PART – C

Answer the following **1 x 20 = 20 Marks**

19. (a) Using finite Fourier cosine transform, solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, given that $\frac{\partial u}{\partial x}(0,t) = 0, \frac{\partial u}{\partial x}(6,t) = 0$ and u (x, 0) = 2x where $0 < x < 6, t > 0$. (10)

(b) Evaluate $\int_{-\infty}^{\infty} \frac{x^2 dx}{(x^2+a^2)(x^2+b^2)}$ by using Contour integration. (10)

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SASTRA UNIVERSITY

(A University under section 3 of the UGC Act, 1956)

B.Tech. Degree Examinations **November 2017**

End Semester

Course Code: **BCECMA 301R01 / BCHCMA 301R02 / BCSCMA 301R02 / BECCMA 301R01 / BEECMA 301R01 / BEICMA 301R02 / BITCMA 301R02 / BMECMA 301R01 / BBTCMA 301R01 / BBECMA 301R02 / BMTCMA 301R01 / BBICMA 301R02 / BICCMA 301R02 / BASCMA 301 / MSTCMA 301R01 / MCMCMA 301R01 / MICCMA 301R01 / MPSCMA 301R01 / MCSCMA 301R01 / MBTCMA 301 / MNNCMA 301R01 / MAMCMA 301R01 / MAUCMA 301R01 / MCHCMA 301 / MBICMA 301**

Course: **ENGINEERING MATHEMATICS - III**

Question Paper No. : **B0239** Duration: **3 hours**

Max. Marks: **100**

PART – A

Answer all the questions **10 x 2 = 20 Marks**

1. Evaluate $\int_0^{\infty} te^{-2t} dt$.
2. Find $L\left[\frac{\sin t}{t}\right]$.
3. Show that $L^{-1}[F(s+a)] = e^{-at} L^{-1}[F(s)]$.
4. Show that the function $v = \sin x \cosh y + 2 \cos x \sinh y + x^2 - y^2 + 4xy$ satisfies Laplace's equation.
5. Show that the function of $f(z) = \cos z$ is analytic.
6. Find the fixed points of the transformation $w = \frac{1-z}{1+z}$.
7. Find the singularities of the function $f(z) = \sin\left(\frac{1}{z+1}\right)$.

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8. State Cauchy's fundamental theorem.

9. State Fourier integral theorem.

10. Find the finite Fourier sine transform of $f(x) = 1$, in $(0, \pi)$.

PART – B

Answer all the questions **4 x 15 = 60 Marks**

11. (a) Solve $\frac{dy}{dt} - y = 2$, given $y(0) = 2$ by using Laplace transforms. (8)

(b) Find $L^{-1}\left[\frac{s+1}{s(s^2-6s+8)}\right]$. (7)

(OR)

12. (a) Find the Laplace transform of the function f(t) with period $\frac{2\pi}{w}$ where $f(t) = \begin{cases} \sin wt, & for\, 0 < t < \frac{\pi}{w} \\ 0, & for\, \frac{\pi}{w} < t < \frac{2\pi}{w} \end{cases}$. (8)

(b) Find $L^{-1}\left[\tan^{-1}\left(\frac{1}{s}\right)\right]$. (7)

13. (a) Find an analytic function $f(z) = u + iv$ where $u + v = \frac{\sin 2x}{\cosh 2y - \cos 2x}$. (8)

(b) Find the bilinear transformation which maps the points 1, i, -1, onto the points i, 0, -i. (7)

(OR)

14. (a) Under the transformation $w = z + \frac{1}{z}$, find the images $|z| = r$ where $r = 1$ and $r \neq 1$. (8)

(b) Find an analytic function $f(z) = u + iv$ where $v = e^{-x}(x\cos y + y \sin y)$. (7)

15. (a) Evaluate $\int_0^{2\pi} \frac{\sin^2 \theta d\theta}{a + b\cos\theta}$ where $a > b > 0$.

(OR)

16. (a) Evaluate $\int_c \frac{z \sec z}{1 - z^2} dz$ where C is $4x^2 + 9y^2 = 9$. (8)

(b) Find the Laurent's series of $f(z) = \frac{1}{z^2 - 3z + 2}$ in the region $1 < |z| < 2$. (7)

17. (a) State and prove Parsaval's identity on Fourier transforms. (8)

(b) Find the function f(x) if its Fourier sine transform is $\frac{e^{-as}}{s}$ (7)

(OR)

18. (a) Obtain the relationship between Fourier transforms and Laplace transforms. (8)

(b) Show that $F\left[\frac{\partial^2 u}{\partial x^2}\right] = -s^2 F[u]$ with usual notations. (7)

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18. (a) Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, $0 < x < 6$, $t > 0$ given

$\frac{\partial u}{\partial x}(0,t) = 0$, $\frac{\partial u}{\partial x}(6,t) = 0$ and u(x, 0) = 6x.

(b) Find the function if its sine transform is $\frac{e^{-as}}{s}$.

PART – C

Answer the following **1 x 20 = 20 Marks**

19. (a) Using Parseval's identity, evaluate

$$\int_0^\infty \frac{dx}{(a^2+x^2)^2} \text{ and } \int \frac{x^2 dx}{(a^2+x^2)^2}, \text{ if } f(x) = e^{-ax};\ a > 0. \quad (10)$$

(b) Evaluate $\int_0^{2\pi} \frac{\sin^2\theta d\theta}{5-3\cos\theta}$ using contour integration. (10)

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SASTRA DEEMED UNIVERSITY

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B.Tech. Degree Examinations **May 2018**

