(IT BRANCHES)

Discrete and Integral Transforms (DIT)

Subject Code : 18MA3GCDIT

Module – 1 (Curve Fitting & Statistics Modelling)

Q.No	Questions
1.	a) Find the linear law $P = m\,W + c$ W: 50, 70, 100, 120 P: 12, 15, 21, 25 b) Fit the best possible curve of the form $y = a\,x + b$, using method of least square for the data x: 5, 10, 15, 20, 25 y: 16, 19, 23, 26, 30
2.	a) Fit the best possible curve of the form $y = a\,x + b$, using method of least square for the data x: 1, 3, 4, 6, 8, 9, 11, 14 y: 1, 2, 4, 4, 5, 7, 8, 9 b) A simply supported beam carries a concentrated load X at its mid-point. Corresponding to various values of X the maximum deflection Y is measured and is given in the following table. Find the law of the form $Y = a + b\,X$ and hence estimate Y when X = 150. X: 100, 120, 140, 160, 180, 200 Y: 0.15, 0.55, 0.6, 0.7, 0.8, 0.85
3.	a) Fit a straight line to the following data. And also find the expected production in the year 2006 Year: 1961, 1971, 1981, 1991, 2001 Production in tones: 8, 10, 12, 10, 16 b) Fit the best possible curve of the form $y = a\,x + b$, using method of least square for the data x: 1, 2, 3, 4, 5 y: 14, 13, 9, 5, 2

Data tables:

1 a)

W	50	70	100	120
P	12	15	21	25

1 b)

x	5	10	15	20	25
y	16	19	23	26	30

2 a)

x	1	3	4	6	8	9	11	14
y	1	2	4	4	5	7	8	9

2 b)

X	100	120	140	160	180	200
Y	0.15	0.55	0.6	0.7	0.8	0.85

3 a)

Year	1961	1971	1981	1991	2001
Production in tones	8	10	12	10	16

3 b)

x	1	2	3	4	5
y	14	13	9	5	2

4.	a) Fit the best possible curve of the form $y = a\,x + b$, using method of least square for the data

x	0	1	2	3	4	5
y	9	8	24	28	26	20

b) Fit a parabola $y = ax^2 + bx + c$ to the data

x	1	2	3	4
y	1.7	1.8	2.3	3.2

5. a) Fit a parabola $y = ax^2 + bx + c$ to the data

x	1	2	3	4	5
y	10	12	13	16	19

Fit a parabola $y = ax^2 + bx + c$ to the data

x	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	1.1	1.3	1.6	2.0	2.7	3.4	4.1

6. a) Fit a parabola $y = ax^2 + bx + c$ to the data

x	0	1	2	3	4	5
y	1	3	7	13	21	31

b) Fit a parabola $y = ax^2 + bx + c$ to the data

x	-2	-1	0	1	2
y	-3.150	-1.390	0.620	2.880	5.378

7. a) The revolution (r) and time (t) are related by quadratic polynomial $r = at^2 + bt + c$. Estimate the number of revolution for time 3.5 units given

t	1.2	1.6	1.9	2.1	2.4	2.6	3
r	5	10	15	20	25	30	35

b) Fit a parabola $y = ax^2 + bx + c$ to the data

x	-3	-2	-1	0	1	2	3
y	38	16	4	2	10	28	56

8.	a) Calculate the mean and standard deviation for the following:

Size of item	6	7	8	9	10	11	12
Frequency	3	6	9	13	8	5	4

b) Find the mean and standard deviation for the following

Mid Value	15	20	25	30	35	40	45	50
Frequency	2	22	19	14	3	4	6	1

9. a) Compute the average for the following data

Class interval	0-99	100-199	200-299	300-399	400-499	500-599	600-699	700-799
Frequency	10	54	184	264	246	40	1	1

b) Following table gives the frequency of the age of a group of 199 teachers. Find the mean of the group.

Age in yrs	20-25	25-30	35-40	40-45	45-50	50-55	55-60	60-65	60-65	65-70
Frequency	21	19	50	40	16	20	10	10	9	4

10. a) The crushing strength of 7 cement concrete experimental blocks, in metric tonnes per sq. cm, was 4.8, 4.2, 5.1, 3.8, 4.4, 4.7 and 4.5. Find the mean crushing strength and the standard deviation

b) The scores obtained by two batsmen A and B in 10 matches are given below. Calculating mean, SD and coefficient of variation for each batsman, determine who is more efficient and who is more consistent.

A:	30	44	66	62	60	34	80	46	20	38
B:	34	46	70	38	55	48	60	34	45	30

11. a) The index number of prices of two articles A and B for six consecutive weeks are given below. Find which has a more variable price?

A:	314	326	336	368	404	412
B:	330	331	320	318	321	330

b) The two observers bring the following two sets of data which represent measurements of the same quantity.

I set	105.1	103.4	104.2	104.7	104.8	105.0	104.9
II set	105.3	105.1	104.8	105.2	106.7	102.9	103.1

Calculate the SD in each case. Which set of data is more reliable?

12. a) Define: (i) Correlation (ii) Co-efficient of correlation (iii) Regression (iv) Lines of Regression (v) Regression co-efficient.

b) Establish the formula $r = \frac{\sigma_x{}^2 + \sigma_y{}^2 - \sigma_{x-y}{}^2}{2\,\sigma_x\,\sigma_y}$

13. a) Find the correlation co-efficient between x and y from the given data:

x	78	89	97	69	59	79	68	57
y	125	137	156	112	107	138	123	108

b) Find the correlation co-efficient between x and y from the given data:

x	21	23	30	54	57	58	72	78	87	90
y	60	71	72	83	110	84	100	92	113	135

14. a) Calculate the correlation co-efficient for the following heights in inches of fathers (x) and their sons (y).

x	65	66	67	67	68	69	70	72
y	67	68	65	68	72	72	69	71

b) Find the co-efficient of correlation between industrial production and export using the following data and comment on the result.

