Code - 2001

G. S. Mandal's

Maharashtra Institute of Technology, Aurangabad

(An Autonomous Institute)

END SEMESTER EXAMINATION

Second Year B.Tech (All) – Feb/Mar-2023

Course Code : BSC204 **Course Name : Linear Algebra and Transform**

Duration : 2 Hrs. **Max. Marks : 50** **Date :01/2/2023**

Instructions :

i) All questions are compulsory

ii) Assume suitable data wherever necessary and clearly state it

iii) Figures to right indicate full marks

iv) You can carry standard normal distribution table

Q. 1	Answer any five(Marks:10)				
		Marks	CO	BL	PI
a)	Find the locus of z given by $\|z-3\|=5$.	2	2	2	1.1.1, 2.1.3
b)	Express $z=2+2i$ in polar form.	2	2	2	1.1.1, 2.1.3
c)	Find the characteristic equation of the matrix $A=\begin{bmatrix}2 & 3\\ 4 & 1\end{bmatrix}$.	2	3	2	1.1.1, 2.1.3, 12.1.1
d)	Write the formulae to find probability by i) Binomial distribution and ii) Poisson's distribution.	2	4	1	1.1.1, 2.1.3, 12.1.1
e)	Find particular integral of $(D^2+2D+1)y=5$.	2	5	2	1.1.1, 2.1.3
f)	If $L\{f(t)\}=\frac{1}{s-1}$ then find $L\{f(3t)\}$.	2	1	2	1.1.1, 2.1.3
g)	i) State Second shifting theorem of Laplace transform. ii) Write the Laplace transform of Heaviside unit step function $H(t)$ and the Dirac delta function $\delta(t)$.	2	1	1	1.1.1, 2.1.3
h)	Find $L^{-1}\left\{\frac{s+1}{s^2-4}\right\}$.	2	6	2	1.1.1, 2.1.3
Q.2	a) If $\sin(\alpha+i\beta)=x+iy$ then prove that $\frac{x^2}{\cosh^2\beta}+\frac{y^2}{\sinh^2\beta}=1$. b) Find all the values of $(1)^{\frac{1}{3}}$. **OR(optional)** a) Prove that $\log\frac{a+ib}{a-ib}=2i\tan^{-1}\left(\frac{b}{a}\right)$. b) Prove that $\cosh^{-1}x=\log(x+\sqrt{x^2-1})$.	4 4 4 4	2	3	1.1.1, 2.1.3

Q.3	a) If the characteristic equation of a matrix $A=\begin{bmatrix}1&0&2\\0&2&1\\2&0&3\end{bmatrix}$ is $A^3-6A^2+7A+2I=0$ then only verify Cayley-Hamilton theorem for A. b) Solve the given simultaneous equations : $2x-y+3z=0,$ $3x+2y+z=0,$ $x-4y+5z=0.$ **OR(optional)** Find the eigen values and eigen vector corresponding to the smallest eigen value of the matrix $A=\begin{bmatrix}2&0&1\\0&2&0\\1&0&2\end{bmatrix}$.	4 4 8	3	3	1.1.1, 2.1.3, 12.1.1
Q.4	a) Solve $\frac{d^2y}{dx^2}-4y=x\sinh x$. b) Solve$(D^2+3D+2)y=e^{e^x}$. **OR(optional)** An electric circuit consists of an inductance L, a condenser of capacitance C and e.m.f $E=E_0\cos\omega t$ so that the charge Q saisfies the differential equation $\frac{d^2Q}{dt^2}+\frac{Q}{LC}=\frac{E_0}{L}\cos\omega t$ if $\omega=\frac{1}{\sqrt{LC}}$ and initially at $t=0, Q=Q_0$ and current $i=i_0$ find the charge at any time t.	4 4 8	5	3	
Q.5	a) Find $L\{(t+1)^2e^t\}$. b) Find $L^{-1}\left[\frac{s+3}{(s+4)^2}\right]$. **OR(optional)** a) Evaluate the integral $\int_0^\infty e^{-3t}\sin t\,dt$. b) Obtain inverse Laplace transform of $\frac{a}{s(s-a)}$.	4 4 4 4	1, 6	3	1.1.1, 2.1.3

Q.6	a) Six dice are thrown 780 *times*. How many times do you expect at least four dice to show a three or four? b) Assuming that the diameter of 1000 brass plugs taken consecutively from a machine form a normal distribution with mean 0.7515 inch and S.D. 0.0020 inch, how many plugs are likely to be rejected if approved diameters are 0.7520 $\pm$ 0.0040. Given that the area under the normal curve for $S.N.V.$ 1.75 is 0.4599 and for $S.N.V.$ 2.25 is 0.4878. **OR(optional)** a) The probability that a man aged 35 years will die before reaching the age of 40 years may be taken as 0.018. Out of 400 men now aged 35 years, what is the probability that 2 men will die within the next 5 years? b) Normal distribution has mean 15.73 and S.D. 2.08. Find the percentage of cases that fall between 17.81 and 13.65. Given that the area under the normal curve for $S.N.V.$ 1 is 0.3413.	4 4 4 4	4	3	1.1.1, 2.1.3