End Semester

Course Code: **BCECMA 301R01 / BCHCMA 301R02 / BCSCMA 301R02 / BECCMA 301R01 / BEECMA 301R01 / BEICMA 301R02 / BITCMA 301R02 / BMECMA 301R01 / BBTCMA 301R01 / BBECMA 301R02 / BMTCMA 301R01 / BBICMA 301R02 / BICCMA 301R02 / BASCMA 301 / MSTCMA 301R01 / MCMCMA 301R01 / MICCMA 301R01 / MPSCMA 301R01 / MCSCMA 301R01 / MBTCMA 301 / MNNCMA 301R01 / MAMCMA 301R01 / MAUCMA 301R01 / MCHCMA 301 / MBICMA 301**

Course: **ENGINEERING MATHEMATICS - III**

Question Paper No. : **B0271** Duration: **3 hours**

Max. Marks: **100**

PART – A

Answer all the questions **10 x 2 = 20 Marks**

1. Find $L^{-1}\left(\frac{1}{s+a}\right)$.
2. Find the Laplace transform of unit step function.
3. Find L(t sin 3t).
4. Prove that $f(z) = z^3$ is analytic at all points.
5. Find the critical points of the transformation $w = z^2$.
6. Find the value of the determinet of the bilinear transformation $w = \frac{2+iz}{iz-1}$.
7. State Cauchy's integral theorem.

8. State Cauchy's fundamental theorem.

9. State Fourier integral theorem.

10. Find the finite Fourier sine transform of $f(x) = 1$, in $(0, \pi)$.

PART – B

Answer all the questions **4 x 15 = 60 Marks**

11. (a) Solve $\frac{dy}{dt} - y = 2$, given $y(0) = 2$ by using Laplace transforms. (8)

(b) Find $L^{-1}\left[\frac{s+1}{s(s^2-6s+8)}\right]$. (7)

(OR)

12. (a) Find the Laplace transform of the function f(t) with period $\frac{2\pi}{w}$ where $f(t) = \begin{cases} \sin wt, & for\, 0 < t < \frac{\pi}{w} \\ 0, & for\, \frac{\pi}{w} < t < \frac{2\pi}{w} \end{cases}$. (8)

(b) Find $L^{-1}\left[\tan^{-1}\left(\frac{1}{s}\right)\right]$. (7)

13. (a) Find an analytic function $f(z) = u + iv$ where $u + v = \frac{\sin 2x}{\cosh 2y - \cos 2x}$. (8)

(b) Find the bilinear transformation which maps the points 1, i, -1, onto the points i, 0, -i. (7)

(OR)

14. (a) Under the transformation $w = z + \frac{1}{z}$, find the images $|z| = r$ where $r = 1$ and $r \neq 1$. (8)

(b) Find an analytic function $f(z) = u + iv$ where $v = e^{-x}(x\cos y + y \sin y)$. (7)

15. (a) Evaluate $\int_0^{2\pi} \frac{\sin^2 \theta d\theta}{a + b\cos\theta}$ where $a > b > 0$.

(OR)

16. (a) Evaluate $\int_c \frac{z \sec z}{1 - z^2} dz$ where C is $4x^2 + 9y^2 = 9$. (8)

(b) Find the Laurent's series of $f(z) = \frac{1}{z^2 - 3z + 2}$ in the region $1 < |z| < 2$. (7)

17. (a) State and prove Parsaval's identity on Fourier transforms. (8)

(b) Find the function f(x) if its Fourier sine transform is $\frac{e^{-as}}{s}$ (7)

(OR)

18. (a) Obtain the relationship between Fourier transforms and Laplace transforms. (8)

(b) Show that $F\left[\frac{\partial^2 u}{\partial x^2}\right] = -s^2 F[u]$ with usual notations. (7)

18. (a) Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, $0 < x < 4$, $t > 0$, given $u(0, t) = u(4, t) = 0$ and $u(x, 0) = 2x$. (7)

(b) Find the finite Fourier sine transform of $f(x) = 1$ in $(0, \pi)$. Use inversion theorem and prove

(i) $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots = \frac{\pi}{4}$ and

(ii) $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots = \frac{\pi^2}{8}$. (8)

PART – C

Answer the following **1 x 20 = 20 Marks**

19. (a) Find Fourier sine and cosine transform of e^{-ax}, $a > 0$. Applying inversion formula find Fourier sine transform of $\frac{x}{a^2 + x^2}$ and Fourier cosine transform of $\frac{1}{a^2 + x^2}$. (10)

(b) Evaluate $\int_0^{2\pi} \frac{d\theta}{a + b\cos\theta}$ $(a > b > 0)$ using Contour integration. (10)

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SASTRA UNIVERSITY

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B.Tech. Degree Examinations **November 2016**

End Semester

Course Code: BCECMA 301R01 / BCHCMA 301R02 / BCSCMA 301R02 / BECCMA 301R01 / BEECMA 301R01 / BEICMA 301R02 / BITCMA 301R02 / BMECMA 301R01 / BBTCMA 301R01 / BBECMA 301R02 / BMTCMA 301R01 / BBICMA 301R02 / BICCMA 301R02 / BASCMA 301 / MSTCMA 301R01 / MCMCMA 301R01 / MICCMA 301R01 / MPSCMA 301R01 / MCSCMA 301R01 / MBTCMA 301 / MNNCMA 301R01 / MAMCMA 301R01 / MAUCMA 301R01 / MCHCMA 301 / MBICMA 301

Course: **ENGINEERING MATHEMATICS - III**

Question Paper No. : **B0245** Duration: 3 hours

Max. Marks: **100**

PART – A

Answer all the questions **10 x 2 = 20 Marks**

1. Find $L^{-1}\left(\frac{1}{s^2}\right)$.

2. Find $L(1 + te^{-t})^3$.

3. If $L(t\cos t) = \frac{s^2 - 1}{(s^2 + 1)^2}$, find L(t cosht cost).

4. Prove that $f(z) = \sin z$ in analytic at all points.

5. Find the critical points of $w = \frac{1}{z}$.

6. Find the value of the determinant of the bilinear transformation $w = \frac{1 + iz}{2z - 1}$.

7. State Cauchy's integral formula.

8. Find the singularities of $\frac{z-2}{(z^2+1)(z^2-1)}$.

9. If F(f(x)) = F(s), show that $F\left(x^n f(x)\right)=(-i)^n \frac{d^n F(s)}{ds^n}$.

10. Find the finite Fouriers sine and cosine transform of f(x) = x in (0 , ℓ).

PART – B

Answer all the questions **4 x 15 = 60 Marks**

11. (a) Find $L^{-1}\left(\frac{(s+1)^2}{(s^2+2s+5)^2}\right)$ and $L^{-1}\left(\frac{s^2}{(s^2-4)^2}\right)$. (7)