Production (in crore tons)	55	56	58	59	60	60	62
Exports(in crore tons)	35	38	38	39	44	43	45

15.

a) Obtain the regression lines of y on x and x on y and hence find the correlation coefficient for the following data:

x	2	4	6	8	10
y	5	7	9	8	11

b) Obtain the regression lines of y on x and x on y and hence find the correlation coefficient for the following data:

x	1	2	3	4	5
y	2	5	3	8	7

16.

a) Obtain the regression lines of y on x and x on y and hence find the correlation coefficient for the following data:

x	1	2	3	4	5	6	7	8	9	10
y	10	12	16	28	25	36	41	49	40	50

b) Obtain the lines of regression and hence find the co-efficient of correlation for the data:

x	1	3	4	2	5	8	9	10	13	15
y	8	6	10	8	12	16	16	10	32	32

17.

a) The following results were obtained from records of age(x) and blood pressure (y) of a group of 10 men, given $\Sigma\,(x-\bar{x})(y-\bar{y}) = 1220$. Find the appropriate regression equation and use it to estimate the blood pressure of a man whose age is 45

	x	y
Mean	53	142
Variance	130	165

b) Given $r = 0.8$, write down the equation of the lines of regression and hence find the most probable value of y when x =70

	x	y
Mean	18	100
S.D	14	20

18.

a) The two regression equations of the variables x and y are $x = 19.13 - 0.87y$ and $y = 11.64 - 0.50x$. Find (i) mean of x's, (ii) mean of y's and (iii) the correlation coefficient between x and y.

b) Two random variables have the regression lines y on x and x on y with equations $3x + 2y = 26$ and $6x + y = 31$ respectively. Find the mean values of x's and y's and the correlation coefficient between x and y

19.	a) In a partially destroyed laboratory data, only the equations giving the two lines of regression of y on x and x on y are$7x - 16y + 9 = 0,\ \ 5y - 4x - 3 = 0$ respectively. Calculate the coefficient of correlation, $\bar{x}$ and $\bar{y}$. b) In a partially destroyed laboratory record of correlation data, the following result only are a variable, variance of x is 9, regression equation y on x and x on y are $4x - 5y + 33 = 0,\ 20x - 9y - 107 = 0$ respectively. Calculate the coefficient of correlation, $\bar{x}$, $\bar{y}$ and σ_y
20.	a) If θ is the acute angle between the two regression lines relating the variables x and y, show that $\tan\theta = \frac{\sigma_x\sigma_y}{\sigma_x{}^2+\sigma_y{}^2}\left(\frac{1-r^2}{r}\right)$ b) Find the co-efficient of correlation between x and y given $2\sigma_x = \sigma_y$ and the angle between the lines of regression is $\tan^{-1}\left(\frac{3}{5}\right)$

Discrete and Integral Transforms (DIT)

Subject Code : 18MA3GCDIT

Module – 2 (Z - Transform)

Q.No	Questions
1.	a) Find the Z- transform of n^3 and hence find $Z_T(k^n n^3)$ b) Prove that $Z_T(\cos n\theta) = \frac{Z(Z-\cos\theta)}{Z^2-2Z\cos\theta+1}$ and hence deduce Z-Transform of $(k^n cosn\theta)$
2.	a) Prove that $Z_T(\sin n\theta) = \frac{Zsin\theta}{Z^2-2Z\cos\theta+1}$ and hence deduce $Z_T(k^{-n} sinn\theta)$. b) Find the Z-Transform of $\cosh n\theta$ and hence find $Z_T(a^n \cosh n\theta\ )$.
3.	a) Find the Z-Transform of $\sinh n\theta$ and hence find $Z_T(a^n \sinh n\theta\ )$. b) Find the Z-Transforms of $(i)(n-1)^2$ $(ii)\cos\left(\frac{\text{n}\pi}{2}+\frac{\pi}{4}\right)$
4.	a) Find the Z-Transform of $(i)a^{n+3}$ (ii)$\cosh\left(\frac{\text{n}\pi}{2}+\theta\right)$ b) Find the Z-Transforms of (i) $(n+1/3)^2$ (ii) $\sin(3n+5)$.
5.	a) Find the Z-Transforms of (i) $\frac{1}{n!}$ (ii) $n\ e^{an}$ b) Find the Z-Transforms of $(i)e^{-an}\,n$ (ii) $n\ \cos n\theta$.
6.	a) Find the Z-Transforms of (i) $(\frac{1}{2})^n + (\frac{1}{3})^n$ (ii) $3^n \cos(\frac{\pi n}{4})$. b) Find the Z-Transforms of (i) $e^{-an}\cos(n\theta)$ $(ii)e^{-an}\,n^2$
7.	a) Find the Z-Transforms of $\frac{n}{3^n} + 2^n n^2 + 4cosn\theta + 4^n + 8$ b) Find the Z-Transforms of (i) $(2n-1)^2$ (ii)$3n - 4sin\frac{n\pi}{4}$
8.	a) If $\bar{u}$(z)=$\frac{2z^2+5z+14}{(z-1)^4}$ evaluate u_2 and u_3. b) Given that $Z(u_n) = \frac{2z^2+3z+4}{(z-3)^3}$, $\|z\| > 3$, show that $u_1 = 2$, $u_2 = 21$ and $u_3 = 139$.
9.	a) If $\bar{u}$(z)=$\frac{5z^2+3z+12}{(z-1)^4}$ Show that $u_2 = 5$ and $u_3 = 23$. b) If $\bar{u}$(z)=$\frac{2z^2+3z+12}{(z-1)^4}$ evaluate u_2 and u_3.
10.	a) State Initial Value Theorem in Z-Transforms and given $Z_T(U_n) = \frac{z}{z-1} + \frac{z}{z^2+1}$, Find U_0, U_1, U_2

