ROLL NO. 5 4

BABU BANARASI DAS

INSTITUTE OF TECHNOLOGY & MANAGEMENT, LUCKNOW(AKTU Code:054)

B.TECH , FIRST YEAR, IT/EC/AIML/DS/ME/EE (B1-B4)

(I SEM), Pre University Examination Odd Sem 2022-23

Subject Name : Engineering Mathematics Ist (BAS103)

Faculty Name: Dr. Subodh Chandra/ Mr. Shekhar Srivastava/ Dr. Ravi Kant Yadav/ Dr. Lav Kush Kumar/ Dr. Ruchi Kaushik

Duration: 3 hrs **Max. Marks: 70**

Note: (i) No student will be allowed to leave the examination room before end of exam.
(ii) Mention question number/section correctly.
(iii) Be precise in your answer.

Course Outcomes:

Following are the course outcomes of the subject: Engineering Mathematics Ist (BAS103)

	Course Outcomes:	Bloom's Level
BAS103.1	Understand the concept of complex matrices, Eigen values, Eigen vectors and apply the concept of rank to evaluate linear simultaneous equations.	K5
BAS103.2	Remember the concept of differentiation to find successive differentiation Leibnitz Theorem, and create curve tracing, and find partial and total derivatives.	K5
BAS103.3	Applying the concept of partial differentiation to evaluate extreme, series expansion, error approximation of functions and Jacobians.	K5
BAS103.4	Remember the concept of Beta and Gamma function; analyze area and volume and Dirichlet's theorem in multiple integral.	K4
BAS103.5	Apply the concept of Vector Calculus to analyze and evaluate directional derivative, line, surface and volume integrals.	K5

Section-A (5X2=10)

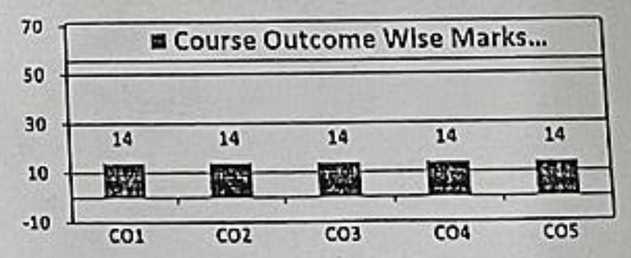
Q. No.		Question (Attempt all the Questions)	Marks	CO	BL
1	A	Prove that the matrix $\frac{1}{\sqrt{3}}\begin{bmatrix} 1 & 1+i \\ 1-i & -1 \end{bmatrix}$ is unitary matrix.	2	BAS103.1	K1
	B	If $I_n = \frac{d^n}{dx^n}(x^n \log x)$, prove that $I_n = nI_{n-1} + (n-1)!$.	2	BAS103.2	K2
	C	Calculate $\frac{\partial(u,v)}{\partial(x,y)}$ for $x = e^u \cos v$ and $y = e^u \sin v$.	2	BAS103.3	K3
	D	Evaluate $\int_0^\infty \frac{dx}{1+x^4}$.	2	BAS103.4	K3
	E	Find unit vector normal to surface $x^3 + y^3 + z^3 + 3xyz = 3$ at (1, 2,-1).	2	BAS103.5	K2

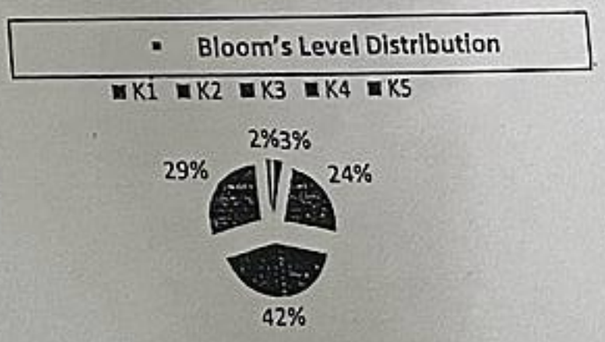
Section-B (5X5=25)

