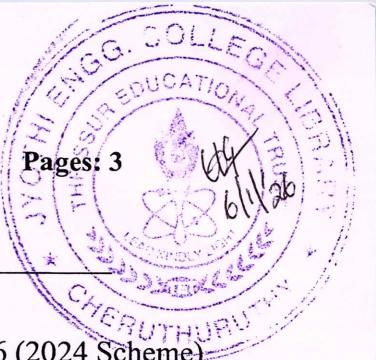


Reg No.: _____

Name: _____



APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech S2 (S) / S1 (Challenge Course) Examination December 2025 / January 2026 (2024 Scheme)

Course Code: GYMAT201**Course Name: MATHEMATICS FOR ELECTRICAL SCIENCE AND PHYSICAL SCIENCE - 2**

Max. Marks: 60

Duration: 2 hours 30 minutes

PART A*(Answer all questions. Each question carries 3 marks)*

		CO	Marks
1	Find $f_x(x,y)$ and $f_y(x,y)$ for $f(x,y) = 2x^3y^2+2y+4x$. Also find $f_x(1,3)$ and $f_y(1,3)$	CO1	(3)
2	If $f(x,y)=e^x \sin y$, show that $\frac{\partial^2 f}{\partial y \partial x} = \frac{\partial^2 f}{\partial x \partial y}$	CO1	(3)
3	Evaluate $\int_0^1 \int_0^2 (x+5) dy dx$	CO2	(3)
4	Evaluate $\iiint_G 12xy^2 z^3 dV$ over the rectangular box G defined by the inequalities $-1 \leq x \leq 2$, $0 \leq y \leq 3$, $0 \leq z \leq 2$	CO2	(3)
5	Find the gradient of $f(x,y,z)=x^2 + yz$	CO3	(3)
6	Show that the vector field $\vec{F} = (2xy+z^3)\hat{i} + x^2\hat{j} + 3xz^2\hat{k}$ is irrotational	CO3	(3)
7	Use Green's theorem to find the area enclosed by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$	CO4	(3)
8	State divergence theorem	CO4	(3)

PART B*(Answer any one full question from each module, each question carries 9 marks)***Module -1**

9	a) Use the local linear approximation of $f(x,y) = \sqrt{x^2 + y^2}$ at the point (3,4) to estimate the value of $f(3.05, 4.05)$	CO1	(5)
	b) Suppose that $w = e^{xyz}$, $x = 3u+v$, $y = 3u-v$, $z = u^2v$. Find $\frac{\partial w}{\partial u}$ and $\frac{\partial w}{\partial v}$ using the chain rule	CO1	(4)

03GYMAT201052505

10 a) Locate all relative extrema and saddle points of $f(x,y)=4xy-x^4-y^4$ CO1 (5)

b) Verify that the function $f(x,y,z)=x^2+y^2-2z^2$ satisfies the function three dimensional Laplace equation $\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} + \frac{\partial^2 f}{\partial z^2} = 0$ CO1 (4)

Module -2

11 a) By reversing the order of integration, evaluate $I = \int_0^2 \int_{\frac{y}{2}}^1 e^{x^2} dx dy$ CO2 (5)

b) Using double integral find the area included between the parabolas $y^2=4ax$ and $x^2=4ay$ CO2 (4)

12 a) Use polar co-ordinates to evaluate $I = \iint_R e^{-(x^2+y^2)} dA$ where R is the region enclosed by the circle $x^2 + y^2=1$ CO2 (5)

b) Use triple integral to find the volume bounded by the co-ordinate planes and the planes $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$ CO2 (4)

Module -3

13 a) Find the divergence and curl of the vector field $\vec{F}(x,y,z) = x^2y\hat{i} + 2y^3z\hat{j} + 3z\hat{k}$ CO3 (5)

b) Let $\vec{F}(x,y,z) = 2xy^3\hat{i} + (1+3x^2y^2)\hat{j}$ CO3 (4)

(i) Show that \vec{F} is conservative vector field on the entire plane

(ii) Find the potential function Φ

14 a) Find the work done by the force field $\vec{F} = z\hat{i} + x\hat{j} + y\hat{k}$ in moving a particle along the curve C given by $\vec{r}(t) = \sin t \hat{i} + \cos t \hat{j} + \sin^2 t \hat{k}$ $0 \leq t \leq \frac{\pi}{2}$ CO3 (5)

b) Find the directional derivative of $\Phi(x,y,z) = x^2yz + 4xz^2$ at the point P(1,-2,-1) in the direction of a vector from P to Q(3,-3,-2) CO3 (4)

Module -4

15 a) Use the divergence theorem to find the outward Flux of the vector field $\vec{F}(x,y,z) = 2x\hat{i} + 3y\hat{j} + z^2\hat{k}$ across the unit cube CO4 (5)

b) Verify Green's theorem for $\oint_C y^2 dx + x^2 dy$, where C is the square with vertices (0,0), (1,0), (1,1) and (0,1) oriented counter clockwise CO4 (4)

16 a) Use Stoke's theorem to evaluate $\oint_C \vec{F} \cdot d\vec{r}$ where CO4 (5)

03GYMAT201052505

$\vec{F}(x, y, z) = z^2 \hat{i} + 3x \hat{j} - y^3 \hat{k}$ and C is the circle $x^2 + y^2 = 1$ in the xy -plane with counter clockwise orientation looking down the positive z -axis

b) Evaluate the surface integral $\iint_{\sigma} xz \, ds$ where σ is the part of the plane

CO4 (4)

$x+y+z=1$ in the first octant

