max Marks: 60 **Date: 28-05-2019** **Duration: 3 Hr.**

Instructions to the Students:

1. *Solve **ANY FIVE** questions out of the following.*
2. *The level 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	**Attempt any three.**		**12**
A)	Find $L\{f(t)\}$, where $f(t) = t^2\, e^{-3t} sinhat$	**Understand**	**4**
B)	Express $f(t)$ in terms of Heaviside's unit step function and hence find its Laplace transform where $f(t) = \begin{cases} cost, & 0 < t < \pi \\ sint, & t > \pi \end{cases}$	**Understand**	**4**
C)	Find $L\{f(t)\}$, where $f(t) = 2^t \int_0^t \frac{\sin 3u}{u}\, du$	**Understand**	**4**
D)	By using Laplace transform evaluate $\int_0^\infty e^{-t} \left(\frac{1-cos2t}{t}\right)\, dt$	**Evaluation**	**4**
Q. 2	**Attempt the following.**		**12**
A)	Using convolution theorem find $L^{-1}\left\{\frac{s^2}{(s^2+4)^2}\right\}$	**Application**	**4**
B)	Find $L^{-1}\{\bar{f}\,(s)\}$, where $\bar{f}\,(s) = cot^{-1}\left(\frac{s+3}{2}\right)$	**Application**	**4**
C)	Using Laplace transform solve $y'' - 3y' + 2y = 12e^{-2t}; y(0) = 2,$ $y'(0) = 6$	**Application**	**4**
Q. 3	**Attempt any three.**		12
A)	Express $f(t) = \begin{cases} 1, & 0 \le x \le \pi \\ 0, & x > \pi \end{cases}$ as a Fourier sine integral and hence deduce that $\int_0^\infty \frac{1-cos\pi\lambda}{\lambda} \sin \pi\lambda\, d\lambda = \frac{\pi}{4}$.	**Evaluation**	**4**
B)	Using Parseval's identity for cosine transform, prove that $\int_0^\infty \frac{sinat}{t(a^2+t^2)}\, dt = \frac{\pi}{2}\left(\frac{1-e^{-a^2}}{a^2}\right)$	**Application**	**4**

C)	Find the Fourier transform of $f(x) = \begin{cases} 1 - x^2, & if\ \lvert x\rvert \le 1 \\ 0, & if\ \lvert x\rvert > 1 \end{cases}$. Hence prove that $\int_0^\infty \left(\frac{x\cos x - \sin x}{x^3}\right)\cos\frac{x}{2}\ dx = -\frac{3\pi}{16}$	Understand	4
D)	Find Fourier sine transform of $5e^{-2x} + 2e^{-5x}$	Understand	4
Q. 4	**Attempt the following.**		**12**
A)	Form the partial differential equation by eliminating arbitrary function f from $f(x+y+z, x^2+y^2+z^2) = 0$	Synthesis	4
B)	Solve $xz(z^2+xy)p - yz(z^2+xy)q = x^4$	Analysis	4
C)	Find the temperature in a bar of length two units whose ends are kept at zero temperature and lateral surface insulated if the initial temperature is $sin\frac{\pi x}{2} + 3\sin\frac{5\pi x}{2}$.	Application	4
Q. 5	**Attempt Any three.**		**12**
A)	If the function $f(z) = (x^2 + axy + by^2) + i(cx^2 + dxy + y^2)$ is analytic, find the values of the constants a, b, c and d.	Understand	4
B)	If $f(z)$ is an analytic function with constant modulus, show that $f(z)$ is constant.	Understand	4
C)	Find the bilinear transformation which maps the points $z = 0, -i, -1$ into the points $w = i, 1, 0$.	Understand	4
D)	Prove that the function $u = e^x(x\cos y - y\sin y)$ satisfies the Laplace's equation. Also find the coresponding analytic function.	Synthesis	4
Q. 6	**Attempt ANY TWO of the following.**		**12**
A)	Evaluate $\oint_C \frac{z+4}{z^2+2z+5}\,dz$, where C is the circle $\lvert z+1-i\rvert = 2$.	Evaluation	6
B)	Find the residues of $f(z) = \frac{\sin z}{z\cos z}$ at its poles inside the circle $\lvert z\rvert = 2$.	Understand	6
C)	Evaluate $\oint_C \frac{\sin\pi z^2 + \cos\pi z^2}{(z-1)^2(z-2)}\,dz$, where C is the circle $\lvert z\rvert = 3$.	Evaluation	6