(b) Solve $y'' - 2y' + y = (t+1)^2$, $y(0) = 4$ and $y'(0) = -2$. (8)

(OR)

12. (a) Find the inverse Laplace transform of $\frac{s^2}{(s-2)^3}$. (7)

(b) Using Laplace transform of derivatives, find L(t sinh at) and hence L(sinhat + at coshat) and L(coshat + ½ atsinhat). (8)

13. (a) If f(z) = u + iv is a regular function of z, prove that $\nabla^2\{\log|f(z)|\}=0$. (7)

(b) Determine the analytic function f(z) = P + iQ given that $P-Q=\frac{\cos x+\sin x-e^{-y}}{2\cos x-e^{y}-e^{-y}}$ and $f\left(\frac{\pi}{2}\right)=0$. (8)

(OR)

14. (a) If w = u(x, y) + iv(x, y) is an analytic function, show that the curves of the family u(x, y) = a and v(x, y) = b cut orthogonally where a and b are varying constants. (7)

(b) Find the bilinear transformation which maps the points z = 0, z = 1 and z = ∞ into the points w = i, w = 1 and w = -i. (8)

15. (a) Expand the function $f(z)=\frac{1}{z^3}e^{z^2}$ in Laurentz series about z = 0. Identify the type of singularity also. (6)

(b) Find the singularities of $f(z)=\frac{z^2+4}{z^3+2z^2+2z}$ and the corresponding residues. (9)

(OR)

16. (a) Evaluate the following integral using Cauchy's residue theorem. $\int_C \frac{dz}{(z^2+9)^2}$ where C is $|z-i|=3$. (6)

(b) Use Contour integration to prove that (9)

$$\int_0^\infty \frac{x^2\,dx}{x^4+a^4}=\frac{\pi}{2\sqrt{2}a} \text{ where } a>0.$$

17. (a) Find the Fourier transform of $f(x)=1-|x|$ if $|x|<1$ and hence evaluate $\int_0^\infty \frac{\sin^4 t}{t^4}\,dt$. (8)

(b) Show that $\frac{1}{\sqrt{x}}$ is reciprocal under Fourier sine and Fourier cosine transformation. (7)

(OR)

SASTRA UNIVERSITY

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B.Tech. Degree Examinations **May 2016**

End Semester

Course Code: **BEECMA 301 / MPSCMA 301**

Course: **MATHEMATICS III**

Question Paper No. : **B0386** Duration: **3 hours**

Max. Marks: **100**

(Use of statistical tables may be permitted)

PART – A

Answer all the questions **20 x 2 = 40 Marks**

1. Find the Laplace transform of $\cos^3 2t$.

2. Find $L^{-1}\left[\dfrac{s+4}{(s+3)^2}\right]$.

3. Find the Laplace transform of unit step function. e^{-as}/s

4. State initial value theorem.

5. Using Laplace transform evaluate $\int_0^\infty te^{-t}\sin t\,dt$.

6. Show that an analytic function with constant real part is constant.

7. Show that w = log z is analytic everywhere in the complex plan except at origin.

8. Show that $u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$ is harmonic.

9. Find the critical points of $W = z + \frac{c}{z}$.

10. Write down the cross ratio of four points.

11. Evaluate $\int_c \frac{dz}{(z-a)}$ where c is circle $|z-a| = r$.

12. Obtain the Taylor expansion of $f(z) = z^2 e^{\frac{1}{z}}$ about $z = 0$.

13. Find the poles $f(z) = \frac{\sin z}{z \cos z}$.

14. Define zero of an analytic function f(z).

15. Find the residue of cot z at each pole.

16. If two independent variables are uncorrelated then coefficient of correlation r is _____

17. Write down the Spearman's coefficient of rank correlation.

18. On the average rain falls on 10 days in every 30 days, find the probability that first three days of a given week will be fine and the remaining 4 days wet.

ix coins are tossed 240 times, using Poisson approximation find expression for the probability of getting 4 heads x times.

nal distribution is symmetrical about_____.

PART – B

Answer all the questions **4 x 15 = 60 Marks**

21. (a) Find $L\left[\frac{\cos 4t \sin 2t}{t}\right]$. (6)

(b) Using Laplace transform solve: $\frac{dy}{dt} + 4y + 5\int_0^t y\,dt = e^{-t}$ when $y(0) = 0$. (9)

(OR)

22. (a) Find $L^{-1}\left[\frac{s^2}{(s^2+a^2)(s^2+b^2)}\right]$ using convolution theorem. (7)

(b) Find the Laplace transform of

$$f(t) = \begin{cases} \sin \omega t, \; for\; 0 \le t \le \pi/\omega \\ 0, \; for\; \pi/\omega \le t \le 2\pi/\omega \end{cases}.$$

given $f\left(t + \frac{2\pi}{w}\right) = f(t)$ (8)

23. (a) In a two dimensional fluid flow, the stream function is $\Psi = \tan^{-1}\left(\frac{y}{x}\right)$ find the velocity potential.Φ. (7)

(b) Discuss the transformation e^z. (8)

(OR)

24. (a) Show that $u = \sin x \cosh y + 2\cos x \sinh y + x^2 - y^2 + 4xy$ satisfies Laplace's equation and find the corresponding analytic function. (7)