	b) If $\overline{U}(z) = \frac{2z^2+3z+12}{(z-1)^2}$, find the values of U_0, U_1, U_2, U_3.
11.	a) Obtain the Inverse Z- transform of $\frac{z^2}{(z-1)(z+3)}$. b) Obtain the Inverse Z- transform of $\frac{z}{(2z^2+z-3)}$.
12.	a) Find the Inverse Z- Transform of $\frac{2z^2+3z}{(z+2)(z-4)}$. b) Find inverse Z-transform of $\frac{z(z+3)}{(z+1)(z-2)}$
13.	a) Find $Z^{-1}\left(\frac{2z}{(z-1)(z^2+1)}\right)$. b) Compute the Inverse Z-Transform of $\frac{3z^2+2z}{(5z-1)(5z+2)}$.
14.	a) Find $Z^{-1}\left(\frac{5z}{(2-z)(3z-1)}\right)$. b) Find inverse Z-transform of $\frac{10z}{(z-1)(z-2)}$
15.	a) Find the Inverse Z-transform of $\frac{8z-z^3}{(4-z)^3}$ b) Find the Inverse Z- Transform of $\frac{4z^2-2z}{z^3-5z^2+8z-4}$.
16.	a) Find the Inverse Z- Transform of $\frac{z^3-20z}{(z-2)^3(z-4)}$ b) Find the Inverse Z- Transform of $\frac{z}{(z+1)^2(z-1)}$
17.	a) Solve the difference equation $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$; $y_0 = 0, y_1 = 0$ using z-transforms. b) Using the Z-transform method, solve $U_{n+2} - 2U_{n+1} + U_n = 3n + 5$.
18.	a) Solve the difference equation using Z-transform $y_{n+2} - 4y_{n+1} + 3y_n = 5^n$. b) Solve $y_{n+2} - 4y_n = 0$ given that $y_0 = 0, y_1 = 2$ using Z-transform.
19.	a) Solve the difference equation using Z-transform $y_{n+2} - 3y_{n+1} + 2y_n = 0$ given that $y_0 = 0, y_1 = 1$ b) Solve the difference equation using Z-transform $U_{n+2} - 2U_{n+1} + U_n = 2^n$; $U_0 = 2,\ U_1 = 1$
20.	a) Solve the difference equation $U_{n+2} + 2U_{n+1} + U_n = n$; $U_0 = U_1 = 0$. Using z-transforms b) Find the response of the system $y_{n+2} - 5y_{n+1} + 6y_n = u_n$, with $y_0 = 0, y_1 = 1$ and $u_n = 1$ for $n = 0,1,2,3, \ldots ..$ by Z–transform method.

Discrete and Integral Transforms (DIT)

Subject Code : 18MA3GCDIT

Module – 3 (Fourier series)

Q.No	Questions
1.	a) Find a Fourier series in $(-\pi, \pi)$ to represent $f(x) = x - x^2$ and hence deduce that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$ b) Expand $(x) = \sqrt{1 - cosx}$, 0 < x < 2π in a Fourier series. Hence evaluate $\frac{1}{1.3} + \frac{1}{3.5} + \frac{1}{5.7} + \cdots \ldots\ldots$
2.	a) Find a Fourier series in $(0,2\pi)$ to represent $f(x) = \frac{\pi - x}{2}$ and hence deduce that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots \ldots\ldots\ldots\ldots\ldots\ldots\ldots$ b) Find the Fourier series for the function $f(x) = \|x\|$ in $-\pi \le x \le \pi$, hence deduce that $\frac{\pi^2}{8} = \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}$.
3.	a) Obtain the Fourier series of the function $f(x)$ defined by $f(x) = \begin{cases} 1 + \frac{2x}{\pi}, & -\pi < x \le 0 \\ 1 - \frac{2x}{\pi}, & 0 \le x < \pi \end{cases}$ and hence prove that $\frac{\pi^2}{8} = \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}$. b) Find the Fourier series of $f(x) = \begin{Bmatrix} 0 \ when \ -\pi \le x \le 0 \\ x^2 \ when \ 0 \le x \le \pi \end{Bmatrix}$
4.	a) Obtain Fourier series of the function $f(x) = \begin{cases} -k & -\pi \le x \le 0 \\ k & 0 \le x \le \pi \end{cases}$ hence deduce that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots \ldots$ b) Find the Fourier series of $f(x) = x^3 \ in \ (-\pi, \pi)$
5.	a) Find the Fourier expansion of the function $f(x)$ defined by the $f(x) = \begin{cases} x, & 0 \le x \le \pi \\ x - 2\pi, & \pi \le x \le 2\pi \end{cases}$ and prove that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots\ldots$ b) Find the Fourier series expansion of $f(x) = e^{ax} \ in \ (0,2\pi)$
6.	a) Find the Fourier series $f(x) = xcosx$ in $(-\pi, \pi)$ b) Obtain the Fourier series for $f(x) = e^{-ax}, a > 0$ in $(0, 2\pi)$
7.	a) Find the Fourier series of $f(x) = \begin{Bmatrix} -\left(\frac{\pi + x}{2}\right) & for \ -\pi \le x < 0 \\ \left(\frac{\pi - x}{2}\right) & for \ 0 \le x < \pi \end{Bmatrix}$ b) Find the Fourier series that represent $f(x) = x^3$, in $(-l, l)$
8.	a) Find the Fourier series expansion of the function $f(x) = 1 - x^2$ in $(-1, 1)$. b) Obtain the Fourier series expansion of $f(x) = \frac{l - x}{2}$ in 0 < x < 2

9.

