MEERUT INSTITUTE OF ENGINEERING AND TECHNOLOGY

NH-58, Delhi-Roorkee Highway, Baghpat Road, Meerut

Roll No.: ....

Sessional Examination -I (SET-B) :Odd Semester 2024-25

Course/Branch: B Tech –I Years(OP1-OP14)

Subject Name :Engg. Mathematics-I

Subject Code : BAS-103

Semester: I

Max. Marks: 60

Time: 120 min

CO-1 : Apply the concept of matrices for solving linear simultaneous equations

CO-2 : Apply the concept of differentiation in successive derivatives, Leibnitz theorem, partial and total derivatives

Section – A (CO - 1) # Attempt both the questions # 30 Marks

Q.1: Attempt any **SIX** questions (Short Answer Type). Each question is of two marks. (12 Marks)

a) Show that the matrix $\begin{bmatrix} \alpha + i\gamma & -\beta + i\delta \\ \beta + i\delta & \alpha - i\gamma \end{bmatrix}$ is unitary if $\alpha^2+\beta^2+\gamma^2+\delta^2=1$. (BKL: K2 Level)

b) The Eigen values of a matrix A are 2,3,1 then find the Eigen values of $A^{-1}+A^2$. (BKL: K2 Level)

c) Examine whether the vectors $X_1=[3,1,1], X_2=[2,0,1], X_3=[4,2,1]$ are linearly independent. (BKL: K2 Level)

d) Test for consistency of the following system of equations: (BKL: K2 Level)

$$2x-y+3z=0$$
$$-x+2y+z=0$$
$$3x+y-4z=0$$

e) Two eigen vaues of the matrix $A=\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ are equal to 1 each.Find the eigen values of A^{-1}. (BKL: K2 Level)

f) Find the rank of the following matrix using Echelon Form Method (BKL: K3 Level)

$$\begin{bmatrix} 1 & -3 & 1 & 2 \\ 0 & 1 & 2 & 3 \\ 3 & 4 & 1 & -2 \end{bmatrix}$$

g) Find the Eigen value of the matrix A=$\begin{bmatrix} 4 & 2 \\ 2 & 4 \end{bmatrix}$ corresponding to the eigen vector $\begin{bmatrix} 102 \\ 102 \end{bmatrix}$. (BKL: Lev

Q.2:**Attempt any THREE questions (Medium Answer Type). Each question is of 6 mar** 18 Marks)

a) For what values of a and b ,the equations x + 2y +3z =6 , x + 3y + 5z = 9 , 2x + 5y + az =b have (B L

(i) no solution

(ii) a unique solution

(iii) more than one solution?

b)	Reduce the matrix A to its normal form when $A=\begin{bmatrix}1&2&1&4\\2&4&3&4\\1&2&3&4\\-1&-2&6&-7\end{bmatrix}$ Hence find the rank of A.	(BKL:K3 Level)
c)	Find the eigen values and eigen vectors of matrix $A=\begin{bmatrix}-2&2&-3\\2&1&-6\\-1&-2&0\end{bmatrix}$	(BKL:K3 Level)
d)	Using elementary row transformation, find the inverse of the following matrix $\begin{bmatrix}2&3&4\\4&3&1\\1&2&4\end{bmatrix}$	(BKL:K3 Level)
e)	If $A=\begin{bmatrix}2&-1&1\\-1&2&-1\\1&-1&2\end{bmatrix}$ (a) State Cayley-Hamilton theorem (b) Compute A^{-1} (c) Evaluate $A^6-6A^5+9A^4-2A^3-12A^2+23A-9I$.	(BKL:K3 Level)

Section – B (CO - 2) # Attempt both the questions # 30 Marks

Q.3: Attempt any **SIX** questions (Short Answer Type). Each question is of two marks. (2 x 6 = 12 Marks)

a)	State Leibnitz Theorem for n^{th} differential coefficient of the product of two functions. If $y^{\frac{1}{m}}+y^{-\frac{1}{m}}=2x$, then find the relation in y_2, y_1, y.	(BKL:K3 Level)
b)	If $u=x\sin^{-1}\left(\frac{y}{x}\right)+y\sin^{-1}\left(\frac{x}{y}\right)$ evaluate $x^2\frac{\partial^2 u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial x\partial y}+y^2\frac{\partial^2 u}{\partial y^2}$	(BKL:K3 Lev)
c)	Find the first order partial derivatives of the function $z=y^x$.	(BKL:K3 Level)
d)	Find the n^{th}derivative of $y=x^2 sinx$.	(BKL:K3 Level)
e)	Find the n^{th} derivative of $\frac{(5x+1)}{(3x-1)(2x+7)}$.	(BKL:K3 Level)
f)	If $u=\cos^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$, find the value of $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}$	(BKL:K3 Level)
g)	Find n^{th} derivative of $y=\sin 2x\sin 3x$.	(BKL:K3 Level)

Q.4:Attempt any **THREE** questions (Medium Answer Type). Each question is of 6 marks. (3 x 6 = 18 Marks)

a)	If $y=(\sin^{-1}x)^2$, then find the relation in y_{n+2}, y_{n+1}, y_n.	(BKL:K3 Level)
b)	Verify Euler's theorem for the function $z=\frac{x^{1/3}+y^{1/3}}{x^{1/2}+y^{1/2}}$.	(BKL:K3 Level)
c)	If $u=x^2\tan^{-1}\left(\frac{y}{x}\right)-y^2\tan^{-1}\left(\frac{x}{y}\right)$, then show that $\frac{\partial^2 u}{\partial x\partial y}=\frac{\partial^2 u}{\partial y\partial x}$.	(BKL:K3 Level)
d)	If $u=cosec^{-1}\left(\frac{x^{\frac{1}{2}}+y^{\frac{1}{2}}}{x^{\frac{1}{3}}+y^{\frac{1}{3}}}\right)^{1/2}$, Find $\left(x^2\frac{\partial^2 u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial x\partial y}+y^2\frac{\partial u}{\partial y}\right)$.	(BKL:K3 Level)
e)	If $y=\sin(m\sin^{-1}x)$, then find the relation in y_{n+2}, y_{n+1}, y_n. and hence find y_n at $x=0$.	(BKL:K3 Level)