(b) Prove that $w = \frac{z}{1-z}$ maps the upper half of the z plane onto the upper of the w plane. Also find the image of the circle $|z| = 1$ under this transformation. (8)

25. (a) Using Cauchy's integral formula, evaluate $\int_C \frac{z+1}{z^2+2z+4} dz$ where C is the circle $|z+1+i| = 2$. (7)

(b) Using contour integration evaluate $\int_0^{2\pi} \frac{d\theta}{13+5\sin\theta}$. (8)

(OR)

26. (a) Find the Laurent's series expansion of $f(z) = \frac{z^2-1}{(z+2)(z+3)}$ in (i) $|z| < 2$ (ii) $2 < |z| < 3$. (7)

(b) Evaluate $\int \frac{z \sec z}{1-z^2} dz$, where C is the ellipse $4x^2 + 9y^2 = 9$ using Cauchy's residue theorem. (8)

27. (a) Find the coefficient of correlation and find the regression equation of y on x from the following (8)

X	62	64	65	69	70	71	72	74
Y	126	125	139	145	165	152	180	208

(b) A car hire firm has two cars which it hires out daily. The number of demands for a car on each day is distributed as Poisson variate with mean 1.5. Obtain the proportion of the days on which (i) there was no demand (ii) demand is refused. (7)

(OR)

28. (a) Find the rank correlation coefficient for the following. (8)

A	124	100	105	112	102	93	99	115	123	104	99	113	121	103	101
B	80	100	102	91	100	111	109	100	89	104	111	102	98	111	123

(b) Find the equation to the best fitting normal curve to the following distribution (7)

x	1	3	5	7	9
f	1	2	3	2	1

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18. (a) Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, $0 < x < 4$, $t > 0$, given $u(0, t) = u(4, t) = 0$ and $u(x, 0) = 2x$. (7)

(b) Find the finite Fourier sine transform of $f(x) = 1$ in $(0, \pi)$. Use inversion theorem and prove

(i) $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots = \frac{\pi}{4}$ and

(ii) $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots = \frac{\pi^2}{8}$. (8)

PART – C

Answer the following **1 x 20 = 20 Marks**

19. (a) Find Fourier sine and cosine transform of e^{-ax}, $a > 0$. Applying inversion formula find Fourier sine transform of $\frac{x}{a^2 + x^2}$ and Fourier cosine transform of $\frac{1}{a^2 + x^2}$. (10)

(b) Evaluate $\int_0^{2\pi} \frac{d\theta}{a + b\cos\theta}$ $(a > b > 0)$ using Contour integration. (10)

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SASTRA UNIVERSITY

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B.Tech. Degree Examinations **November 2016**

End Semester

Course Code: **BCECMA 301R01 / BCHCMA 301R02 / BCSCMA 301R02 / BECCMA 301R01 / BEECMA 301R01 / BEICMA 301R02 / BITCMA 301R02 / BMECMA 301R01 / BBTCMA 301R01 / BBECMA 301R02 / BMTCMA 301R01 / BBICMA 301R02 / BICCMA 301R02 / BASCMA 301 / MSTCMA 301R01 / MCMCMA 301R01 / MICCMA 301R01 / MPSCMA 301R01 / MCSCMA 301R01 / MBTCMA 301 / MNNCMA 301R01 / MAMCMA 301R01 / MAUCMA 301R01 / MCHCMA 301 / MBICMA 301**

Course: **ENGINEERING MATHEMATICS - III**

Question Paper No. : **B0245** Duration: **3 hours**

Max. Marks: **100**

PART – A

Answer all the questions **10 x 2 = 20 Marks**

1. Find $L^{-1}\left(\frac{1}{s^2}\right)$.

2. Find $L(1 + te^{-t})^3$.

3. If $L(t\cos t) = \frac{s^2 - 1}{(s^2 + 1)^2}$, find L(t cosht cost).

4. Prove that f(z) = sinz in analytic at all points.

5. Find the critical points of $w = \frac{1}{z}$.

6. Find the value of the determinant of the bilinear transforma $w = \frac{1 + iz}{2z - 1}$.

7. State Cauchy's integral formula.

8. Find the singularities of $\frac{z-2}{(z^2+1)(z^2-1)}$.

9. If $F(f(x)) = F(s)$, show that $F\left(x^n f(x)\right) = (-i)^n \frac{d^n F(s)}{ds^n}$.

10. Find the finite Fouriers sine and cosine transform of f(x) = x in (0 , ℓ).

PART – B

Answer all the questions **4 x 15 = 60 Marks**

11. (a) Find $L^{-1}\left(\frac{(s+1)^2}{(s^2+2s+5)^2}\right)$ and $L^{-1}\left(\frac{s^2}{(s^2-4)^2}\right)$. (7)

(b) Solve $y'' - 2y' + y = (t+1)^2$, $y(0) = 4$ and $y'(0) = -2$. (8)

(OR)

12. (a) Find the inverse Laplace transform of $\frac{s^2}{(s-2)^3}$. (7)

(b) Using Laplace transform of derivatives, find L(t sinh at) and hence L(sinhat + at coshat) and L(coshat + ½ atsinhat). (8)

13. (a) If f(z) = u + iv is a regular function of z, prove that $\nabla^2\{\log|f(z)|\} = 0$. (7)

(b) Determine the analytic function f(z) = P + iQ given that $P - Q = \frac{\cos x + \sin x - e^{-y}}{2\cos x - e^{y} - e^{-y}}$ and $f\left(\frac{\pi}{2}\right) = 0$. (8)

(OR)

14. (a) If w = u(x, y) + iv(x, y) is an analytic function, show that the curves of the family u(x, y) = a and v(x, y) = b cut orthogonally where a and b are varying constants. (7)

(b) Find the bilinear transformation which maps the points z = 0, z = 1 and z = ∞ into the points w = i, w = 1 and w = -i. (8)