*** End ***

	DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE		
	Supplementary Examination – Summer 2022		
	Course: B. Tech. **Branch:** **Semester: III**		
	Subject Code & Name: BTBS301(Engineering Mathematics III)		
	Max Marks: 60 **Date:** **Duration: 3 Hr.**		
	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 Two of the following.**		
A)	Find the Laplace Transform of $e^{4t} sin^3 t$	CO1	6
B)	Evaluate $\int_0^{\infty} \frac{cosat-cosbt}{t} dt$ by using Laplace transform.	CO1	6
C)	Express in terms of Heaviside unit step function and find its Laplace trans-form. f(t) = sint, for, 0 < t < $\boldsymbol{\pi}$ = sin2t, for, $\boldsymbol{\pi}$ < t < $\boldsymbol{2\pi}$ = sin3t, for, t > $\boldsymbol{2\pi}$	CO1	6
Q.2	**Solve Any Two of the following.**		
A)	Find the inverse Laplace transform of $log(\frac{s+a}{s+b})$	CO2	6
B)	Find the inverse Laplace transform of $\frac{5s^2-15s-11}{(s+1)((s-2^2)}$	CO2	6
C)	Solve using Laplace transform $3\frac{dy}{dt} + 2y = e^{3t}, y = 1 \: at \: t = 0.$	CO2	6
Q. 3	**Solve Any Two of the following.**		
A)	Find the Fourier Transform of $f(x) = 1\,, for |x| < 1$ $= 0\,, for\ |x| > 1$ Hence evaluate that $\int_0^{\infty} \frac{sinx}{x} dx$.	CO3	6
B)	Find the Fourier cosine transform of e^{-x^2}	CO3	6
C)	Using Parseval's Identity, prove that $\int_0^{\infty} \frac{t^2}{(t^2+1)^2} dt = \frac{\pi}{4}$	CO3	6
Q.4	**Solve Any Two of the following.**		

A)	Form the partial differential equation by eliminating the arbitrary function from: $f(x+y+z\,, x^2+y^2+z^2)$	CO4	6
B)	Solve the partial differential equation: $(mz-ny)p+(nx-lz)q=ly-mx$.	CO4	6
C)	If the initial displacement and velocity of a string stretched between $x=0\;\&\;x=l$ are given by $y=f(x)\;\&\;\frac{dy}{dt}=g(x)$, determine the displacement y of any point at a distance x from one end at time t.	CO4	6
Q. 5	**Solve Any Two of the following.**		
A)	If $f(z)=u+iv$ is an analytic function and $u-v=e^x(cosy-siny)$, find $\boldsymbol{f}(\boldsymbol{z})$ in terms of $\boldsymbol{z}$.	CO5	6
B)	Find the bilinear transformation that maps the points $\boldsymbol{z}$=**0**, $-\mathbf{1}$, $\boldsymbol{i}$ into the points $\boldsymbol{w}$=$\boldsymbol{i}$,**0**, ∞ respectively.	CO5	6
C)	Use Cauchy's Integral formula to evaluate $\oint_C \frac{e^{2z}}{(z+1)^4}dz$, Where C is the circle $\lvert z\rvert=2$	CO5	6
	*** **End** ***		

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DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE.

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. **(12)**

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

$$f(x) = \begin{cases} 1-x^2, & |x| \le 1 \\ 0 \quad , & |x| > 1 \end{cases}$$ 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 $f(y) = \begin{cases} cosy, & 0 < y < a \\ 0, & y > a \end{cases}$ L3/CO3 **4**

Q.4 Solve Any Three of the following. **(12)**

A) Form the partial differential equation by eliminating arbitrary constants from L3/CO4 **4**

$$(x-a)^2 + (y-b)^2 = z^2 \cot^2 \alpha$$

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. **(12)**

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 $f(z) = \frac{2Z-1}{Z(Z+1)(Z-3)}$ and also find the residue at each pole

& sum of all residues. L3/CO5 **4**

D) Evaluate L3/CO5 **4**

$\oint_c \frac{\sin \pi z^2 + 2z}{(z-1)^2(z-2)} dz$, Where C is the circle $|z| = 4$

*** End ***

	DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE **Supplementary Examination – Supplementary Summer 2023** **Course: B. Tech.** **Branch :All Branches** **Semester :III** **Subject Code & Name: BTES301 Engineering Mathematics-III** **Max Marks: 60** **Date:08/08/2023** **Duration: 3 Hr.**		
	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)	$Find \quad L\{e^{-t}tsin2tcohs2t\}$	**Understand**	**4**
B)	$Find \ L\left\{e^{-2t}\int_0^t \frac{sin3t}{t}dt\right\}$	**Understand**	**4**
C)	$Evaluate\ using\ Laplace\ transform \ \int_0^\infty e^{-t}\left[\frac{cos5t - cost}{t}\right]dt$	**Application**	**4**
D)	$Express\ the\ following\ function\ in\ Heaviside's\ unit\ step\ function$ $and\ find\ it's\ Laplace\ transform$ $f(t) = \begin{cases} t-1, & 1<t<2 \\ 3-t, & 2<t<3 \\ 0, & t>3 \end{cases},$	**Application**	**4**
Q.2	**Solve Any Three of the following.**		**12**
A)	$Find \ L^{-1}\left[\frac{s-1}{s(s+2)(s-3)}\right]$	**Application**	**4**
B)	$Find \ L^{-1}\left[\frac{1}{(s+4)(s^2+1)}\right] by\ convolution\ theorem$	**Application**	**4**
C)	$Find \ L^{-1}\left\{log\left[\frac{s^2-4}{(s-2)^2}\right]^{1/5}\right\}$	**Application**	**4**
D)	$Solve \ y'' - 6y' + 9y = t^2e^{3t},$ $where \quad y(0) = 2, y'(0) = 6$	**Application**	**4**
Q. 3	**Solve Any Three of the following.**		**12**
A)	$Find\ the\ Fourier\ integral\ representation\ of\ the\ function$ $f(x) = \begin{cases} e^{ax}, & x \le 0 \\ e^{-ax}, & x \ge 0 \end{cases}$ $and\ show\ that$ $\int_0^\infty \frac{cos\lambda x}{a^2+\lambda^2}d\lambda = \frac{\pi}{2a}e^{-ax}$	**Evaluation**	**4**
B)	$Find\ the\ Fourier\ cosine\ transform\ of \ \ f(x) = e^{-x} + e^{-2x}, x > 0$	**Evaluation**	**4**
C)	$Find\ the\ Fourier\ sine\ transform\ of \ \ f(x) = \begin{cases} x, & 0 \le x \le 1 \\ 2-x, & 1 \le x \le 2 \\ 0, & x > 2 \end{cases}$		**4**

