Paper / Subject Code: 50901 / Applied Mathematics-III

S.E. (Comps) (Sem-III) (CBCGS) May-2023

Time: 3 Hours **Marks: 80**

Note:

1) **Q. No. 01 is compulsory.**
2) **Solve any three from Q. No. 02 to 06.**
3) **Numbers to the right indicate full marks.**

Q. 1. Solve.

a) If $(t) = t, 0 < t < 2,\ f(t) = 4, t > 2$. Find the L. T. of $f(t)$. 5

b) Find the Z – transform of $a^k, k \geq 0$. Also give the region of convergence. 5

c) Find the constants k if, 5

$f(z) = \frac{1}{2} log\ log\ (x^2 + y^2) + i\ tan^{-1}\left[\frac{ky}{x}\right]$ is analytic.

d) Fit a straight to the data. 5

X:	1	2	3	4	5	6
Y:	49	54	60	73	80	86

Q. 2.

a) Solve $\frac{d^2y}{dt^2} - \frac{dy}{dt} - 2y = 20\ Sin2t$, given $y(0) = 1, y'(0) = 2$. 6

b) Find the Bilinear transformation which maps the points 0, 1. ∞ of the Z- plane to $-5, -1, 3$ of the W- plane. 6

c) Find the Fourier expansion of $f(z) = x^2$, in (- 1. 1). 8

Q. 3.

a) Find Correlation coefficient of the data. 6

X:	10	12	18	18	15	40.
Y:	12	18	25	25	50	25.

b) Find inverse Z – transform of $\frac{1}{(z+1)(z-3)}$ for the region $|z| > 3$. 6

c) Obtain Fourier Series for the function f(x) = $\{1 + \frac{2x}{\pi}$, $-\pi \leq x \leq 0$ 8

$= \{1 - \frac{2x}{\pi}$, $0 \leq x \leq \pi$.

Q. 4.

a) Obtain half range cosine series for $f(x) = 2x$. in $(0, \pi)$. 6

b) Find the orthogonal trajectories of family of the curve $2x - x^3 + 3xy^2 = a$. 6

c) Find the Laplace Transform of i) $e^{-2t}\ Sin\ 4t$, ii) $\frac{Cos\ 2t - Cos\ 3t}{t}$. 8

Q. 5.

a) Find inverse L. T. by using Convolution theorem. $\frac{s}{(s^2+9)^2}$. 6

b) Given 6y = 5x + 90, 15x = 8y + 130 & Var (x) = 16. Find means of x, y, Var (y) & r. 6

c) Show that the functions $f_1(x) = 1, f_2(x) = x$ are orthogonal on $(-1, 1)$. Determine the constants a, b such that the function $f_3(x) = -1 + ax + bx^2$ is orthogonal to both f_1 and f_2 on that interval. 8

Q. 6.

a) Find an analytic function whose imaginary part is $e^{-x}(-xsiny + ycosy)$. 6

b) Evaluate $\int_0^{\infty} e^{-2t} t\ sin^3 t\ dt$. 6

c) Find inverse Laplace Transform of i) $\frac{s}{(2s+1)^2}$ ii) $\frac{s+3}{s^2+6s+13}$. 8

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