15. (a) Expand the function $f(z) = \frac{1}{z^3} e^{z^2}$ in Laurentz series about z = 0. Identify the type of singularity also. (6)

(b) Find the singularities of $f(z) = \frac{z^2+4}{z^3+2z^2+2z}$ and the corresponding residues. (9)

(OR)

16. (a) Evaluate the following integral using Cauchy's residue theorem. $\int_C \frac{dz}{(z^2+9)^3}$ where C is $|z-i| = 3$. (6)

(b) Use Contour integration to prove that (9)

$$\int_0^\infty \frac{x^2\,dx}{x^4+a^4} = \frac{\pi}{2\sqrt{2}a} \text{ where } a > 0.$$

17. (a) Find the Fourier transform of $f(x) = 1 - |x|$ if $|x| < 1$ and hence evaluate $\int_0^\infty \frac{\sin^4 t}{t^4}\,dt$. (8)

(b) Show that $\frac{1}{\sqrt{x}}$ is reciprocal under Fourier sine and Fourie cosine transformation.

(OR)

(b) Using contour integration prove that $\int_0^\infty \frac{x^2}{x^4+a^4}dx = \frac{\pi}{2\sqrt{2}a}$ where $a > 0$. (8)

27. Find the Fourier transform of $f(x) = \begin{cases} 1-x^2 & |x|<a \\ 0 & otherwise \end{cases}$.

Hence evaluate $\int_0^\infty \left(\frac{x\cos x - \sin x}{x^3}\right)\cos\frac{x}{2}dx$

(OR)

28. (a) Use Parseval's identity to evaluate $\int_0^\infty \frac{dx}{(x^2+a^2)^2}$ and

$\int_0^\infty \frac{x^2}{(x^2+a^2)^2}dx$ (7)

(b) Find the inverse sine transform of $\frac{1}{s}e^{-as}$ (8)

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SASTRA UNIVERSITY

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B.Tech. Degree Examinations **May 2017**

End Semester

Course Code: **BCECMA 301R01 / BCHCMA 301R02 / BCSCMA 301R02 / BECCMA 301R01 / BEECMA 301R01 / BEICMA 301R02 / BITCMA 301R02 / BMECMA 301R01 / BBTCMA 301R01 / BBECMA 301R02 / BMTCMA 301R01 / BBICMA 301R02 / BICCMA 301R02 / BASCMA 301 / MSTCMA 301R01 / MCMCMA 301R01 / MICCMA 301R01 / MPSCMA 301R01 / MCSCMA 301R01 / MBTCMA 301 / MNNCMA 301R01 / MAMCMA 301R01 / MAUCMA 301R01 / MCHCMA 301 / MBICMA 301**

Course: **ENGINEERING MATHEMATICS - III**

Question Paper No. : **B0253** Duration: **3 hours**

Max. Marks: **100**

PART – A

Answer all the questions **20 x 2 = 40 Marks**

1. Write the conditions for the existence of the Laplace transform.
2. Whether L (t^n) needs Gamma function?
3. Define Dirac delta function.
4. Find $L(\sqrt{t})$
5. State initial and final value theorems.
6. Write C—R equations in polar form.
7. What is isogonal transformation?
8. Whether log z is analytic or not?
9. Write the critical point in the conformal mapping.

10. In the areas of heat flows, electrostatics and gravitational fields what is the representation of $w = f(z)$ complex function.

11. State Cauchy integral formula for derivatives.

12. What is isolated singularity?

13. Find the singularity in the Laurent's series $\left(\frac{1-\cos z}{z}\right)$.

14. State Cauchy's residue theorem.

15. Write the analytic part and principal part in Laurent series.

16. Write Dirichlet's conditions on Fourier transform.

17. Find the sine transform of $f(x) = 1$.

18. Write Parseval's identity.

19. Write the relation between the Fourier transform and Laplace transform.

20. Find the Fourier sine transform of $f(x) = \sin x$, $0 < x < a$.

PART – B

Answer all the questions **4 x 15 = 60 Marks**

21. (a) Using Laplace transform solve $y'' - 4y' + 8y = e^{2t}$, $y(0) = 2$ and $y'(0) = -2$. (7)

(b) Find the Laplace transform of square wave function $f(t)$ defined by $f(t) = k$, $0 \le t \le a$, $= -k$ in $a \le t \le 2a$ and $f(t + 2a) = f(t)$ for all t. (8)

(OR)

22. (a) Find the inverse Laplace transform of $\frac{4(s-1)}{(s^2-2s+5)^2}$. (7)

(b) Find the Laplace transform of $\int_0^t te^{-t} \sin 3t\,dt$. (8)

23. (a) Determine the analytic function $f(z) = u + iv$ given that $3u + 2v = y^2 - x^2 + 16xy$. (7)

(b) Write the transformation $w = e^z$. (8)

(OR)

24. (a) Find the bilinear transformation which maps the points (i) $i, -1, 1$ of the z-plane into $0, 1, \infty$ of the e-plane respectively (ii) $0, 1, \infty$ of z-plane into $i, 1, -i$ of the w-plane. (7)

(b) If $f(z)$ is a regular function of z, find the value of $\nabla^2 \{\log|f(z)|\}$. (8)

25. (a) Use Cauchy's integral formula to evaluate

$$\int_c \frac{z+1}{(z^3-2z^2)}\,dz \text{ where C is the circle } |z-2-i| = 2. \quad (7)$$

(b) Find the Laurent's series of $f(z) = \frac{1}{z(1-z)}$ valid in the region (i) $|z+1| < 1$, (ii) $1 < |z+1| < 2$. (8)

(OR)

26. (a) Find the residues of $f(z) = \frac{z^2}{(z-1)(z+2)^2}$ at its isolated singularities using Laurent's series expansions. (7)

26. (a) Find the Laplace transform of the "square wave" function f(t) defined as below:

$$f(t)=\begin{cases} k & in\ 0\le t\le a \\ -k & in\ a<t\le 2a \end{cases}$$

and f(t + 2a) = f(t) for all t. (8)

(b) Find the Laplace transform of

$$\int_0^t t e^{-4t} \sin 3t \ dt$$ (7)

27. (a) Find Fourier series of $f(x) = x + x^2$ in $(-\pi, \pi)$ of periodicity 2π.