D)	Solve the integral equation $\int_0^\infty f(x)\cos\omega x\,dx = \begin{cases} 1-\omega, & 0<\omega<1 \\ 0, & \omega>1 \end{cases}$	**Evaluation**	**4**
Q.4	**Solve Any Three of the following.**		**12**
A)	Form the partial differential equation by eliminating the arbitrary function from $(x-h)^2+(y-k)^2+z^2=a^2$, h & k being constants	**Understand**	**4**
B)	Solve the partial differential equation $\frac{y-z}{yz}p+\frac{z-x}{zx}q=\frac{x-y}{xy}$	**Application**	**4**
C)	Using the method of separation of variables, solve $\frac{\partial u}{\partial x}+u=\frac{\partial u}{\partial t}$, if $u=4e^{-3x}$, when $t=0$	**Application**	**4**
D)	Solve $\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}$ under the conditions $u(x,0)=3\sin n\pi x,\ u(0,t)=0,\ u(l,t)=0$, where $0<x<l$.	**Application**	**4**
Q. 5	**Solve Any Three of the following.**		**12**
A)	Prove that $v=e^x\cos y+x^3-3xy^2$ is harmonic function. Find its harmonic conjugate and corresponding analytic function.	**Understand**	**4**
B)	Find the analytic function whose imaginary part is $r^2\cos 2\theta - r\cos\theta + 2$	**Understand**	**4**
C)	Evaluate $\int_c \frac{z}{(z-1)(z-2)^2}\,dz$, if c is the circle $\lvert z-2\rvert=\frac{3}{2}$ by using Cauchy residue theorem.	**Evaluation**	**4**
D)	Evaluate $\int_c \frac{3z+4}{z(2z+1)}\,dz$, if c is the circle $\lvert z\rvert=1$ by using Cauchy Integral theorem.	**Evaluation**	**4**
	*** End ***		

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	DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE **Supplementary Examination – Summer 2023** **Course: B. Tech. (Common to all Branches)** **Semester : III** **Subject Name & Code: Engineering Mathematics – III (BTBSC 301)** **Max Marks: 60** **Date:08/08/2023** **Duration: 3 Hrs.**	
	Instructions to the Students: 1. *Attempt any* ***FIVE*** *of the following questions.* 2. *All questions carry equal marks.* 3. *Use of non-programmable scientific calculators is allowed.* 4. *Assume suitable data wherever necessary and mention it clearly.*	
		Marks
Q. 1	**Solve Any Two of the following.**	**12**
A)	Find the Laplace transform of $F(t) = \frac{e^{-at}-e^{-bt}}{t}$	**6**
B)	Find the Laplace transform of $F(t) = \sin 2t \cos 3t$	**6**
C)	Find the Laplace transform of $erf\left(\sqrt{t}\right)$.	**6**
Q.2	**Solve Any Two of the following:**	**12**
A)	State and prove the convolution theorem for finding the inverse Laplace transform.	**6**
B)	Using Partial Fraction method, find the inverse Laplace transform of $\bar{f}(s) = \frac{5s+3}{(s-1)(s^2+2s+5)}$	**6**
C)	Find the inverse Laplace transform of $\bar{f}(s) = \cot^{-1}\left(\frac{s+3}{2}\right)$	**6**
Q. 3	**Solve any Two of the following:**	**12**
A)	Find the Fourier sine transform of $e^{-\lvert x\rvert}$, and hence show that $\int_0^\infty \frac{x \sin mx}{1+x^2} dx = \frac{\pi e^{-m}}{2}, \ m > 0$	**6**
B)	Find the Fourier transform of $f(x) = \begin{cases} 1-x^2, & \lvert x\rvert \le 1 \\ 0, & \lvert x\rvert > 1 \end{cases}$. Hence evaluate $\int_0^\infty \left(\frac{x\cos x - \sin x}{x^3}\right) \cos\frac{x}{2} dx$.	**6**
C)	Evaluate the integral $\int_0^\infty \frac{t^2}{(t^2+1)^2} dt = \frac{\pi}{4}$.	**6**
Q.4	**Solve any Two of the following:**	**12**
A)	The partial differential equation by eliminating the arbitrary function from $z = x + y + f(xy)$	**6**
B)	The partial differential equations by eliminating the arbitrary constant $z = (x^2+a)(y^2+b)$	**6**
C)	Solve the following partial differential equations $(mz - ny)p + (nx + lz)q = ly - mx$ where the symbols have got their usual meanings.	**6**
Q. 5	**Solve any Two of the following:**	**12**
A)	Show that $u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$ is a harmonic function and hence determine the corre-	**6**