a) Obtain the Fourier series for the function $f(x) = \begin{cases} \pi x & 0 \le x \le 1 \\ \pi(2-x) & 1 \le x\ 2 \end{cases}$ and deduce that $\frac{\pi^2}{8} = \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}$

b) Obtain the Fourier Series for $f(x) = \begin{Bmatrix} x & 0 < x < 1 \\ 0 & 1 < x < 2 \end{Bmatrix}$

10.

a) Expand $f(x) = 2x - x^2$ as a Fourier series in $0 \le x \le 2$

b) Obtain the Fourier Series for $f(x) = \begin{Bmatrix} 8 & 0 < x < 2 \\ -8 & 2 < x < 4 \end{Bmatrix}$

11.

a) Obtain the Fourier expansion for the function $f(x) = x\cos\frac{\pi x}{l}$ in the interval $(-l, l)$.

b) Obtain Fourier series $f(x) = 4 - x^2\ in\ (-2, 2)$

12.

a) Find the Fourier series for the function $f(x) = \begin{Bmatrix} -1\ , & -2 \le x < 0 \\ 2\ , & 0 < x \le 2 \end{Bmatrix}$, defined on (-2,2)

b) Expand $f(x) = sinx$ in Half range cosine series in the interval $(0, \pi)$.

13.

a) Find the Half range Sine series for the function $(x) = \begin{cases} x\ , & 0 < x \le \pi/2 \\ \pi - x, & \pi/2 \le x \le \pi \end{cases}$.

b) Determine the Half range Fourier cosine series $f(x) = x^2\ in\ (0, \pi)$

14.

a) Expand $f(x) = \begin{cases} \frac{1}{4} - x\ , & 0 < x < 1/2 \\ x - \frac{3}{4}, & 1/2 < x < 1 \end{cases}$ in Half range sine series.

b) Determine the Half range Fourier cosine series $f(x) = \begin{Bmatrix} x & 0 \le x < \frac{l}{2} \\ l - x & \frac{l}{2} \le x \le l \end{Bmatrix}$

15.

a) Find the half range cosine series for the function $f(x) = (x-1)^2$ in the interval $0 < x < 1$

b) Obtain the Fourier series of $xsinx$ as half range cosine series in $(0, \pi)$

16.

a) Find the Half range Cosine series for the function $f(x) = \begin{cases} kx\ , & 0 < x \le l/2 \\ k(l-x), & l/2 \le x \le l \end{cases}$

b) Find the Half range sine series for the function $f(x) = \begin{Bmatrix} x - 1 & 0 \le x \le 2 \\ 3 - x & 2 \le x \le 4 \end{Bmatrix}$

17.

a) Find the constant term and the first 2 harmonics for the function $f(x)$ given by the following table

x	0	60	120	180	240	300	360
y	0.8	0.6	0.4	0.7	0.9	1.1	0.8

b) Obtain the Fourier series neglecting terms higher than the first harmonics

x	0	$60°$	$120°$	$180°$	$240°$	$300°$
y	7.9	7.2	3.6	0.5	0.9	6.8

18.	a) For the periodic function f(x) of period 6 specified by the following table over the interval (0,6), find the Fourier coefficients a_0,$a_1$and b_1

x	0	1	2	3	4	5	6
y	9	18	24	28	26	20	9

b) Express y as a Fourier Series upto the 3rd harmonics given the fallowing values

x	0	1	2	3	4	5
y	4	8	15	7	6	2

19.	a) The following table gives the variations of periodic current over a period. Show that there is a direct current part of 0.75amp in the variable current and obtain the amplitude of the 1st harmonic.

t(sec)	0	T/6	T/3	T/2	2T/3	5T/6	T
A(amp)	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

b) The fallowing values of y and x are given , Find the Fourier series of y up to second harmonics

x	0	2	4	6	8	10	12
y	9.0	18.2	24.4	27.8	27.5	22.0	9.0

20.	a) Analyze harmonically the data given below &express y as a Fourier series up to 2nd harmonic.

x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	2π
y	1.0	1.4	1.9	1.7	1.5	1.2	1.0

b) Determine the constant terms and the first cosine and sine terms of the Fourier series expansion of y from fallowing table

x	0	45	90	135	180	225	270	315
y	2	3/2	1	1/2	0	1/2	1	3/2

Discrete and Integral Transforms (DIT)
Subject Code : 18MA3GCDIT
Module – 4 (Integral Transform – I)

Q.No	Question
1.	a) Prove that (i) $L(coshat) = \frac{s}{s^2-a^2}$ (ii) $L(sinat) = \frac{a}{s^2+a^2}$ b) Prove that $L[t^n] = \frac{n!}{s^{n+1}}$, n is a positive integer
2.	Find a) $L(cost\ cos2t\ cos3t)$ b) $L(e^{at} + 2t^n - 3sin3t + 4cosh2t)$
3.	Find a) $L[e^{-2t}(2cos5t - sin5t]$ b) $L(tsint)$
4.	Find a) $L\{e^{3t}\ sin5t\ sin3t\}$ b) $L(e^{-t}cos^2 4t)$
5.	Find a) $L[t(sin^3 t - cos^3 t)]$ b) $L(t^5 e^{4t} cosh3t)$
6.	Find a) $L(te^{-2t}sin4t)$ b) $L\{e^{-2t}\sin 3t + e^t\ t\ cost\}$
7.	Find a) $L(te^{2t} - \frac{2sin3t}{t})$ b) $L(3^t + \frac{cos2t - cos3t}{t})$
8.	a) If f (t) is a periodic function of period T, then show that $L(f(t)) = \frac{1}{1-e^{-sT}}\int_0^T e^{-st}f(t)dt$ b) Prove that L (f (t)) = $\frac{E}{s}\tanh\left(\frac{as}{4}\right)$ where f(t+a)=f(t),given $f(t) = \begin{cases} E & 0 \le t \le \frac{a}{2} \\ -E & \frac{a}{2} \le t \le a \end{cases}$
9.	a) Find the Laplace transform of periodic function $f(t) = \begin{cases} t & 0 \le t \le \pi \\ \pi - t & \pi \le t \le 2\pi \end{cases}$ b) Find the Laplace transform of a periodic function of period $2\pi/\omega$ is defined by $f(t) = \begin{cases} Esin\omega t & 0 \le t \le \pi/\omega \\ 0 & \pi/\omega \le t \le 2\pi/\omega \end{cases}$
10.	a) Find $L[2\delta(t-1) + cosh3t\delta(t-2)]$ b) Find $L\left[\frac{2\delta(t-3)+3\delta(t-2)}{t}\right]$
11.	Find the Inverse Laplace transform a) $\frac{2s^2-6s+5}{(s-1)(s-2)(s-3)}$ b) $\frac{s^2}{(s+1)^3}$
12.	Find the Inverse Laplace transform a) $\frac{4s+5}{(s-1)^2(s+2)}$ b) $\frac{1}{s(s+1)(s+2)(s+3)}$

