

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2024
(First Semester)

Branch - ELECTRONICS

MATHEMATICS I FOR ELECTRONICS

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(10 × 1 = 10)

Question No.	Question	K Level	CO
1	A square matrix A is said to be symmetric about the principal diagonal if _____. a) $a_{ij} = -a_{ji}$ b) $a_{ij} = a_{ji}$ c) All diagonal elements are equal to 1 d) All elements below the diagonal are zero	K1	CO2
2	In a square matrix $A = [a_{ij}]$ if $a_{ij} = \overline{a_{ji}}$ then that matrix A is called the _____. a) Hermitian matrix b) Skew-Hermitian matrix c) unitary matrix d) Orthogonal matrix	K2	CO2
3	What is the value of $\cosh^2 x - \sinh^2 x$? a) 0 b) $\cosh 2x$ c) $\sinh 2x$ d) 1	K1	CO1
4	What is the expansion of $\cos n\theta$? a) $\cos^n \theta + n_{C_2} \cos^{n-2} \theta \sin^2 \theta + \dots$ b) $\cos^n \theta - n_{C_2} \cos^{n-2} \theta \sin^2 \theta + \dots$ c) $-\cos^n \theta - n_{C_2} \cos^{n-2} \theta \sin^2 \theta - \dots$ d) $\cos^n \theta + n_{C_2} \cos^{n-3} \theta \sin^3 \theta + \dots$	K2	CO1
5	Identify the value of $\int_0^{\frac{\pi}{2}} \cos^7 x \, dx$? a) $\frac{48\pi}{105}$ b) $\frac{38\pi}{105}$ c) $\frac{48}{105}$ d) $\frac{38}{105}$	K1	CO4
6	If $f(x)$ is an even function then $\int_{-a}^a f(x) dx =$ _____. a) $2 \int_0^a f(x) dx$ b) 0 c) 1 d) $-2 \int_0^a f(x) dx$	K2	CO4
7	Identify the value of $\int_0^3 \int_0^2 \int_0^1 (x + y + z) dz \, dx \, dy$. a) 9 b) 10 c) 12 d) 18	K1	CO4
8	Which one of the following is the limit of x (x as constant limit) when evaluating $\iint (x + y)^2 \, dx \, dy$ over the area bounded by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$? a) $x = -a$ to $x = a$ b) $x = a$ to $x = 0$ c) $x = 0$ to $x = a$ d) $x = a$ to $x = b$	K2	CO4
9	Which of the following is the direct method? a) Gauss-Seidal method b) Gauss-Elimination method c) Gauss-Jacobi method d) both (b) and (c)	K1	CO5
10	The rate of convergence of Gauss-Seidal method is roughly _____ that of Gauss-Jacobi method. a) twice b) Equal to c) Faster than d) Half	K2	CO5

Cont....

SECTION - B (35 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks

(5 × 7 = 35)

Question No.	Question	K Level	CO
11.a.	If $A = \begin{bmatrix} 3 & -4 \\ 1 & 1 \\ 2 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 1 & 2 \\ 1 & 3 & 4 \end{bmatrix}$, show that $(AB)' = B'A'$.	K3.	CO1
	(OR)		
11.b.	Find the eigenvalues and eigenvectors of the matrix $= \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$.		
12.a.	Show that $\frac{\sin 6\theta}{\sin \theta} = 32 \cos^5 \theta - 32 \cos^3 \theta + 6 \cos \theta$.	K4	CO2
	(OR)		
12.b.	If $\sin(A + iB) = x + iy$, prove that $\frac{x^2}{\cos^2 A} + \frac{y^2}{\sin^2 A} = 1$ and $\frac{x^2}{\cos^2 B} - \frac{y^2}{\sin^2 B} = 1$.		
13.a.	Evaluate $\int x^4 \cos 2x \, dx$ using reduction formula.	K4	CO4
	(OR)		
13.b.	Evaluate $\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x \, dx$.		
14.a.	Evaluate $\int_0^a \int_0^{\sqrt{ax-x^2}} x^2 dy \, dx$.	K3	CO2
	(OR)		
14.b.	Evaluate $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z} dz \, dy \, dx$.		
15.a.	Solve the following equations by Gauss-Jordan method: $2x - 3y + z = -1$; $x + 4y + 5z = 25$; $3x - 4y + z = 2$.	K5	CO5
	(OR)		
15.b.	Solve by Gauss-elimination method the equations $2x + y + 4z = 12$; $8x - 3y + 2z = 20$; $4x + 11y - z = 33$.		

SECTION - C (30 Marks)

Answer ANY THREE questions

ALL questions carry EQUAL Marks

(3 × 10 = 30)

Question No.	Question	K Level	CO
16	Verify Cayley-Hamilton theorem and hence find the inverse for $\begin{pmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{pmatrix}$.	K4	CO1
17	Prove that $\sin^8 \theta = \frac{1}{27} [\cos 8\theta - 8 \cos 6\theta + 28 \cos 4\theta - 56 \cos 2\theta + 35]$.	K5	CO1
18	(i) Evaluate $\int_0^{\frac{\pi}{2}} \frac{\sin^n x}{\sin^n x + \cos^n x} dx$ (ii) Evaluate $\int \tan^6 x \, dx$ using reduction formula.	K4	CO4
19	Change the order of integration and then evaluate $\int_0^1 \int_{x^2}^{2-x} xy \, dy \, dx$.	K4	CO4
20	Solve the following equations using Gauss-Jacobi method, correct to three decimal places: $x + 17y - 2z = 48$; $30x - 2y + 3z = 75$; $2x + 2y + 18z = 30$.	K5	CO5

Z-Z-Z END