Deduce $\sum_1^\infty \frac{1}{n^2} = \frac{\pi^2}{6}$ (8)

(b) Calculate the first two harmonics of the Fourier series for f(x) from the following table (7)

x	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	2π
y	10	14	19	17	15	12	10

(OR)

28. (a) Find the Fourier transform of f(x) where

$$f(x)=\begin{cases} 1-|x| & for\ |x|<1 \\ 0 & otherwise \end{cases}$$

Also deduce that $\int_0^\infty \frac{\sin^4 t}{t^4}\, dt = \frac{\pi}{3}$ (8)

(b) Evaluate the following integral using Parseval's identity:

$$\int_0^\infty \frac{dx}{(a^2+x^2)^2}$$ (7)

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SASTRA UNIVERSITY

(A University under section 3 of the UGC Act, 1956)

B.Tech Degree Examinations **November 2011**

Third Semester

Course Code: **BECCMA 301 / MCSCMA 301**

Course: **COMPLEX VARIABLES AND TRANSFORMS**

Question Paper No. : **B476** Duration: **3 hours**

Max. Marks: **100**

PART – A

Answer all the questions **20 x 2 = 40 Marks**

1. Distinguish between analyticity and differentiability.
2. State C-R equations in polar form.
3. Find the image of the circle $|z| = 2$ under the transformation $\omega = 3z$.
4. Define cross-ratio of four points in complex plane.
5. Explain the term 'orthogonal trajectories'.
6. State Cauchy's integral formula.
7. What is meant by 'removable singularity'? Give an example.
8. Give the Taylor series expansion for $f(z) = \cos z$ about $z = \frac{-\pi}{2}$
9. Find the residue of $f(z) = \frac{z^2}{(z-1)(z+2)^2}$ at $z = 1$.

10. State Cauchy's residue theorem.

11. Find the Lapalce transform of the unit step function.

12. Find $L(\sin^2 2t)$

13. Evaluate L (cos abt . cosh t)

14. What is a periodic function? Illustrate with examples.

15. Find the inverse Laplace transform of $\log\left[\frac{s^2+a^2}{s^2+b^2}\right]$

16. Write down the Dirichlet's conditions for a function f(x) to be expanded as a Fourier series.

17. What is the value of b_n in the Fourier series expansion of $f(x) = |x|$ in $(-\pi,\pi)$?

18. State Parseval's theorem on Fourier constants.

19. Find the Fourier sine transform of 1/x.

20. Find the Fourier Cosine transform of e^{-x}.

PART – B

4 x 15 = 60 Marks

Answer all the questions

21. (a) Prove that the function $u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$ is harmonic. Also find the conjugate harmonic v and the corresponding analytic function. (8)

(b) Discuss the transformation $\omega = e^z$. (7)

(OR)

22. (a) Show that the function $f(z) = \sqrt{|xy|}$ is not regular at the origin, although C-R equations are satisfied at the origin. (8)

(b) Find the bilinear transformation that maps the points 1, -i, i of the z-plane into the points 0, 1, ∞ of the w-plane respectively. (7)

23. (a) Using Cauchy's integral formula, evaluate $\int_C \frac{z+1}{(z^3-2z^2)}dz$ where C is the circle $|z-2-i| = 2$. (8)

(b) Expand the function $f(z) = \frac{1-\cos z}{z}$ as a Laurent's series about z = 0. Identify the type of singularity. Is f(0) defined? (7)

(OR)

24. (a) Using Cauchy's residue theorem, evaluate $\int_C \frac{dz}{(z^2+9)}$ where C is the circle $|z-i| = 3$. (8)

(b) Prove that $\int_0^\infty \frac{x\sin x}{x^2+a^2}dx = \frac{\pi}{2}e^{-a}$ using contour integration. (7)

25. (a) Solve the following differential equation using Laplace transforms. (8)

$y'' - 4y' + 8y = e^{2t}$, $y(0) = 2$ and $y'(0) = -2$

(b) Use convolution theorem to find the inverse Laplace transform of $\frac{s}{(s^2+a^2)^2}$. (7)

(OR)

20. Solve $y_{n+3} - 3y_{n+1} + 2y_n = 0$, y(0) = 4, y(1) = 0 and y(2) = 8 by using z-transforms.

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SASTRA UNIVERSITY

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B.Sc. Degree Examinations

November 2016

End Semester

Course Code: **BSEL 302R02 / BSEL 302R03 / BSCS 302R01 / BSCS 302R02 / MICE 303**

Course: **MATHEMATICS - III**

Question Paper No. : **S1005** Duration: **3 hours**

Max. Marks: **100**

PART – A

Answer all the questions **10 x 2 = 20 Marks**

1. Find the constant term a_0 for f(x) = x in $(-\pi, \pi)$.
2. Define RMS value of function f(x) in (a, b).
3. Find L[cosh3t].
4. Find $L^{-1}\left[\dfrac{s-2}{(s-2)^2+4}\right]$.
5. Define infinite Fourier transform pair.
6. State Convolution theorem on Fourier transform.
7. Write the order and degree of the difference equation $y_{x+3} - 7y_{x+1} + 8y_x = \cos x$.
8. Solve the difference equation $y_{n+2} - 5y_{n+1} + 6y_n = 0$.

9. Find $Z\left[\frac{1}{n}\right]$.

10. Using Convolution theorem, find $Z^{-1}\left[\frac{Z^2}{(Z+a)^2}\right]$.

PART – B

Answer all the questions **5 x 7 = 35 Marks**

11. (a) Find the Fourier series expansion of $f(x)=|\sin x|$ in $(-\pi, \pi)$.