13.	Find the Inverse Laplace transform a) $\frac{s+1}{(s-1)^2(s+2)}$ b) $\log\frac{s^2+1}{s(s+1)}$
14.	Find the Inverse Laplace transform a) $\log\left(1+\frac{a^2}{s^2}\right)$ b) $\log\left(\frac{s+1}{s-1}\right)$
15.	Find the Inverse Laplace transform a) $\tan^{-1}\left(\frac{a}{s}\right)$ b) $\cot^{-1}\left(\frac{s+a}{b}\right)$
16.	a) Find the Inverse Laplace transform $\cot^{-1}\left(\frac{s}{a}\right)$ b) Using the convolution theorem, obtain Inverse Laplace transform of $\frac{1}{s^2(s+1)^2}$
17.	Using the convolution theorem, obtain Inverse Laplace transform of a) $\frac{1}{(s-1)(s^2+1)}$ b) $\frac{s}{(s^2+a^2)^2}$
18.	Using the convolution theorem, obtain Inverse Laplace transform of a) $\frac{s^2}{(s^2+a^2)(s^2+b^2)}$ b) $\frac{1}{s^3(s^2-1)}$
19.	a) Solve the differential equation using the Laplace transform method. $\frac{d^2y}{dt^2}+5\frac{dy}{dt}+6y=5e^{2t}$ given that y (0) =2, $\frac{dy(0)}{dt}=1$ b) Solve the differential equation by using the Laplace transform method $y'''+2y''-y'-2y=0, y=1, y''=2=y'\ at\ t=0$
20.	a) A particle is moving with damping motion according to the law $\frac{d^2y}{dt^2}+6\frac{dy}{dt}+8y=0$. If the initial position of the particle is at $y=20$ and the initial speed is 10, find the displacement of the particle at any time t using Laplace transforms. b) A voltage Ee^{-at} is applied at $t=0$ to a circuit of inductance L resistance R. Show that the current at any time t is $\frac{E}{R-aL}\left(e^{-at}-e^{-\frac{Rt}{L}}\right)$

Discrete and Integral Transforms (DIT)

Subject Code : 18MA3GCDIT

Module – 5 (Integral Transform – II)

Q.no	Questions
1)	a) Find the Fourier transform of $e^{-a\|x\|}$. Where a>0 b) Find the Fourier transform of $e^{-a^2x^2}$ $, a > 0$ $(-\infty < x < \infty)$. Hence prove that $e^{-x^2/2}$ is Self- reciprocal
2)	a) Find Fourier transform of $f(x) = \begin{cases} x, & \|x\| \leq \alpha \\ 0, & \|x\| > \alpha \end{cases}$ where is a α is a positive constant b) Find the Fourier transform of $xe^{-a\|x\|}$. Where a>0
3)	a) Find Fourier transform of $f(x) = \begin{cases} x & for\ \ 0<x<1 \\ 2-x & for\ \ 1<x<2 \\ 0 & for\ \ x>2 \end{cases}$ b) Find a Fourier transform of $f(x) = \begin{cases} x^2 & for\ \|x\| < a \\ 0 & for\ \|x\| > a \end{cases}$ Where a is a positive constant.
4)	a) Find the Fourier transform of $e^{-\|x\|}$. b) Find the Fourier transform of $f(x) = \begin{cases} -e^{x} & for\ x < 0 \\ e^{-x} & for\ x > 0 \end{cases}$
5)	a) Find the Fourier transform $f(x) = \begin{cases} 1, & \|x\| \leq a \\ 0, & \|x\| > a \end{cases}$ a>0 evaluate $\int_0^{\infty} \frac{sinax}{x} dx$ b) Find a Fourier transform of $f(x) = \begin{cases} 1-\|x\| & for\ \|x\| \leq 1 \\ 0 & for\ \|x\| > 1 \end{cases}$ and evaluate $\int_0^{\infty} \frac{sin^2x}{x^2} dx$
6)	a) Find a Fourier transform of $f(x) = \begin{cases} 1-x^2 & for\ \|x\| \leq 1 \\ 0 & for\ \|x\| > 1 \end{cases}$ and evaluate $\int_0^{\infty} \left(\frac{xcosx-sinx}{x^3}\right) dx$ b) Find a Fourier transform of $f(x) = \begin{cases} 1-x^2 & for\ \|x\| \leq 1 \\ 0 & for\ \|x\| > 1 \end{cases}$ and evaluate $\int_0^{\infty} \frac{sinx-xcosx}{x^3} \cos\left(\frac{x}{2}\right) dx$
7)	a) Find the inverse Fourier transform of $e^{-a\|u\|}$ where a>0 b) Find the inverse Fourier transform of e^{-u^2}
8)	a) Obtain the Fourier Cosine transform of the function $f(x) = \begin{cases} 4x & for\ \ 0<x<1 \\ 4-x & for\ \ 1<x<4 \\ 0 & for\ \ x>4 \end{cases}$ b) Find the Fourier Cosine transform of e^{-x^2}
9)	a) Find Fourier Cosine transformation of $f(x) = \begin{cases} x & 0 < x < 2 \\ 0 & elsewhere \end{cases}$ b) Find the Cosine transform of $f(x) = xe^{-ax},\ a > 0$