	sponding analytic function	
B)	If $f(z)$ is an analytic function with constant modulus, show that $f(z)$ is constant	**6**
C)	Under the transformation $W = \frac{1}{z}$, find the image of $\|z - 2i\| = 2$.	**6**
Q. 6	**Solve any Two of the following:**	
A)	Evaluate $\int_0^{1+i} (x^2 + iy)\, dz$ along the path $y = x$ and $y = x^2$	**6**
B)	Evaluate $\oint_C \frac{e^{-z}}{z+1} dz$ where C is the circle $\|z\| = 2$ and $\|z\| = \frac{1}{2}$	**6**
C)	Use Cauchy's integral formula to evaluate $\oint_C \frac{e^{2z}}{(z+1)^4}\, dz$, where C the circle is $\|z\| = 2$.	**6**
	*** **End** ***	

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Supplementary Summer Examination – 2023

Branch : B. Tech (Common to all) **Semester : III**

Subject with code: Engineering Mathematics – III (BTBS 301) **Max Marks: 60**

Date: 08/08/2023 **Duration: 3 Hr**

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 Two of the following.**		**12**
A)	**Find the Laplace transform of** $f(t) = \frac{e^t - \cos t}{t}$	**Understand/ (CO1)**	**6**
B)	**Using Laplace transform prove That** $\int_0^\infty t\ e^{-3t} \sin t\, dt = \frac{3}{50}$	**Understand/ (CO1)**	**6**
C)	**Find the Laplace transform of the triangular wave function of period** $2c$ **given by** $f(t) = \begin{cases} t, & 0 \le t \le c \\ 2c - t, & c < t < 2c \end{cases}$	**Remember/ (CO1)**	**6**
Q.2	**Solve Any Two of the following.**		**12**
A)	**Find the inverse Laplace transforms of** $\bar{f}(s) = \frac{s\, e^{-4s}}{s^2+9}$	**Understand/ (CO2)**	**6**
B)	**By convolution theorem, find the inverse Laplace Transforms of** $\bar{f}(s) = \frac{1}{s(s^2 - a^2)}$	**Understand/ (CO2)**	**6**
C)	**Solve the equation** $\frac{d^3y}{dt^3} + 2\frac{d^2y}{dt^2} - \frac{dy}{dt} - 2y = 0$ **, where** $y = 1, \frac{dy}{dt} = 2, \frac{d^2y}{dt^2} = 2$ **at** $t = 0$**, by Laplace transform method.**	**Remember/ (CO2)**	**6**
Q. 3	**Solve Any Two of the following.**		**12**
A)	**Using the Fourier integral representations, show that** $\int_0^\infty \frac{\cos x\omega}{1+\omega^2}\, d\omega = \frac{\pi}{2} e^{-x}\ (x \ge 0)$	**Understand/ (CO3)**	**6**
B)	**Find the Fourier sine transform of** $\frac{e^{-ax}}{x}$.	**Understand/ (CO3)**	**6**
C)	**Using Parseval's identity Evaluate** $\int_0^\infty \frac{\sin^2 x}{x^2} dx$	**Remember/ (CO3)**	**6**

Q.4	**Solve Any Two of the following.**		**12**
A)	**Form the partial differential equation by eliminating the arbitrary functions from $z = f(x + it) + g(x - it)$**	**Understand/ (CO4)**	**6**
B)	**Solve the partial differential equation $x(y^2 + z)p - y(x^2 + z)q = z(x^2 - y^2)$**	**Understand/ (CO4)**	**6**
C)	**Use the method of separation of variables to solve the equation $\frac{\partial^2 u}{\partial x^2} - 2\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 0$.**	**Remember/ (CO4)**	**6**
Q. 5	**Solve Any Two of the following.**		**12**
A)	**Find a function $w = u + iv$ which is analytic if $u = x^2 - y^2$.**	**Understand/ (CO5)**	**6**
B)	**Evaluate $\int_C \frac{\cos \pi z^2}{(z-1)(z-2)} dz$, where C is $\lvert z \rvert = \frac{3}{2}$.**	**Understand/ (CO5)**	**6**
C)	**By Residue theorem evaluate $\int_c \frac{dz}{(z^2+4)^2}$, where C is the circle $\lvert z - i \rvert = 2$.**	**Understand/ (CO5)**	**6**

