

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 $L\{f(t)\} = \frac{e^{-as}}{s^3}$ then $L\{f(3t)\}$ is equal to	Understand CO1	1
	a. $\frac{e^{-s}}{(\frac{s}{a})^3}$ b. $\frac{e^{-s}}{(\frac{s}{3})^3}$ 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 $f(t) = t \sin at$ 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. $\frac{1}{9} \sin 3t$ b. $\frac{1}{3} \sin 3t$ c. $\sin 3t$ 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 CO4	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. $\frac{1}{r} \frac{\partial v}{\partial \theta}$		
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		
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 $f(x) = \begin{cases} 1, & \text{for } x < 1 \\ 0, & \text{for } x > 1 \end{cases}$. 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 $C: z = 1$			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.

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5. Use of non-programmable scientific calculators is allowed.
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		(Level/CO)	Marks
Q. 1	Objective type questions. (Compulsory Question)		12
1	The Laplace transform of $F(t) = \operatorname{erf}(\sqrt{t})$ 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 $\bar{f}(s) = \frac{1}{(s+3)^5}$ 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 $\bar{f}(s) = \frac{s^2-3s+4}{s^3}$ 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. $\frac{1}{9}\sin 3t$ b. $\frac{1}{3}\sin 3t$ c. $\sin 3t$ 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 CO4	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	A Bilinear transformation map circles into				Understand CO5	1
	a. circles	b. hyperbola	c. parabola	d. None		
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 $f(x) = \begin{cases} 1, & x < 1 \\ 0, & x > 1 \end{cases}$ 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 $e^{- x }$, 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 $C: z = 1$				Apply/CO5	6
C)	State Cauchy's residue theorem and evaluate $\oint_C \frac{e^{-2z}}{(z-1)^2} dz$ where $C: z = 1.5$				Remember /CO5	6
	*****END*****					

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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,

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

b) Find the Laplace transform of

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

c) Find the Laplace transform of the function

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

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

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

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

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

Q. 3. a) Find the Fourier transform of

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

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

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

- c) Using Parseval's Identity, prove that

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

- Q.4.** a) Solve the partial differential equation

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

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

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

- 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

$$\sin\left(\frac{\pi x}{2}\right) + 3 \sin\left(\frac{5\pi x}{2}\right). \quad [4]$$

- 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 – 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 $f(t) = t^2 e^{-3t} \sinh at$	Understand	4
B) Express $f(t)$ in terms of Heaviside's unit step function and hence find its Laplace transform where $f(t) = \begin{cases} \cos t, & 0 < t < \pi \\ \sin t, & t > \pi \end{cases}$	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 $\int_0^\infty e^{-t} \left(\frac{1 - \cos 2t}{t} \right) dt$	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 $f(t) = \begin{cases} 1, & 0 \leq x \leq \pi \\ 0, & x > \pi \end{cases}$ 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 $\int_0^\infty \frac{\sin at}{t(a^2+t^2)} dt = \frac{\pi}{2} \left(\frac{1 - e^{-a^2}}{a^2} \right)$	Application	4

- C) Find the Fourier transform of $f(x) = \begin{cases} 1 - x^2, & \text{if } |x| \leq 1 \\ 0, & \text{if } |x| > 1 \end{cases}$. 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.

- 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 corresponding 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 $|z+1-i|=2$. **Evaluation** 6

- B) Find the residues of $f(z) = \frac{\sin z}{z \cos z}$ at its poles inside the circle $|z|=2$. **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 $|z|=3$. **Evaluation** 6

*** End ***

<p style="text-align: center;">DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE End Semester Examination – Winter 2019</p> <p>Course: B. Tech in Sem: III Subject Name: Engineering Mathematics-III (BTBSC301) Marks: 60 Date: 10/12/2019 Duration: 3 Hr.</p>			
<p>Instructions to the Students:</p> <ol style="list-style-type: none"> 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 $L\left\{\cos ht \int_0^t e^u \cosh u \, du\right\}$.	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 $f(x) = \begin{cases} \sin x, & 0 \leq x \leq \pi \\ 0, & x > \pi \end{cases}$ 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 $f(x) = \begin{cases} x, & 0 \leq x \leq 1 \\ 2-x, & 1 \leq x \leq 2 \\ 0, & x > 2 \end{cases}$.	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 $ z = 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 $ z = 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.

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B) Express $f(t)$ in terms of Heaviside's unit step function and hence find its Laplace transform where $f(t) = \begin{cases} \cos t, & 0 < t < \pi \\ \sin t, & t > \pi \end{cases}$	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 $\int_0^\infty e^{-t} \left(\frac{1 - \cos 2t}{t} \right) dt$	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 $f(t) = \begin{cases} 1, & 0 \leq x \leq \pi \\ 0, & x > \pi \end{cases}$ 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 $\int_0^\infty \frac{\sin at}{t(a^2+t^2)} dt = \frac{\pi}{2} \left(\frac{1 - e^{-a^2}}{a^2} \right)$	Application	4

- C) Find the Fourier transform of $f(x) = \begin{cases} 1 - x^2, & \text{if } |x| \leq 1 \\ 0, & \text{if } |x| > 1 \end{cases}$. Hence prove **Understand** **4**
that $\int_0^\infty \left(\frac{x \cos x - \sin x}{x^3} \right) \cos \frac{x}{2} dx = -\frac{3\pi}{16}$

- D) Find Fourier sine transform of $5e^{-2x} + 2e^{-5x}$ **Understand** **4**

Q. 4 Attempt the following.

- 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 **Application** **4**
 $\sin \frac{\pi x}{2} + 3 \sin \frac{5\pi x}{2}$.