(OR)

(b) Find the Fourier series of $f(x)=\begin{cases}0, & -1<x<0\\ 1, & 0<x<1\end{cases}$.

12. (a) Find $L[t^2 e^{-t}\cos t]$.

(OR)

(b) Find $L^{-1}\left[\frac{s^2-s+2}{s(s+2)(s-3)}\right]$.

13. (a) Find the Fourier transform of $f(x)=\begin{cases}1, & for\,|x|<a\\ 0, & for\,|x|>a\end{cases}$ and hence show that $\int_0^\infty\left(\frac{\sin t}{t}\right)^2 dt=\frac{\pi}{2}$.

(OR)

(b) Find the Fourier cosine and sine transform of e^{-ax}, $a>0$.

14. (a) Solve $y_{n+3}-4y_{n+1}+4y_n=2^n+3^n+\pi$ by using difference equation.

(OR)

(b) Solve the difference equation $u_{n+2}+u_n=\sin x$.

15. (a) Find $Z\left[\frac{\sin^3 n\pi}{4}\right]$.

(OR)

(b) Find $Z^{-1}\left[\frac{Z^2}{(Z+2)(Z^2+4)}\right]$ by the method of partial fractions.

PART – C

Answer any Three questions **3 x 15 = 45 Marks**

16. Express $f(x) = x - x^2$ as a Fourier series in $-1 < x < 1$ and using this series find the RMS value of f(x) in the interval.

17. Solve $y'' - 3y' + 2y = 4$, $y(0) = 2$, $y'(0) = 3$ using Laplace transforms.

18. Find the Fourier transform of $f(x)=\begin{cases}1-x^2, & if\,|x|<1\\ 0, & if\,|x|>1\end{cases}$ and hence evaluate $\int_0^\infty\left(\frac{x\cos x-\sin x}{x^3}\right)\frac{\cos x}{2}dx$.

19. Solve the difference equation $y_{n+2}-5y_{n+1}+6y_n=x^2+x+1$

(b) Find the Laplace transform of the function $f(t)=\begin{cases} k & 0\le t\le a \\ -k & a\le t\le 2a \end{cases}$ and $f(t+2a)=f(t),\ \forall t$. (7)

(OR)

26. (a) Solve the integral equation $y(t)=a\sin t-2\int_0^t y(u)\cos(t-u)\,du$ using Laplace transform. (7)

(b) Find the inverse Laplace transform of $\frac{s}{(s^2+a^2)^2}$ using convolution theorem. (8)

27. (a) Find the Fourier series for $f(x)=x^2$ in $-\pi<x<\pi$. Hence show that $\frac{1}{1^4}+\frac{1}{2^4}+\frac{1}{3^4}+\cdots=\frac{\pi^4}{90}$. (8)

(b) Find the Fourier cosine transform of $\frac{1}{x^2+1}$. (7)

(OR)

28. (a) Find the Fourier transform of f(x) given by $f(x)=\begin{cases} 1 & for\ |x|<2 \\ 0 & for\ |x|>2 \end{cases}$ and hence evaluate $\int_0^\infty \frac{\sin x}{x}\,dx$ and $\int_0^\infty \left(\frac{\sin x}{x}\right)^2 dx$. (8)

(b) Obtain the sine series for the function

$$f(x)=\begin{cases} x, & 0<x<\frac{\ell}{2} \\ \ell-x, & \frac{\ell}{2}<x<\ell \end{cases}$$ (7)

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SASTRA UNIVERSITY

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B.Tech Degree Examinations November 2009

Third Semester

Course Code: **BEC/CMA 301**

Course: **COMPLEX VARIABLES AND TRANSFORMS**

Question Paper No. : **B0378** Duration: 3 hours

Max. Marks: 100

PART – A

Answer all the questions **20 x 2 = 40 Marks**

1. State any two properties of an analytic function.
2. Show that the function x^2+iy^2 is not analytic anywhere.
3. Find the fixed points of $\omega=\frac{2zi+5}{z-4i}$.
4. Define conformal mapping.
5. State Cauchy's residue theorem.
6. Use Laurent's series to find the residue of $f(z)=\frac{e^{2z}}{(z-1)^2}$ at $z=1$.
7. Find the singular points of $f(z)=\sin\left(\frac{1}{z+1}\right)$ and state its nature.

8. Find the poles of $f(z) = \frac{\cos z}{(z-1)^3}$.

9. Evaluate $\int_C \frac{3z^2+7z+1}{z+1}dz$ where C is $|z| = \frac{1}{2}$.

10. State the sufficient condition for the existence of Laplace transform of f(t).

11. Find $L\left(\frac{1}{\sqrt{t}}\right)$.

12. State initial and final value theorems on Laplace transform.

13. Find the Laplace transform of unit step function.

14. Find $L^{-1}\left(\frac{s}{(s+2)^2}\right)$.

15. Find the Fourier constant b_n for the function f(x) = xsinx in $(-\pi, \pi)$.

16. If $f(x) = x^2$ in $(-\ell, \ell)$ is expressed as a Fourier series then find the constant term.

17. Obtain the sine series for unity in $(0, \pi)$.

18. Write the Fourier transform in pairs.

19. State Parseval's identity on Fourier transforms.

20. Find the finite Fourier sine transform of f(x) = x in $(0, \ell)$.

PART – B

Answer all the questions **4 x 15 = 60 Marks**

21. (a) Determine the analytic function $f(z) = u + iv$ where $v = e^{2x}(x\cos 2y - y\sin 2y)$ and hence find u. (8)

(b) Discuss the transformation $w = e^z$. (7)

(OR)

22. (a) If $u = x^2 - y^2$ and $v = \frac{-y}{x^2+y^2}$, prove that both u and v satisfy Laplace equation, but that u + iv is not a regular function of z. (8)