10)	a) Find the Fourier Cosine transform of e^{-ax}, $a \geq 0$, hence find $\int_0^\infty \frac{\cos\lambda x}{a^2+x^2}dx$ b) Solve Integral equation $\int_0^\infty f(x)\cos ux\, dx = \begin{cases} 1-u, & 0<u<1 \\ 0, & u \geq 1 \end{cases}$ Hence deduce that $\int_0^\infty \frac{\sin^2 x}{x^2}dx = \frac{\pi}{2}$
11)	a) Solve the integral equation $\int_0^\infty f(x)\cos ux\, dx = e^{-u}$and hence show that$\int_0^\infty \frac{\cos\lambda x}{1+x^2}dx = \frac{\pi}{2}e^{-\lambda}$ b) Obtain the Fourier Sine transform of the function $f(x) = \begin{cases} x & for\ \ 0<x<1 \\ 2-x & for\ \ 1<x<2 \\ 0 & for\ \ \ x>2 \end{cases}$
12)	a) Find the finite Fourier Sine transform of $f(x) = 2x\ in\ 0 \leq x \leq 4$. b) Find the Fourier Sine transform of e^{-ax}, $a \geq 0$.
13)	a) Find the Fourier Sine transform of the Functions $f(x) = \begin{cases} \sin x, & 0<x<a \\ 0, & x \geq a \end{cases}$ b) Find Fourier Sine transform of $\frac{1}{x}e^{-ax}$,$x \neq 0$,
14)	a) Find Fourier Sine transformation of $f(x) = \begin{cases} x & 0<x<2 \\ 0 & elsewhere \end{cases}$ b) Find the Fourier Sine transform of $f(x) = xe^{-ax}$, $a>0$
15)	a) Find the Fourier Sine transform of e^{-x}. Hence prove that $\int_0^\infty \frac{x\sin mx}{1+x^2}dx = \frac{\pi}{2}e^{-m}, m>0$ b) Find the inverse Fourier Cosine transform of e^{-2u}
16)	a) Solve the integral equation $\int_0^\infty f(x)\sin ux\, dx = \begin{cases} 1 & for\ \ 0 \leq u < 1 \\ 2 & for\ \ 1 \leq u < 2 \\ 0 & for\ \ \ u \geq 2 \end{cases}$ b) Find the inverse Fourier Sine transform of $\frac{1}{u}e^{-au}$ where a>0
17)	a) Find the inverse Fourier Cosine transform of e^{-au} where a>0 b) Show that the inverse Fourier Sine transform of $F_s(u) = \frac{1}{u}\left(1+\cos u\pi - 2\cos\frac{u\pi}{2}\right)$ is $f(x) = \begin{cases} 1, & 0 \leq x \leq \frac{\pi}{2} \\ -1, & \frac{\pi}{2} < x \leq \pi \end{cases}$
18)	a) Find the inverse Fourier Sine transform of $\frac{u}{1+u^2}$. b) Employ Convolution theorem to find $F(f*g)\ given\ f(x) = g(x) = e^{-x^2}$
19)	a) Employ Convolution theorem to find $F(f*g) given f(x) = g(x) = \begin{cases} 1, & \lvert x\rvert \leq 1 \\ 0, & \lvert x\rvert > 1 \end{cases}$ b) Using Parseval's identities prove that $\int_0^\infty \frac{dt}{(a^2+t^2)(b^2+t^2)} = \frac{\pi}{2ab(a+b)}$
20)	a) Using Parseval's identities prove that $\int_0^\infty \frac{t^2}{(t^2+1)^2}dt = \frac{\pi}{4}$ b) An infinite string is initially at rest and that the initial displacement is $f(x)$, $(-\infty < x < \infty)$ Determine the displacement $y(x,t)$ of the string.

(IT BRANCHES)

Discrete and Integral Transforms (DIT)

Subject Code : 18MA3GCDIT

Module – 1 (Curve Fitting & Statistics Modelling)

Q.No	QUESTIONS
1.	The method of finding the curve of best fit is called the ______ fitting. a) Curve b) Straight line c) Parabola d) None of these
2.	The method of least square provides a relationship y = f(x) such that the sum of squares of the residuals is ________. a) Maximum b) Minimum c) maximum and Minimum d) None of these
3.	Curve fitting is a method of finding a suitable relation or law in the form y = f(x) for a set of observed values (x_i , y_i) , i = 1,2,3, ……. Such relationship of connecting x and y is known as _____. a) Linear law b) Gauss law c) Empirical Law d) None of these
4.	Average scores of two batsmen A and B are respectively 40, 45 and their S. D.'s are respectively 9, 11. Which batsman is more consistent? a) Batsman – A b) Batsman – B c) Batsmen – A & B d) None of these
5.	The mean of the numbers {11, 10, 12, 13, 9} is _____. a) 11 b) 10 c) 12 d) 13
6.	The numerical measure of correlation between two variables x and y is known as _____. a) Correlation coefficient b) Regression c) mean d) variance
7.	The coefficient of correlation numerically does not exceed _____. a) Zero b) unity c) two d) None of these
8.	The product of the regression coefficients is equal to _____. a) r b) r^3 c) r^4 d) r^2
9.	If the correlation coefficient is zero then the two regression lines are _______ a) Parallel b) perpendicular c) equal d) None of these
10.	The equations of regression lines are $y = 0.5x + a$ and $x = 0.4y + b$, then the correlation coefficient is _______ a) ± 0.5224 b) ± 0.4472 c) ± 0.5210 d) ± 0.4452

