06GYMAT301112502

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Reg No.:_______________ Name:_______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S3 (FT/WP) (S) and S2 Challenge Course Examinations April/May 2026 (2024 Scheme)

Course Code: GYMAT301

Course Name: MATHEMATICS FOR ELECTRICAL SCIENCE AND PHYSICAL SCIENCE – 3

Max. Marks: 60 Duration: 2 hours 30 minutes

PART A

	(Answer all questions. Each question carries 3 marks)	CO	Marks
1	Show that $\int_0^\infty \frac{\cos\omega x}{1+\omega^2} = \frac{\pi}{2}\, e^{-x}$ where $x \geq 0$	1	(3)
2	Find the Fourier cosine transform of $f(x) = \begin{cases} x\,; 0 < x < 2 \\ 0\,; \quad x > 2 \end{cases}$	1	(3)
3	Test whether the function $f(z) = \overline{z}$ is analytic. Justify your answer	2	(3)
4	If $u(x, y) = x^2 - y^2$, find the harmonic conjugate $v(x, y)$ of u .	2	(3)
5	Evaluate $\oint_C \frac{1}{z^2}\, dz$, where C is the unit circle $\lvert z\rvert = 1$ oriented counterclockwise.	3	(3)
6	Evaluate $\oint_C \frac{e^z}{(z-1)^2}\, dz$, where C is the circle $\lvert z - 1\rvert = 2$ oriented counterclockwise.	3	(3)
7	Find the Taylor series expansion of $\frac{z}{z+2}$ about $z = 1$	4	(3)
8	Determine the singularities of $f(z) = \frac{\sin z}{z}$ and classify their nature.	4	(3)

PART B

(Answer any one full question from each module, each question carries 9 marks)

Module -1

			CO	Marks
9	a)	Find the Fourier transform of $f(x) = \begin{cases} 1 - x^2 & \lvert x\rvert \leq 1 \\ 0 & \lvert x\rvert > 1 \end{cases}$ and prove that that $f(x) = \frac{4}{\pi}\int_0^\infty \frac{\sin\omega - \omega\cos\omega}{\omega^3} \cos\omega x \, d\omega$.	1	5

	b)	Show that $\int_0^\infty \frac{\sin\pi\omega}{1-\omega^2} \sin\omega x \, d\omega = \begin{cases} \frac{\pi}{2}\sin x & 0 < x < \pi \\ 0 & x > \pi \end{cases}$	1	4
10	a)	Find the Fourier sine transform of $f(x) = \begin{cases} 3x, & 0 < x < 6 \\ 0, & x > 6 \end{cases}$	1	3
	b)	Find the Fourier integral representation of the function $f(x) = \begin{cases} 1 & \lvert x\rvert < 1 \\ 0 & \lvert x\rvert > 1 \end{cases}$. Hence show that $\int_0^\infty \frac{\sin w}{\omega} dw = \frac{\pi}{2}$.	1	6

Module -2

11	a)	Find the image of the region $\frac{1}{2} \leq x \leq 1$ under the transformation $w = z^2$	2	4
	b)	If $f(z)$ is analytic in a region and $\lvert f(z)\rvert$ is constant, prove that f is constant.	2	5
12	a)	Show that $u(x, y) = \ln\sqrt{x^2 + y^2}$ is harmonic, and hence find an analytic function $f(z)$ for which u is the real part.	2	5
	b)	Find the image of the circle $\lvert z - 2i\rvert = 2$ under the transformation $w = \frac{1}{z}$.	2	4

Module -3

13	a)	Evaluate $\int_C (x + 2y)dx + (y - 2x)dy$ where C is the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$	3	5
	b)	Evaluate using Cauchy's integral formula $\int_C \frac{e^z}{z^2+1} dz$, where C is the circle $\lvert z\rvert = 2$ oriented counterclockwise.	3	4
14	a)	Evaluate $\int_C \frac{z^2}{(z-1)^2(z+2)} dz$ where C is taken counter clockwise around the circle $\lvert z - 1\rvert = \frac{1}{2}$.	3	4
	b)	Evaluate $\int_C Im\,(z^2)\, dz$ counter clockwise around the triangle with vertices $0, 1, i$.	3	5

Module -4

15	a)	Find the Laurent series expansion of $f(z) = \frac{z^2+1}{(z-1)(z-2)}$ valid in the regions $i)\ 0 < \lvert z-2 \rvert < 1$ and $ii)\ \lvert z-1 \rvert > 1$ $iii) 1 < \lvert z \rvert < 2$	4	5
	b)	Evaluate $\int_C \frac{z^2+1}{z^2-2z}\, dz$ using the residue theorem, where C is the circle $\lvert z \rvert = 3$ oriented counterclockwise.	4	4
16	a)	Find the singularities and residues of the function $f(z) = \frac{z^4}{z^2-iz+2}$.	4	3
	b)	Evaluate $\int_0^{2\pi} \frac{1+sin\theta}{3+cos\theta}\, d\theta$.	4	6

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