(b) Find the bilinear transformation which maps the points 0, +1, ∞ of the z – plane into the points i, 1, -i of the w-plane respectively. (7)

23. (a) Evaluate $\int_C \frac{zdz}{(z-1)(z-2)^2}$, where C is the circle $|z-2| = \frac{1}{2}$, using Cauchy's integral formula. (8)

(b) Find the Laurent's series of $f(z) = \frac{1}{z(1-z)}$ valid in the region $1 < |z+1| < 2$. (7)

(OR)

24. (a) Using Contour integration, evaluate $\int_{-\infty}^{\infty} \frac{xdx}{(x+1)(x^2+1)}$. (8)

(b) Evaluate $\int_C \frac{e^z dz}{(z^2+\pi^2)^2}$ where C is $|z| = 4$ using Cauchy's residue theorem. (7)

25. (a) Solve the equation $y'' + y' - 2y = 3\cos 3t - 11\sin 3t$, y(0) = 0 and y′(0)=6 using Laplace transform. (8)

... transform of $f(x)=\begin{cases}1 & if \quad |x|<1\\ 0 & if \quad |x|\geq 1\end{cases}$. Hence deduce that $\int_0^\infty \left(\frac{\sin t}{t}\right)^2 dt=\frac{\pi}{2}$.

25. (a) Find the analytic function, whose real part is $\frac{\sin 2x}{\cosh 2y-\cos 2x}$. (8)

(b) Find the bilinear transformation which maps the points z = 1, i, -1 onto the points i, 0, -i. (7)

(OR)

26. (a) If $u = r^2 \cos 2\theta$, then construct the corresponding analytic function $f(z) = u(r,\theta) + iv(r,\theta)$. (8)

(b) Show that under the mapping $\omega=\frac{1}{z}$, all circles and straight lines in the z plane are transformed to circles and straight lines in the ω – plane. (7)

27. (a) Evaluate $\int_c \frac{z-1}{(z+1)^2(z-2)}dz$ where c is $|z-i|=2$. (8)

(b) Evaluate $\int_0^{2\pi} \frac{1}{5-4\sin\theta}\, d\theta$. (7)

(OR)

28. (a) Using residue theorem, evaluate $\int_c \frac{z^2 dz}{(z-1)^2(z+2)}$ where $c:|z|=3$. (8)

(b) Evaluate $\int_{-\infty}^{\infty} \frac{x^2 dx}{(x^2+1)(x^2+4)}$. (7)

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SASTRA UNIVERSITY

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B.Tech Degree Examinations

Third Semester **November 2009**

Course Code: BCSCMA 301 / BITCMA 301 / BICCMA 301

Course: TRANSFORMS AND COMPLEX VARIABLES

Question Paper No. : **B0256**

Duration: 3 hours

Max. Marks: 100

PART – A

Answer all the questions **20 x 2 = 40 Marks**

1. State the linear property of laplace transform.
2. Find L(sin 2t sin 3t)
3. If L f(t) = F(s), then show that $L(tf(t)) = -\frac{d}{ds}F(s)$.
4. State convolution theorem on Laplace transform.
5. Find the Laplace transform of unit step function.
6. If F f(x) = F(s), show that $F\, f(ax) = \frac{1}{a} F\left(\frac{s}{a}\right)$.
7. State the Parseval's identity for Fourier cosine transform
8. Show that Fourier sine transform of $f'(x)$ is – s ti cosine transform of f(x)

9. Find the finite Fourier sine transform of $f(x) = 1$ in $(0,\pi)$.

10. State the inversion formula for finite Fourier cosine transform.

11. Find the constants a and b such that the function $f(z) = x - 2y + i(ax - by)$ is analytic.

12. Show that the function $u = x^2 - y^2 - 2xy - 2x - y - 1$ is harmonic.

13. If the imaginary part of an analytic function f(z) is constant, then show that f(z) is constant.

14. Define the fixed points of the bilinear transformation.

15. Let $z = re^{i\Theta}$. Find the image of Θ = constant under the mapping $w = Re^{i\phi} = iz^2$.

16. Evaluate $\int_c \frac{1}{z-a}\,dz$, where c is a simple closed curve and the point $z = a$ is outside c.

17. State Taylor's series expansion of a function of the complex variable.

18. Define singular point of a function.

19. Give an example for removable singularity.

20. Determine the nature of singularity of the function $f(z) = \frac{1}{\cos z - \sin z}$.

PART – B

Answer all the questions **4 x 15 = 60 Marks**

21. (a) Find $L\left[e^{-t}\int_0^t te^{-t}\sin 4t\,dt\right]$. (7)

(b) Using convolution theorem, evaluate the inverse Laplace transform of $\frac{s^2}{(s^2+4)(s^2+9)}$. (8)

(OR)

22. (a) Find the Laplace transform of the function

$$f(t) = \begin{cases} \sin \omega t; & 0 < t < \frac{\pi}{\omega} \\ 0 \quad ; & \frac{\pi}{\omega} < t < \frac{2\pi}{\omega} \end{cases}$$ (7)

(b) Using Laplace transform technique, solve the initial value problem $2y'' + 5y' + 2y = e^{-2t}$, $y(0) = 1$, $y'(0) = 1$. (8)

23. (a) Show that the Fourier transform of $e^{\frac{-x^2}{2}}$ is $e^{\frac{-s^2}{2}}$. (7)

(b) Find the Fourier sine transform of e^{-x}. Hence show that $\int_0^\infty \frac{x\sin mx}{1+x^2}\,dx = \frac{\pi}{2}e^{-m}, m > 0$. (8)

(OR)

24. (a) If $\int_0^\infty f(x)\cos\lambda x\,dx = \begin{cases} 1-\lambda, & 0 \le \lambda \le 1 \\ 0 \quad , & \lambda > 1 \end{cases}$ find f(x) (7)