***** End *****

	DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE **Regular & Supplementary Winter Examination-2023** **Course: B. Tech.** **Branch: ALL** **Semester: III** **Subject Code & Name: BTBS301/ BTES 301 Engineering Mathematics-III** **Max Marks: 60** **Date: 02.01.2024** **Duration: 3 Hr.**		
	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 Two of the following.**		**12**
A)	Find the Laplace transform of $\boldsymbol{f(t) = t^2 \sin 2t}$	**Understand/ CO1**	**6**
B)	Find Laplace transform of $\boldsymbol{F(t) = \int_0^t \frac{e^{-at} - e^{-bt}}{t} dt}$	**Understand /CO1**	**6**
C)	Find the Laplace transforms of $\boldsymbol{f(t) = \frac{t}{T}}$, **for** $\boldsymbol{0 < t < T}$ (saw - tooth wave function of period T)	**Apply/CO1**	**6**
Q.2	**Solve Any Two of the following.**		**12**
A)	Find inverse Laplace transform of $\boldsymbol{\cot^{-1}\left(\frac{s+3}{2}\right)}$	**Understand /CO2**	**6**
B)	By using Partial fraction expansion to find inverse Laplace transform of $\boldsymbol{F(s) = \frac{s}{(s^2+1)(s^2+4)}}$	**Understand /CO2**	**6**
C)	Using the Laplace transform, solve the differential equation $\boldsymbol{\frac{d^2x}{dt^2} + 9x = \cos 2t;}$ **if** $\boldsymbol{x(0) = 1,\ x\left(\frac{\pi}{2}\right) = -1}$.	**Apply/CO2**	**6**
Q. 3	**Solve Any Two of the following.**		**12**
A)	Express the function $\boldsymbol{f(x) = \begin{cases} 1 & \text{for } \lvert x \rvert \le 1 \\ 0 & \text{for } \lvert x \rvert > 1 \end{cases}}$ as a Fourier integral.	**Understand /CO3**	**6**
B)	Find the Fourier sine transform of $\boldsymbol{f(x) = e^{-\lvert x \rvert}}$, and hence show that $\boldsymbol{\int_0^\infty \frac{x \sin mx}{1+x^2} dx = \frac{\pi e^{-m}}{2},\ m > 0}$.	**Understand /CO3**	**6**
C)	Using Parseval's identity, show that $\boldsymbol{\int_0^\infty \frac{t^2}{(4+t^2)(9+t^2)} dt = \frac{\pi}{10}}$	**Apply/CO3**	**6**
Q.4	**Solve Any Two of the following.**		**12**
A)	Solve the following partial differential equations $\boldsymbol{(mz - ny)p + (nx - lz)q = ly - mx}$	**Understand /CO4**	**6**

B)	A string is stretched and fastened to two points $\boldsymbol{l}$ apart. Motion is started by replacing the string in the form $\boldsymbol{y} = \boldsymbol{A}\sin\frac{\boldsymbol{\pi x}}{\boldsymbol{l}}$ from which it is released at time $\boldsymbol{t} = \boldsymbol{0}$. Show that the displacement of a point at a distance x from one end at time t is given by $\boldsymbol{y}(\boldsymbol{x}, \boldsymbol{t}) = \boldsymbol{A}\sin\frac{\boldsymbol{\pi x}}{\boldsymbol{l}}\cos\frac{\boldsymbol{\pi c t}}{\boldsymbol{l}}$.	**Apply/CO4**	**6**
C)	Solve the following equation by the method of separation of variables: $\frac{\partial^2 \boldsymbol{u}}{\partial x \partial t} = \boldsymbol{e}^{-\boldsymbol{t}}\cos \boldsymbol{x}$, given that $\boldsymbol{u} = \boldsymbol{0}$ when $\boldsymbol{t} = \boldsymbol{0}$ and $\frac{\partial \boldsymbol{u}}{\partial t} = \boldsymbol{0}$ when $\boldsymbol{x} = \boldsymbol{0}$.	**Apply /CO4**	**6**
Q. 5	**Solve Any Two of the following.**		**12**
A)	If $\boldsymbol{f}(\boldsymbol{z})$ is analytic, show that $\left[\frac{\partial \lvert \boldsymbol{f}(\boldsymbol{z}) \rvert}{\partial \boldsymbol{x}}\right]^2 + \left[\frac{\partial \lvert \boldsymbol{f}(\boldsymbol{z}) \rvert}{\partial \boldsymbol{y}}\right]^2 = \lvert \boldsymbol{f}'(\boldsymbol{z}) \rvert^2$.	**Understand /CO5**	**6**
B)	Apply Cauchy's integral Formula to evaluate $\oint_C \frac{\boldsymbol{e}^{-\boldsymbol{z}}}{\boldsymbol{z}+\boldsymbol{1}}\, dz$, where **C** is the circle **(a)** $\lvert \boldsymbol{z} \rvert = \boldsymbol{2}$ and **(b)** $\lvert \boldsymbol{z} \rvert = \frac{\boldsymbol{1}}{\boldsymbol{2}}$.	**Apply/CO5**	**6**
C)	State Cauchy's residue theorem and evaluate $\oint_C \tan \boldsymbol{z}\, \boldsymbol{dz}$, where C is the circle $\lvert \boldsymbol{z} \rvert = \boldsymbol{2}$.	**Apply /CO5**	**6**
	***** End *****		

	DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE **Supplementary Examination – Summer 2024** **Course: B. Tech.** **Branch: Common to all Branches** **Semester : III** **Subject Name & Code: Engineering Mathematics – III (BTBS301/BTES301)** **Max Marks: 60** **Date:29/06/2024** **Duration: 3 Hrs.**	
	Instructions to the Students: 1. *All the questions are compulsory.* 2. *Use of non-programmable scientific calculators is allowed.* 3. *Assume suitable data wherever necessary and mention it clearly.*	
		Marks
Q. 1	**Solve Any Two of the following.**	**12**
A)	Find the Laplace transform of $\frac{\sin 2t}{t}$.	**6**
B)	Find the Laplace transform of $\int_0^t \left(\frac{e^{-at}-e^{-bt}}{t}\right) dt$.	**6**
C)	Find the Laplace transform of $erf\left(\sqrt{t}\right)$.	**6**
Q.2	**Solve Any Two of the following:**	**12**
A)	Find the inverse Laplace transform of $\log\left(1+\frac{1}{s^2}\right)$	**6**
B)	Using Partial Fraction method, find the inverse Laplace Transform $\frac{s}{(s^2+1)(s^2+4)}$	**6**
C)	Find the inverse Laplace transform of $\frac{4s+15}{16s^2-25}$	**6**
Q. 3	**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 $\int_0^\infty \frac{\sin x}{x}dx$.	**6**
B)	Find the Fourier sine transform of $e^{-\lvert x\rvert}$, and hence show that $\int_0^\infty \frac{x\sin mx}{1+x^2}dx=\frac{\pi e^{-m}}{2},\ m>0$.	**6**
C)	Evaluate the integral $\int_0^\infty \frac{dx}{(a^2+x^2)(b^2+x^2)}$.	**6**
Q.4	**Solve any Two of the following:**	**12**
A)	Form the partial differential equation by eliminating the arbitrary function from $z=f(x^2-y^2)$.	**6**
B)	The partial differential equations by eliminating the arbitrary constant $z=(x^2+a)(y^2+b)$	**6**
C)	Solve the following partial differential equations $p+3q=5z+\tan(y-3x)$ where the symbols have got their usual meanings.	**6**
Q. 5	**Solve any Two of the following:**	**12**
A)	Show that $u=x^3-3xy^2+3x^2-3y^2+1$ is a harmonic function and hence determine the corre-	**6**

	sponding analytic function	
B)	Evaluate $\oint_C \frac{e^{-z}}{z+1} dz$ where C is the circle $\lvert z \rvert = 2$ and $\lvert z \rvert = \frac{1}{2}$	**6**
C)	Use Cauchy's integral formula to evaluate $\oint_C \frac{e^{2z}}{(z+1)^4} dz$, where C the circle is $\lvert z \rvert = 2$.	**6**
	*****END*****	

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 $f(t) = e^{-3t}\cos 4t$ 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 $f(t) = t \sin hat$ 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 $f(t) = \frac{15}{s^2+4s+13}$ is,				**Understand CO2**	1
	a. $e^{-2t}\sin 3t$	b. $5\, e^{-2t}\sin 3t$	c. $e^{-t}\sin 3t$	d. None		
5	Inverse Laplace transform of the function $f(t) = \frac{1}{\sqrt{s+4}}$ is				**Understand CO2**	1
	a. $e^{-4t}\frac{1}{\sqrt{\pi t}}$	b. $e^{-t}\frac{1}{\sqrt{\pi t}}$	c. $e^{-4t}\frac{1}{\sqrt{t}}$	d. None		
6	The inverse Laplace transform of the function $f(t) = \frac{1}{s^2+9}$ is				**Understand CO2**	1
	a. $\frac{1}{9} sin3t$	b. $\frac{1}{3} sin3t$	c. $sin3t$	d. None		
7	The Fourier cosine transform of 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 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 $z = ax + by + ab$ 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 $p(\tan x) + q(\tan y) = \tan z$				**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 $v = \sinh x \cos y$ 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******					