Discrete and Integral Transforms (DIT)

Subject Code : 18MA3GCDIT

Module – 2 (Z - Transform)

Q.No	QUESTIONS
1.	Z-transform of a function u_n where n is an integer, $n \geq 0$ is ________. a) $Z_T(u_n) = \sum_{n=0}^{\infty} u_n z^{-n}$ c) $Z_T(u_n) = \sum_{n=1}^{\infty} u_n z^{-n}$ b) $Z_T(u_n) = \sum_{n=0}^{\infty} u_n z^{n}$ d) $Z_T(u_n) = \sum_{n=1}^{\infty} u_n z^{n}$
2.	The value of $z_T(1)$ is _________. a) $\frac{z}{z+1}$ b) $\frac{z}{z-1}$ c) $\frac{z^2}{z-1}$ d) $\frac{z^2}{z+1}$
3.	Damping rule states that if $\mathrm{Z_T}(u_n) = \bar{\mathrm{u}}(\mathrm{z})$, then $\mathrm{Z_T}(k^n u_n) =$__________. a) $\bar{u}\left(\frac{1}{k}\right)$ b) $\bar{u}\left(\frac{1}{kz}\right))$ c) $\bar{u}\left(\frac{z}{k}\right)$ d) $\bar{u}\left(\frac{k}{z}\right)$
4.	The value of $z_T(k^n)$ is ________. a) $\frac{z}{z+k}$ b) $\frac{z^2}{z+k}$ c) $\frac{z^2}{z-k}$ d) $\frac{z}{z-k}$
5.	The value of $z_T(sinn\theta)$ is _________. a) $\frac{z\,sin\theta}{z^2-2z\,cos\theta+1}$ b) $\frac{z\,sin\theta}{z^2+2z\,cos\theta+1}$ c) $\frac{z\,sin\theta}{z^2-2z\,cos\theta-1}$ d) $\frac{z\,sin\theta}{z^2+2z\,cos\theta-1}$
6.	If $\mathrm{Z_T(u_n)} = \bar{\mathrm{u}}(\mathrm{z})$ then $\mathrm{Z_T(u_{n-k})} =$ ___________. a) $z^k\,\bar{u}(z)$ b) $z^{-k}\bar{u}(z)$ c) $z^k\bar{u}(kz)$ d) $z^{-nk}\bar{u}(nz)$
7.	Initial Value theorem states that, if $\mathrm{Z_T}(u_n) = \bar{\mathrm{u}}(\mathrm{z})$, then _______. a) $\lim_{z\to 1}\bar{u}(z) = u_0$ c) $\lim_{z\to\infty}\bar{u}(z) = u_0$ b) $\lim_{z\to 0}\bar{u}(z) = u_0$ d) $\lim_{z\to-\infty}\bar{u}(z) = u_0$
8.	The value of $\mathrm{Z_T(u_{n+1})} =$ ______. a) $z[\bar{u}(z) + u_0]$ b) $z[\bar{u}(z) - u_1]$ c) $z[\bar{u}(z) + u_1]$ d) $z[\bar{u}(z) - u_0]$
9.	The value of $Z_T{}^{-1}\left[\frac{z}{z^2+1}\right]$ is __________. a) $\sin\left(\frac{n\pi}{2}\right)$ b) $\sin\left(\frac{n\pi}{3}\right)$ c) $\sin\left(\frac{n\pi}{6}\right)$ d) $\sin\left(\frac{n\pi}{4}\right)$
10.	The value of $Z_T{}^{-1}\left[\frac{kz}{(z-k)^2}\right] =$ _________. a) $k^{-n}n$ b) $k^n n$ c) $k^n n^2$ d) $k^{-n}n^2$

Discrete and Integral Transforms (DIT)

Subject Code : 18MA3GCDIT

Module – 3 (Fourier Series)

Q.No	QUESTIONS
1.	A real valued function f(x) is said to be periodic of period T if ________ a) $f(x-T)=-f(x)$ b) $f(x+T)=-f(x)$ c) $f(x+T)=f(x)$ d) $f(x-T)=f(Tx)$
2.	If $f(x)$ is discontinuous at x then the Fourier series converges to _______ where $f(x^+)$, $f(x^-)$ are respectively right hand and left hand limits of $f(x)$ a) $\frac{f(x^+)+f(x^-)}{2}$ b) $\frac{f(x^+)-f(x^-)}{2}$ c) $\frac{f(x^+)+f(x^-)}{-2}$ d) $\frac{f(x^+)-f(x^-)}{-2}$
3.	A function $f(x)$ is said to be EVEN in the interval (-a , a) if ________ a) $f(-x)=-f(x)$ b) $f(-x)=f(x)$ c) $f(a-x)=f(ax)$ d) $f(a+x)=f(ax)$
4.	A function $f(x)$ is said to be ODD if _______in the interval $(0,2l)$ a) $f(2l-x)=f(x)$ b) $f(2l+x)=f(x)$ c) $f(2l-x)=-f(x)$ d) $f(2l+x)=-f(x)$
5.	Half range cosine series contains only ________ a)Cosine term b) Sine term c) Both cosine and Sine d) None of these
6.	In the Fourier series $\frac{a_0}{2}$ is called ________term a) Positive term b) negative term c) Remainder term d) Constant term
7.	In Fourier Series a_0 , a_n , b_n are called _________ a) Fourier constants b) Fourier coefficients c) Half range values d) None of these
8.	In Fourier Series expansion, if f(x) is ODD then _________ a) $a_0=0$, $a_n=0$ b) $a_0\neq 0$, $a_n=0$ c) $a_0=0$, $a_n\neq 0$ d) $a_0\neq 0$, $a_n\neq 0$
9.	_________is the process of finding the constant term and first few cosine and sine term numerically a) Numerical analysis b) Harmonic Analysis c) Theoretical analysis d) None of these
10.	In harmonic analysis , $a_0=$ ______- a) $a_0=\frac{N}{2}\sum x$ b)$a_0=\frac{N}{2}\sum y^2$ c) $a_0=\frac{2}{N}\sum x$ d) $a_0=\frac{2}{N}\sum y$

