STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086
(For candidates admitted during the academic year 2019 – 20)

SUBJECT CODE : 19MT/AC/MP15

B. Sc. DEGREE EXAMINATION, NOVEMBER 2019
BRANCH III - PHYSICS
FIRST SEMESTER

COURSE : ALLIED – CORE
PAPER : MATHEMATICS FOR PHYSICS – I
TIME : 3 HOURS **MAX. MARKS : 100**

SECTION – A **(10 × 2 = 20)**
ANSWER ANY TEN QUESTIONS

1. Define similar matrices
2. State Cayley-Hamilton Theorem.
3. Obtain the characteristic equation of the matrix $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$
4. Find y_n where $y = \frac{2}{2x-1}$
5. If $y = (ax+b)^m$ then find y_n.
6. Evaluate $\int \frac{dx}{(1+x)^{3/2}+(1+x)^{1/2}}$.
7. Eliminate the arbitrary function from $z = f(x^2+y^2)$.
8. Define singular integral.
9. Define even function and odd function.
10. Express $f(x) = x(-\pi < x < \pi)$ as a Fourier series with period 2π.
11. What is Linear Programming Problem.
12. Define feasible solution for a Linear programming problem.

SECTION – B **(5 × 8 = 40)**
ANSWER ANY FIVE QUESTIONS

13. Verify Cayley Hamilton Theorem for the matrix $\begin{bmatrix} 0 & 0 & 2 \\ 2 & 1 & 0 \\ -1 & -1 & 3 \end{bmatrix}$.
14. Evaluate $\int \sqrt{1+x-2x^2}\,dx$.
15. Eliminate the arbitrary function f and ϕ from the relation $z = f(x+ay) + \phi(x-ay)$
16. Solve $(y^2+z^2)p - xyq = -xz$.
17. Find a sine series for $f(x) = c$ in the range 0 to π.
18. If $f(x) = \begin{cases} -x, & -\pi < x < 0 \\ x, & 0 < x < \pi \end{cases}$, expand $f(x)$ as a Fourier series in the interval $-\pi$ to π.
    Deduce that $\frac{\pi^2}{8} = 1 + \frac{1}{3^2} + \frac{1}{5^2} + \cdots$.
19. Solve using Graphical Method
    Maximize $z = 3x + 5y$
    Subject to constraints
    $3x + 2y \le 18$
    $x \le 4$
    $y \le 6$
    $x, y \ge 0$.

SECTION – C **(2 × 20 = 40)**

ANSWER ANY TWO QUESTIONS

20. a) Diagonalise the matrix $\begin{bmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{bmatrix}$.

b) Evaluate $\int \frac{3x-2}{\sqrt{4x^2-4x-5}}dx$.

21. a) Find in the range $-\pi$ to π, a Fourier series for

$$y = 1 + x, \quad 0 < x < \pi$$
$$y = -1 + x, \quad -\pi < x < 0.$$

b) Solve the partial differential equation $p + q = pq$.

22. a) If $y = \left(x + \sqrt{1 + x^2}\right)^m$, prove that $(1 + x^2)y_{n+2} + (2n + 1)xy_{n+1} + (n^2 - m^2)y_n = 0$

b) Solve using Simplex method

Maximize $z = 5x_1 + 2x_2$

Subject to constraints

$10x_1 + 2x_2 \leq 2100$

$x_1 + 0.5x_2 \leq 600$

$x_2 \leq 800$

$x_1, x_2 \geq 0.$

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