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

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

Subject Code & Name: (BTBSC301) Engineering Mathematics - III

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	The Laplace transform of $F(t) = \text{erf}(\sqrt{t})$ is equal to				**Understand CO1**	1
	a. $\frac{1}{s\sqrt{s^2+1}}$	b. $\frac{1}{s\sqrt{s-1}}$	c. $\frac{1}{s\sqrt{s+1}}$	d. None		
2	The Laplace transform of $F(t) = e^{2t}\, t^3$ is equal to				**Understand CO1**	1
	a. $\frac{12}{(s-4)^2}$	b. $\frac{12}{(s+4)^2}$	c. $\frac{12}{(s+2)^4}$	d. None		
3	The Laplace transform of $f(t) = t^{\frac{-1}{2}}$ is equal to				**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	The inverse Laplace transform of $\overline{f}(s) = \frac{1}{(s+3)^5}$ is equal to				**Understand CO2**	1
	a. $\frac{e^{-3t}t^4}{24}$	b. $\frac{e^{3t}t^4}{24}$	c. $e^{-3t}\ t^4$	d. None		
5	The inverse Laplace transform of $\overline{f}(s) = \frac{s^2-3s+4}{s^3}$ is equal to				**Understand CO2**	1
	a. $1 - 3t - 2t^2$	b. $1 + 3t + 2t^2$	c. $1 - 3t + 2t^2$	d. None		
6	The inverse Laplace transform of the function $f(t) = \frac{1}{s^2+9}$ is				**Understand CO2**	1
	a. $\frac{1}{9}$sin3t	b. $\frac{1}{3}sin3t$	c. $sin3t$	d. None		
7	The Fourier cosine transform of the function $f(t)$ is				**Understand CO3**	1
	a. $F_c(s) = \int_0^\infty f(t)\cos st$	b. $F_c(s) = \int_0^\infty f(t)\cos t\, dt$	c. $F_c(s) \int_0^\infty f(st)\cos t\, dt$	d. None		
8	The Fourier sine transform of e^{-ax} $(a > 0)$ is				**Understand CO3**	1
	a. $\frac{s}{s^2+a^2}$	b. $\frac{a}{s^2+a^2}$	c. $\frac{s}{s^2-a^2}$	d. None		
9	The general solution of $zp = -x$ is given by				**Understand CO4**	1
	a. $\phi(x^2 + z^2, y) = 0$	b. $\phi(x^2 - z^2, y) = 0$	c. $\phi(x^2 + z^2, 2y) = 0$	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 a. $\frac{\partial v}{\partial \theta}$ b. $r\frac{\partial v}{\partial \theta}$ c. $\frac{1}{r}\frac{\partial v}{\partial \theta}$ d. None	Understand CO5	1
12	A Bilinear transformation map circles into a. circles b. hyperbola c. parabola d. None	Understand CO5	1
Q. 2	**Solve the following.**		**12**
A)	Find Laplace transform of $\frac{\cos 3t - \cos 2t}{t}$	**Understand/ CO1**	**6**
B)	Apply Laplace transform property to find Laplace transform of $\int_0^t te^{-4t}\sin 3t\,dt$	**Apply/CO1**	**6**
Q.3	**Solve the following.**		**12**
A)	Find inverse Laplace transform of $\log\left(\frac{s^2+b^2}{s^2+a^2}\right)$	**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 Fourier integral representation of the function $f(x) = \begin{cases} 1, & \lvert x\rvert < 1 \\ 0, & \lvert x\rvert > 1 \end{cases}$ and hence evaluate i) $\int_0^\infty \frac{\sin\omega\cos\omega x}{\omega}\,d\omega$ ii) $\int_0^\infty \frac{\sin\omega}{\omega}\,d\omega$	**Apply/CO3**	**6**
B)	Find the Fourier sine transform of $e^{-\lvert x\rvert}$, and hence show that $\int_0^\infty \frac{x\sin mx}{1+x^2}\,dx = \frac{\pi e^{-m}}{2}$, $m > 0$.	**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)	Obtain partial differential equation by eliminating arbitrary function f and g from $y = f(x - at) + g(x + at)$	**Understand CO4**	**6**
B)	Solve $yzp + zxq = xy$	**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)	Show that function $v = \sin x\,\cos y$ is harmonic function. Also find its harmonic conjugate function.	**Remember /CO5**	**6**
B)	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**
C)	State Cauchy's residue theorem and evaluate $\oint_C \frac{e^{-2z}z}{(z-1)^2}\,dz$ where $C: \lvert z\rvert = 1.5$	**Remember /CO5**	**6**
	********END*******		

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Supplementary Summer Examination – 2025