Discrete and Integral Transforms (DIT)

Subject Code : 18MA3GCDIT

Module – 4 (Integral Transform - I)

Q.No	QUESTIONS
1.	Laplace transform is a ________ (a) Definite integral (b) Indefinite integral (c) Improper integral (d) None of these
2.	L[f(t)] is a function of ______ (a) s (b) t (c) x (d) None of these
3.	A function f(t) is said to be periodic function of period T if ______ (a) f(t+T)=f(t) (b) f(t-T)=f(t) (c) f(t+nT)=f(t) (d) all of these
4.	Laplace transform of e^{at} ________ (a) $\frac{1}{s+a}$ (b) $\frac{s}{s+a}$ (c) $\frac{1}{s-a}$ (d) None of these
5.	$L[\delta(t-2)] =$_____ (a) e^{2s} (b) e^{-2s} (c) e^{-s} (d) None of these
6.	$L^{-1}\left[\frac{s^2-3s+4}{s^3}\right]$= (a)1-3t+2$t^2$ (b) 1+3t+2t^2 (c) 1-3t-2t^2 (d) 1+3t-2t^2
7.	$L^{-1}[F(s+a)] =$ (a)$e^{-at}L^{-1}(F(s))$ (b) $e^{at}L^{-1}(F(s))$ (c) $e^{at}L^{-1}(F'(s))$ (d) $e^{-at}L^{-1}(F'(s))$
8.	From convolution we have f(t)* g(t) is (a)g(t) * f(t) (b) f '(t) * g'(t) (c) g'(t) * f '(t) (d) None of these
9.	If $L^{-1}[F(s)] = f(t)$ then $L^{-1}[-F'(s)] =$ (a) –t f(t) (b) t f(t) (c) s f(s) (d) –s f(s)
10	L[f '(t)]= _______ (a) sL[f(t)]-f(0) (b) s^2 L[f(t)]-f(0) (c) s^2 L[f(t)]-sf(0) (d) None of these

Discrete and Integral Transforms (DIT)

Subject Code : 18MA3GCDIT

Module – 5 (Integral Transform – II)

Q.No	QUESTIONS
1.	Definition of Fourier transform is given by mathematical expression: a) $\int_0^\infty f(x) cosux\, dx$ b) $\int_0^\infty f(x) sinux\, dx$ c) $\int_{-\infty}^\infty f(x) e^{iux}\, dx$ d) $\int_{-\infty}^\infty f(x) e^{-iux} dx$
2.	Definition of Inverse Fourier transform is given by mathematical expression: a) $\frac{2}{\pi}\int_0^\infty F(u) cosux\, du$ b) $\frac{2}{\pi}\int_0^\infty F(u) sinux\, du$ c) $\int_{-\infty}^\infty F(u) e^{-iux}\, ds$ d) $\frac{1}{2\pi}\int_{-\infty}^\infty F(u) e^{-iux}\, du$
3.	Fourier transform of f(x)=1 in $-1 \le x \le 1$ a) $\frac{2sinu}{u}$ b) $\frac{2sinu}{\pi u}$ c) $\frac{sinu}{\pi u}$ d) $\frac{sinu}{u}$
4.	Boundary –value problem is a differential equation with a) no conditions b) conditions at one point c) conditions at more than one point d) none of these
5.	Definition of cosine Fourier transform is given by mathematical expression: a) $\int_0^\infty f(x) cosux\, dx$ b) $\int_0^\infty f(x) sinux\, dx$ c) $\int_0^\infty f(x) e^{iux}\, dx$ d) $\int_{-\infty}^\infty f(x) cosux\, dx$
6.	Fourier sine transform of $f(x) = \begin{cases} 1 & 0 < x < a \\ 0 & x > a \end{cases}$ a) $\frac{1-cosau}{u}$ b) $\frac{tanau}{u}$ c) $\frac{cosau}{u}$ d) $\frac{1-cosau}{au}$
7.	Inverse cosine Fourier transform is given by mathematical expression: a) $\frac{2}{\pi}\int_0^\infty F(u) cosux\, du$ b) $\frac{2}{\pi}\int_0^\infty F(u) sinux\, du$ c) $\int_{-\infty}^\infty F(u) cosux\, du$ d) $\frac{1}{2\pi}\int_{-\infty}^\infty F(u) e^{-iux}\, du$
8.	Fourier transform is employed to solve a) Initial- value problem b) Boundary-value problem c) initial-boundary value problem d) none of these
9.	Convolution of f=f(x) and g=g(x) denoted by f*g is defined as a) $\int_{-\infty}^\infty f(x-t) g(t) dt$ b) $\int_0^\infty f(x-t) g(t) dt$ c) $\int_{-\infty}^\infty f(t) g(t) dt$ d) $\int_{-\infty}^\infty f(xt) g(t) dt$
10.	If the Fourier transform of $f(x)$ and $g(x)$ are $F(s), G(s)$ then $\frac{1}{2\pi}\int_{-\infty}^\infty [F(s)]^2\, ds =$ ________ a) $\int_{-0}^\infty \lvert f(x)\rvert^2 dx$ b) $\int_{-\infty}^\infty \lvert f(x)\rvert^2 dx$ c) $\int_{-\infty}^\infty \lvert f(x)\rvert dx$ d) $\int_{-\infty}^\infty \lvert f(x) g(x)\rvert^2 dx$