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, **Understand** **4**
find the values of the constants a, b, c and d .

- B) If $f(z)$ is an analytic function with constant modulus, show that $f(z)$ is **Understand** **4**
constant.

- C) Find the bilinear transformation which maps the points $z = 0, -i, -1$ into **Understand** **4**
the points $w = i, 1, 0$.

- D) Prove that the function $u = e^x(x \cos y - y \sin y)$ satisfies the Laplace's **Synthesis** **4**
equation. Also find the corresponding analytic function.

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 $|z + 1 - i| = 2$. **Evaluation** **6**

- B) Find the residues of $f(z) = \frac{\sin z}{z \cos z}$ at its poles inside the circle $|z| = 2$. **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 $|z| = 3$. **Evaluation** **6**

*** End ***

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE End Semester Examination – Winter 2019 Course: B. Tech in Subject Name: Engineering Mathematics-III (BTBSC301) Date: 10/12/2019 Sem: III Marks: 60 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 $L\left\{\cosh t \int_0^t e^u \cosh u \, du\right\}$.	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 $f(x) = \begin{cases} \sin x, & 0 \leq x \leq \pi \\ 0, & x > \pi \end{cases}$ 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 $f(x) = \begin{cases} x, & 0 \leq x \leq 1 \\ 2-x, & 1 \leq x \leq 2 \\ 0, & x > 2 \end{cases}$.	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 $ z = 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 $ z = 1$.	Evaluation	4
*** Paper End ***			

<p style="text-align: center;">DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE End Semester Examination – Winter 2019 Course: B. Tech in Subject Name: Engineering Mathematics-III (BTBSC301) Date: 10/12/2019</p> <p style="text-align: right;">Sem: III Marks: 60 Duration: 3 Hr.</p>			
<p>Instructions to the Students:</p> <ol style="list-style-type: none"> 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 $L\left\{\cos ht \int_0^t e^u \cosh u \, du\right\}$.	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 $f(x) = \begin{cases} \sin x, & 0 \leq x \leq \pi \\ 0, & x > \pi \end{cases}$ 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 $f(x) = \begin{cases} x, & 0 \leq x \leq 1 \\ 2-x, & 1 \leq x \leq 2 \\ 0, & x > 2 \end{cases}$.	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 $ z = 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 $ z = 1$.	Evaluation	4
*** Paper 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 $f(t) = t^2 \sin 2t$	Understand/ CO1	6
B)	Find Laplace transform of $F(t) = \int_0^t \frac{e^{-at} - e^{-bt}}{t} dt$	Understand /CO1	6
C)	Find the Laplace transforms of $f(t) = \frac{t}{T}$, for $0 < t < T$ (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 $\cot^{-1}\left(\frac{s+3}{2}\right)$	Understand /CO2	6
B)	By using Partial fraction expansion to find inverse Laplace transform of $F(s) = \frac{s}{(s^2+1)(s^2+4)}$	Understand /CO2	6
C)	Using the Laplace transform, solve the differential equation $\frac{d^2x}{dt^2} + 9x = \cos 2t$; if $x(0) = 1$, $x\left(\frac{\pi}{2}\right) = -1$.	Apply/CO2	6
Q. 3	Solve Any Two of the following.		12
A)	Express the function $f(x) = \begin{cases} 1 & \text{for } x \leq 1 \\ 0 & \text{for } x > 1 \end{cases}$ as a Fourier integral.	Understand /CO3	6
B)	Find the Fourier sine transform of $f(x) = e^{- x }$, and hence show that $\int_0^\infty \frac{x \sin mx}{1+x^2} dx = \frac{\pi e^{-m}}{2}$, $m > 0$.	Understand /CO3	6
C)	Using Parseval's identity, show that $\int_0^\infty \frac{t^2}{(4+t^2)(9+t^2)} dt = \frac{\pi}{10}$	Apply/CO3	6
Q.4	Solve Any Two of the following.		12
A)	Solve the following partial differential equations $(mx - ny)p + (nx - lz)q = ly - mx$	Understand /CO4	6

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

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 $f(x) = \begin{cases} 1, & \text{for } |x| < 1 \\ 0, & \text{for } |x| > 1 \end{cases}$. Hence evaluate that $\int_0^\infty \frac{\sin x}{x} dx$.

6

B) Find the Fourier sine transform of $e^{-|x|}$, and hence show that $\int_0^\infty \frac{x \sin mx}{1+x^2} dx = \frac{\pi e^{-m}}{2}$, $m > 0$.

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

	spending analytic function	
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	

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