Course: B. Tech.	**Branch: Common to all branch**	**Semester: III**
Subject Code & Name: BTBSC301 & Engineering Mathematics-III		
Max Marks: 60	**Date:21.07.2025**	**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	The Laplace transform of $\boldsymbol{F(t) = (a + bt)^2}$, where a & b are constant, is given by				**CO1**	1
	a. $(a + bs)^2$	b. $\frac{1}{(a+bs)^2}$	c. $\frac{a^2}{s} + \frac{2ab}{s^2} + \frac{b^2}{s^3}$	d. None		
2	The Laplace transform of $\boldsymbol{F(t) = e^{3t} \sin 5t}$ is equal to				**CO1**	1
	a. $\frac{5}{(s-3)^2+5^2}$	b. $\frac{5}{(s+3)^2+5^2}$	c. $\frac{5}{(s-3)^2-5^2}$	d. None		
3	The Laplace transform of $\boldsymbol{F(t) = e^{4t}\, \mathrm{erf}(\sqrt{t})}$ is equal to				**CO1**	1
	a. $\frac{1}{(s-4)\ \sqrt{s+3}}$	b. $\frac{1}{(s+4)\ \sqrt{s-3}}$	c. $\frac{1}{(s+4)\ \sqrt{s+3}}$	d. None		
4	The inverse Laplace transform of $\boldsymbol{\overline{f}(s) = \frac{1}{(s+3)^5}}$ is equal to				**CO2**	1
	a. $\frac{e^{-3t}t^4}{24}$	b. $\frac{e^{3t}t^4}{24}$	c. $e^{-3t}\ t^4$	d. None		
5	The inverse Laplace transform of $\boldsymbol{\overline{f}(s) = \frac{s^2-3s+4}{s^3}}$ is equal to				**CO2**	1
	a. $1 - 3t - 2t^2$	b. $1 + 3t + 2t^2$	c. $1 - 3t + 2t^2$	d. None		
6	The inverse Laplace transform of $\boldsymbol{\overline{f}(s) = \frac{s+3}{(s+3)^2+4}}$ is equal to				**CO2**	1
	a. $e^{-3t}\ sin2t$	b. $e^{3t}\ sin2t$	c. $e^{-3t}\ cos2t$	d. None		
7	The Fourier cosine transform of $\boldsymbol{e^{-x}}$ is				**CO3**	1
	a. $\frac{s}{s^2+1}$	b. $\frac{s}{s^2-1}$	c. $\frac{1}{s^2+1}$	d. None		
8	The Fourier sine transform of $\boldsymbol{e^{-ax}}$ $(a > 0)$ is				**CO3**	1
	a. $\frac{s}{s^2+a^2}$	b. $\frac{a}{s^2+a^2}$	c. $\frac{s}{s^2-a^2}$	d. None		
9	The partial differential equation obtained by eliminating the function from $\boldsymbol{z = e^{ny}\ \emptyset(x - y)}$				**CO4**	1
	a. $p - q = nz$	b. $p + q = n$	c. $p + q = nz$	d. None		
10	The order of the partial differential equation $\boldsymbol{\frac{\partial z}{\partial x} + \frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial x\, \partial y} = 1}$ is				**CO4**	1
	a. 1	b. 2	c. 3	d. None		

11	The harmonic conjugate of $v = x^3 - 3xy^2$ is				CO5	1
	a. $y^3 - 3x^2y + c$	b. $y^3 + 3x^2y + c$	c. $y^3 - 3x^2 + c$	d. None		
12	Which out of the following, is an analytic function				CO5	1
	a. $f(z) = sinz$	b. $f(z) = \bar{z}$	c. $f(z) = Im(z)$	d. None		
Q. 2	**Solve the following.**					**12**
A)	Find the Laplace transform of $f(t) = \left(\sqrt{t} + \frac{1}{\sqrt{t}}\right)^3$				**CO1**	**6**
B)	Find the Laplace transform of $f(t) = t\sin^2 t$				**CO1**	**6**
Q.3	Solve the following.					**12**
A)	Using Partial Fraction method, find the inverse Laplace Transform $\frac{s^2+2s-3}{s(s-3)(s+2)}$				**CO2**	**6**
B)	Find the inverse Laplace transform of $\bar{f}(s) = \log\left(\frac{s+a}{s+b}\right)$				**CO2**	**6**
Q. 4	Solve Any Two of the following.					**12**
A)	Express the function $f(x) = \begin{cases} 1 \text{ for } \lvert x\rvert \le 1 \\ 0 \text{ for } \lvert x\rvert > 1 \end{cases}$ as a Fourier integral.				**CO3**	**6**
B)	Find the Fourier cosine transform of $f(x) = \frac{1}{1+x^2}$.				**CO3**	**6**
C)	Using Parseval's identity, prove that $\int_0^\infty \frac{t^2}{(t^2+1)^2} dt = \frac{\pi}{4}$.				**CO3**	**6**
Q.5	**Solve Any Two of the following.**					**12**
A)	Solve by partial differential equation by eliminating the arbitrary function $f(x+y+z,\ x^2+y^2+z^2) = 0$.				**CO4**	**6**
B)	Solve: $p + 3q = 5z + \tan(y - 3x)$				**CO4**	**6**
C)	Use the method of separation of variables to solve the equation $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$, given that $u(x, 0) = 6\, e^{-3x}$.				**CO4**	**6**
Q. 6	**Solve Any Two of the following.**					**12**
A)	Find m such that the function $f(z)$ expressed in polar co-ordinates as $f(z) = r^2 \cos 2\theta + i\, r^2 \sin m\theta$ is analytic.				**CO5**	**6**
B)	If $f(z)$ is analytic, show that $\left[\frac{\partial \lvert f(z)\rvert}{\partial x}\right]^2 + \left[\frac{\partial \lvert f(z)\rvert}{\partial y}\right]^2 = \lvert f'(z)\rvert^2$.				**CO5**	**6**
C)	Use Cauchy's integral formula to Evaluate $\oint_C \frac{e^z}{z-2} dz$, where C is the circle (a) $\lvert z\rvert = 3$ and (b) $\lvert z\rvert = 1$.				**CO5**	**6**
	*** End ***					