

Satyug Darshan Institute of Engineering & Technology, Faridabad

Department of Applied Science and Humanities

Academic year 2025-26

Programme: BCA (GEN/DS)	Year & Semester: 3 rd
Course Name: Algebra and Calculus	Course Code: MTU-209-V
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Unit I

Short answer questions

Q.N.	Question	KL
1	Calculate the determinant of the matrix $A = \begin{bmatrix} 3 & 4 & 5 & 0 & 5 \\ -3 & -2 & -7 & 6 \end{bmatrix}$	KL5
2	Define symmetric matrix and Skew-symmetric matrix with example.	KL1
3	Let $P = \begin{bmatrix} 2 & -1 & 3 & 0 & 1 & 4 \end{bmatrix}$, $Q = \begin{bmatrix} 1 & 5 & 2 & 0 & -3 & 4 \end{bmatrix}$, Calculate $P \times Q$.	
4	Find the transpose, determinant and co-factor of the matrix $A = \begin{bmatrix} 1 & 4 & 7 & 0 \\ -3 & 2 & 5 & 6 \\ -1 \end{bmatrix}$	KL1
5	Find K for which the matrix $A = \begin{bmatrix} 2k & + & 3 & 4 & 5 \\ -4 & 0 & -6 & -5 & 6 \\ -2k & -3 \end{bmatrix}$ is skew symmetric.	KL1

Long answer questions

Q.N.	Question	KL
1	Solve the following system of linear equations. $x - y + z = 2$, $2x - y = 0$, $2y - z = 1$	KL3
2	Find the inverse of the matrix $A = \begin{bmatrix} 0 & 1 & 2 & 1 & 2 & 3 & 3 & 1 & 1 \end{bmatrix}$	KL1
3	Find the Eigen values and Eigen vectors of the matrix $A = \begin{bmatrix} 2 & 2 & 1 & 1 & 3 & 1 & 1 & 2 & 2 \end{bmatrix}$	KL1
4	Solve the following system of linear equations by matrix method and Cramer's rule $x + y + z = 3$, $x + 2y + 3z = 4$, $x + 4y + 9z = 6$	KL3
5	Test the consistency and solve the following system of linear equations $x + 2y + z = 3$, $2x + 2y + 2z = 5$, $3x - 5y + 5z = 2$, $3x + 9y - z = 4$	KL4

Unit II

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Short answer questions

Q.N.	Question	KL
1	Differentiate the function w.r.t.x $f(x)=\cos (\tan x)$	KL4
2	Differentiate the function w.r.t.x $Y=e^{e^x}$	KL4
3	Differentiate the function w.r.t.x $Y=\log (\sec x+\tan x)$	KL4
4	Differentiate the function w.r.t.x $Y=\log (x+\sqrt{a^2+x^2})$	KL4
5	Differentiate the function with respect to x, $Y=\sin x -x \cos x$ w. r. t. x.	KL4

Long answer questions

Q.N.	Question	KL
1	If $x\sqrt{1+y}+y\sqrt{1+x}=0$, $x \neq y$ then prove that $(1+x^2)\frac{dy}{dx} + 1 = 0$	
2	Find $\frac{dy}{dx}$ if $y=\frac{e^x+e^{-x}}{e^x-e^{-x}}$	KL1
3	Differentiating with respect to x, if $y=\log\frac{x^2+1}{x^2+2}$	KL4
4	If $y=\sqrt{x}-\frac{1}{\sqrt{x}}$, then show that $2x\frac{dy}{dx}+y=2\sqrt{x}$.	KL1
5	Find $\frac{dy}{dx}$ when $\log xy=x^2+y^2$	KL1

Unit III

Short answer questions

Q.N.	Question	KL
1	Integrate the function 5^x with respect to x.	KL4
2	Integrate $\int \frac{1}{\sqrt{x}} dx$	KL4
3	Integrate $\int \frac{3x+2}{3x^2+4x+7} dx$	KL4
4	Prove that $\int_0^{\frac{\pi}{4}} \log \log (1 + \tan \theta) d\theta = \frac{\pi}{8}(\log 2)$.	KL5
5	Evaluate the integral $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin^{99} x dx$	KL5

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Long answer questions

Q.N.	Question	KL
1	Find $\int_0^5 (1 + x) dx$ as the limit of sum.	KL1
2	Evaluate (i) $\int \frac{\sec^2 x}{\csc^2 x} dx$ (ii) $\int \frac{\tan^4 \sqrt{x} \sec^2 \sqrt{x}}{\sqrt{x}} dx$ (iii) $\int \sin^3 x \cos^2 x dx$	KL5
3	Evaluate 1) $\int (\log x)^2 dx$ b) $\int_0^{\frac{\pi}{2}} \sin^4 x dx$	KL5
4	Evaluate $\int \frac{dx}{4 \cos x + 3 \sin x}$	KL5
5	Evaluate the following (i) $\int_0^{\frac{\pi}{2}} \frac{\sin x \cos x}{\sin^2 x + \cos^2 x} dx$ (ii) $\int_0^{\frac{\pi}{2}} \frac{\sin^2 x}{\sin^2 x + \cos^2 x} dx$	KL5

Unit IV

Short answer questions

Q.N.	Question	KL
1	Find the upper and lower limit of the sequence a) $\{1, 2, 1/2, 3, 1/3, 4, 1/4, 5, 1/5, \dots\}$	KL1
2	Test the convergence of the series $\frac{5}{1.2.4} + \frac{7}{2.3.5} + \frac{9}{3.4.6} + \frac{11}{4.5.7} + \dots$	KL4
3	State conditional convergence and absolute convergence of a series.	KL1
4	Define alternating series with example.	KL1
5	Test the convergence of the sequence $S_n = 2 + (-1)^n$	KL4

Long answer questions

Q.N.	Question	KL
1	Examine the convergence or divergence of the series for $x > 0$ $\frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^4}{4\sqrt{3}} + \frac{x^6}{5\sqrt{4}} + \dots$	KL4

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2	Test the convergence or divergence of the series a) $\frac{1}{\sqrt{1.2}} + \frac{1}{\sqrt{2.3}} + \frac{1}{\sqrt{3.4}} + \dots \infty$ b) $\sum(\sqrt{n^2 + 1} - n)$ c)	KL4
3	Test for convergence the positive term series $1 + \frac{\alpha+1}{\beta+1} + \frac{(\alpha+1)(2\alpha+1)}{(\beta+1)(2\beta+1)} + \frac{(\alpha+1)(2\alpha+1)(3\alpha+1)}{(\beta+1)(2\beta+1)(3\beta+1)} + \dots$	KL4
4	Examine the convergence or divergence of the series $\frac{a}{b} + \frac{a(a+d)}{b(b+d)}x + \frac{a(a+d)(a+2d)}{b(b+d)(b+2d)}x^2 + \dots$	KL4
5	Discuss the convergence of the series $\sum_{n=1}^{\infty} \frac{n!2^n}{n^n}$	KL6
6	Find the middle term of the expansion $(x^4 - \frac{1}{x^3})^{15}$	KL1
7	Find the Taylor series expansion of $f(x)=\sqrt{x}$ about the point $x=1$, up to 3rd degree.	KL1