Q. No.		Question (Attempt All the Questions)	Marks	CO	BL
2(A)	I	Reduce the following matrix to normal form and hence find its rank $A = \begin{bmatrix} 1 & -3 & 1 & 2 \\ 0 & 1 & 2 & 3 \\ 3 & 4 & 1 & -2 \end{bmatrix}$.	5	BAS103.1	K3
		OR			
	II	Verify Cayley Hamilton theorem for matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{bmatrix}$ and hence find A^{-1}.	5		K3
2(B)	I	If $x = \sin(\frac{\log y}{a})$, then prove that $(1-x^2)y_{n+2} - (2n+1)x\,y_{n+1} - (n^2+a^2)y_n = 0$. Hence find y_n at x=0.	5	BAS103.2	K5
		OR			
	II	If $u = f(2x-3y,\ 3y-4z,\ 4z-2x)$, compute $6\frac{\partial u}{\partial x} + 4\frac{\partial u}{\partial y} + 3\frac{\partial u}{\partial z}$	5		K5
2(C)	I	Expand x^y , in power of $(x-1)$ and $(y-1)$ up to third degree terms .	5	BAS103.3	K4
		OR			
	II	In estimating the cost of piles of bricks measured in feet as (6 X 50 X 4), the tape is stretched is 1% beyond the standard length. If the count is 12 bricks to one feet³ and bricks cost Rs 100 per thousand, Find the approximate error in the cost.	5		K4
2(D)	I	Change the order of integration in $\int_0^a \int_{\sqrt{a^2-x^2}}^{x+2a} \emptyset(x,y)\,dxdy$.	5	BAS103.4	K3
		OR			
	II	State and prove Duplication formula for Beta and Gamma.	5		K3
2(E)	I	For the function $\emptyset = \frac{y}{x^2+y^2}$, find the magnitude of the directional derivative making an angle 60° with the positive direction of y-axis at the point (0,1).	5	BAS103.5	K4
		OR			
	II	Show that $\vec{F} = (x^2 - y^2 + x)\hat{i} - (2xy + y)\hat{j}$ is irrotational? Find its scalar potential.	5		K4

Section-C (5X7=35)

Q. No.		Question (Attempt All the Questions)	Marks	CO	BL
3	A	Solve the system of equations are consistent and solve it. $x+y+z=6,\ x+2y+3z=14$ and $x+4y+7z=30$.	7	BAS103.1	K5
		OR			
	B	Find the Eigen values and Eigen vectors of the matrix $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$	7		K5
4	A	If $\frac{x^2}{a^2+u} + \frac{y^2}{b^2+u} + \frac{z^2}{c^2+u} = 1$, show that $\left(\frac{\partial u}{\partial x}\right)^2 + \left(\frac{\partial u}{\partial y}\right)^2 + \left(\frac{\partial u}{\partial z}\right)^2 = 2\left(x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z}\right)$.	7	BAS103.2	K5
		OR			
	B	Verify Euler's theorem for $z = \frac{x^{1/3}+y^{1/3}}{x^{1/2}+y^{1/2}}$.	7		K3
5	A	Find maximum and minimum distance of the point (1,2,-1) from sphere $x^2+y^2+z^2 = 24$.	7	BAS103.3	K4
		OR			
	B	If $u^3+v^3+w^3 = x+y+z,\ u^2+v^2+w^2 = x^3+y^3+z^3$ and $u+v+w = x^2+y^2+z^2$ then find $\frac{\partial(x,y,z)}{\partial(u,v,w)}$.	7		K5
6	A	Evaluate $\iiint \frac{dxdydz}{\sqrt{1-x^2-y^2-z^2}}$ being extended to all positive values of variables for which the expression is real.	7	BAS103.4	K4
		OR			
	B	Find the volume of solid under the surface $x^2+y^2 = 4z$ and whose base R is the circle $x^2+y^2 = 16$.	7		K4
7	A	Evaluate $\int_C \vec{F}.dr$, Where $\vec{F} = (x^2+y^2)\hat{i} - 2xy\,\hat{j}$, the curve C is the rectangle in the x-y plane bounded by $y=0, x=a, y=b, x=0$.	7	BAS103.5	K4
		OR			
	B	Verify divergence theorem for $\vec{F} = (x^2-yz)\hat{i} + (y^2-zx)\hat{j} + (z^2-xy)\hat{k}$ taken over the rectangular parallelepiped $0 \le x \le a,\ 0 \le y \le b, 0 \le z \le c$.	7		K4





Checked By:
(Head of Department)