Priyadarshini College of Engineering, Nagpur
Sessional Examination (2023-24) Odd Semester
B. Tech. Third Semester (Computer Technology /Information Technology) (C. B. C. S.)
Mathematics-III

Pages: 2 **PCE/KW/23/BECT/IT301T**
Time: Three Hours **Max. Marks: 70**

Notes:

1) All questions carry marks as indicated.
2) Solve Question 1 or Question 2
3) Solve Question 3 or Question 4
4) Solve Question 5 or Question 6
5) Solve Question 7 or Question 8
6) Solve Question 9 or Question 10

Q. No.	Questions	CO	BL	Marks
1	a) Find L. T. of $L\left[\frac{\cos at-\cos bt}{t}\right]$, hence evaluate $\int_0^\infty \left[\frac{\cos at-\cos bt}{t}\right]dt$	CO1	3	5
	b) Find Fourier Transform of f(x) = 1, $\lvert x\rvert<1$; 0, $\lvert x\rvert>1$.	CO1	3	4
	c) Find $L^{-1}\left\{\frac{s}{((s^2+a^2)^2}\right\}$ by convolution theorem.	CO1	3	5
	OR			
2	a) Solve the D.E. by L.T. method $\frac{d^2y}{dt^2}+2\frac{dy}{dt}+5y=e^{-t}\sin t, y(0)=0, y'(0)=1.$	CO1	3	7
	b) Solve the integral equation $\int_0^\infty f(x)\cos axdx=e^{-a}, a>0$	CO1	3	7
3	a) Prove that $Z\{n^p\}=-z\frac{d}{dz}(n^{p-1})$, where p is any positive integer and hence deduce that $Z\{n\}=\left\{\frac{z}{(z-1)^2}\right\}$ and $Z\{n^2\}=\left\{\frac{z(z+1)}{(z-1)^3}\right\}$	CO2	3	7
	b) Find inverse Z-transform of $F(z)=\frac{z^2+1}{(z-1)(z^2+1)}$ by partial fraction method.	CO2	3	7
	OR			
4	a) Solve the following difference equation by Z- Transform $y_{n+2}+6y_{n+1}+9y_n=2^n$, given $y_0=y_1=0$	CO2	3	7
	b) Using power series method, find inverse Z-transform of, $\frac{1}{z^2-3z+2}$ for the region $\lvert z\rvert<1$	CO2	3	7
5	a) Investigate the linear Dependence of the vectors $X_1=[1,2,4]$, $X_2=[2,-1,3]$ $X_3=[0,1,2]$ and $X_4=[-3,7,2]$ and if possible find relation between them	CO3	3	7
	b)Find the matrix B which reduce $A=\begin{bmatrix}6&-2&2\\-2&3&-1\\2&-1&3\end{bmatrix}$ to a diagonal form by transformation $B^{-1}AB$.	CO3	3	7
	OR			

6	a) Find largest eigen value and corresponding eigen vector for the matrix $\begin{bmatrix} -4 & -5 \\ 1 & 2 \end{bmatrix}$	CO3	3	7
	b) Find the singular values decomposition of the matrix A = $\begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \end{bmatrix}$.	CO3	3	7
7	a) A density function of random variable X is $f(x) = \begin{cases} e^{-x}, & x > 0 \\ 0, & \text{otherwise,} \end{cases}$ Find (i) E(X) (ii) Var(X) (iv) σ_x	CO4	3	7
	b) Suppose that the customers arriving at ticket counter according to poisson process with a mean rate of 2 per minutes. Then in arrival of 5 minutes find the probability that the number of customers is (i) exactly 5 (ii) less than 4 (iii) greater than 3.	CO4	3	7
	OR			
8	a) Find moment generating function and first four moments about origin for random variable X given by $X = \begin{cases} 1/2, & \text{prob. } 1/2 \\ -1/2, & \text{prob. } 1/2 \end{cases}$	CO4	3	7
	b)A machine produces bolts which are 10% defective. Find the probability that in a random sample of 400 bolts produced by this machine (i) between 30 and 50, (ii) at the most 30, (iii) 55 or more of the bolts will be defective	CO4	3	7
9	a) Find the multiple linear regression equation of X_1 on X_2 and X_3 from the data relating to three variables given below:	CO5	3	7

X_1	4	6	7	9	13	15
X2	15	12	8	6	4	3
X_3	30	24	20	14	10	4

b) For the following frequency distribution calculate median, quartile, 4th decile and 27th percentile — CO5, 3, 7

x	0	1	2	3	4	5	6	7	8
f	1	9	26	59	72	52	29	7	1

	OR		
10	a) Calculate Karl Pearson's coefficient of skewness of the following distribution	CO5	3	7

x	0	1	2	3	4	5	6	7	8
f	7	12	32	56	70	56	28	8	1

b) Find the measures of skewness on the basis of moments — CO5, 3, 7

x	2	3	4	5	6
f	1	3	7	3	1