

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086
(For candidates admitted from the academic year 2015-16 & thereafter)

SUBJECT CODE : 15MT/AC/MP25

B. Sc. DEGREE EXAMINATION, APRIL 2019
BRANCH III – PHYSICS
SECOND SEMESTER

COURSE : ALLIED CORE

PAPER : MATHEMATICS FOR PHYSICS - II

TIME : 3 HOURS

MAX. MARKS : 100

SECTION – A

ANSWER ALL QUESTIONS:

(10x2=20)

1. Evaluate $\int_0^a \int_0^b xy(x-y)dydx$

2. Evaluate $\int_0^{\frac{\pi}{2}} \int_0^{\infty} \frac{rdrd\theta}{(r^2 + a^2)^2}$

3. Define Jacobian matrix.

4. By changing to polar coordinates find the value of the integral

$$\int_0^a \int_y^a \frac{x^2 dx dy}{(x^2 + y^2)^{\frac{3}{2}}}$$

5. Find the Laplace transforms of $L(\sin^2 2t)$.

6. Find the Laplace transforms of $L(e^{-at} \cos bt)$.

7. Define Jordan curve.

8. State Laurent's Series.

9. Write Rodrigue's formula for Legendre polynomials.

10. Write Legendre's differential equation.

SECTION-B

ANSWER ANY FIVE QUESTIONS:

(5x8=40)

11. Evaluate $\iint (x-y)dydx$ over the region between the line $x = y$ and the parabola

$$y = x^2.$$

12. Evaluate the $\int_0^1 \int_0^x \sqrt{x^2 + y^2} dx dy$ by means of the transformation $x = u, y = uv$.

13. Find the Laplace transforms of $f(t) = \begin{cases} \sin t & \text{when } 0 < t < \pi \\ 0 & t > \pi \end{cases}$.
14. Find $L^{-1}\left(\frac{1}{s^2(s^2+a^2)}\right)$.
15. Determine and classify the singular points of $f(z) = \frac{z - \sin z}{z^3}$.
16. Find the residue of $\frac{1+e^z}{\sin z + z \cos z}$ at the pole $z = 0$.
17. Prove the orthogonality relation $\int_{-1}^1 p_m(x)p_n(x)dx = 0$ if $m \neq n$.

SECTION-C

ANSWER ANY TWO QUESTIONS:

(2x20=40)

18. (a) By changing into polar coordinates evaluate the integral $\int_0^{2a\sqrt{2ax-x^2}} \int_0^{\sqrt{2ax-x^2}} (x^2 + y^2) dx dy$.
- (b) $\iiint \frac{dx dy dz}{\sqrt{1-x^2-y^2-z^2}}$ for all positive values of x, y, z for which the integral is real.
19. (a) Find $L^{-1}\left(\frac{1+2s}{(s+2)^2(s-1)^2}\right)$.
- (b) Using Laplace transforms solve $\frac{d^2y}{dx^2} - y = x^2 + x$, given that $y(0) = y'(0) = 0$.
20. (a) Obtain Taylor series for $f(z) = \frac{1}{(z+1)(z+3)}$ in $|z| < 1$.
- (b) Obtain the Rodrigue's formula for legendre polynomials.
