

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

SUBJECT CODE : 19MT/AC/MP15

B. Sc. DEGREE EXAMINATION, NOVEMBER 2022
BRANCH III - PHYSICS
FIRST SEMESTER

COURSE : ALLIED – CORE
PAPER : MATHEMATICS FOR PHYSICS – I
TIME : 3 HOURS

MAX. MARKS : 100
(10 × 2 = 20)

SECTION – A
ANSWER ANY TEN QUESTIONS

1. Define Similar matrices.
2. Obtain the Characteristic equation of the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ and use it to calculate A^2 .
3. Find the Eigen values of the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$.
4. Find the nth differential coefficient of $\sin^3 x$.
5. Evaluate $\int \frac{dx}{\sqrt{x} + \sqrt{1+x}}$.
6. Obtain a partial differential equation by eliminating the arbitrary constants 'a' and 'b' from $z = ax^2 + by^2$.
7. Form a partial differential equation by eliminating the arbitrary function from $f(x - y, x + y + z) = 0$.
8. Define singular integral.
9. Define Fourier Series.
10. If $f(x) = -x$ in $-\pi < x < 0$
 $= x$ in $0 < x < \pi$ find the value of b_n .
11. Define Linear Programming problem.
12. What are the characteristics of a standard LPP.

SECTION – B
ANSWER ANY FIVE QUESTIONS

(5 × 8 = 40)

13. Find the Eigen values and Eigen vectors of the matrix $\begin{bmatrix} 5 & 1 & -1 \\ 1 & 3 & -1 \\ -1 & -1 & 3 \end{bmatrix}$.
14. Find the characteristic equation of the matrix and hence determine the inverse of $\begin{bmatrix} 3 & 1 & -1 \\ 1 & 3 & 1 \\ -1 & 1 & 3 \end{bmatrix}$.
15. If $y = \sin(m \sin^{-1} x)$, prove that $(1 - x^2)y_2 - xy_1 + m^2 y = 0$ and $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} + (m^2 - n^2)y = 0$.
16. Solve $\sqrt{p} + \sqrt{q} = \sqrt{x}$.

17. Find the Fourier expansion of $f(x) = x$ in $-\pi < x < \pi$.
18. A manufacturer produces two types of models M_1 and M_2 . Each M_1 model requires 4 hours of grinding and 2 hours of polishing whereas each M_2 model requires 2 hours of grinding and 5 hours of polishing. The manufacturer has 2 grinders and 3 polishers. Each grinder works for 40 hours a week and each polisher works for 60 hours a week. Profit on an M_1 model is Rs. 3 and on an M_2 model is Rs. 4. Whatever is produced in a week is sold in the market. Formulate the above as a LPP to maximize profit.
19. Solve using graphical method the following LPP

$$\begin{aligned} \text{Max } z &= 20x_1 + 30x_2 \quad \text{subject to} \\ x_1 + x_2 &\leq 12 \\ 5x_1 + 2x_2 &\leq 50 \\ 2x_1 + 6x_2 &\leq 60 \\ x_1, x_2 &\geq 0 \end{aligned}$$

SECTION – C
ANSWER ANY TWO QUESTIONS

(2 × 20 = 40)

20. (a) Diagonalise the matrix $\begin{bmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{bmatrix}$ (12)

(b) Solve $x(y^2 - z^2)p + y(z^2 - x^2)q = z(x^2 - y^2)$ (8)

21. (a) Evaluate $\int \sqrt{(x-3)(7-x)} dx$ (8)

(b) Find a cosine series in the range 0 to π for $(x) = x$, $0 < x < \frac{\pi}{2}$
 $= \pi - x$, $\frac{\pi}{2} < x < \pi$ (12)

22. Solve by Simplex method Max $z = 10x_1 + 6x_2 + 4x_3$ subject to

$$\begin{aligned} x_1 + x_2 + x_3 &\leq 100 \\ 10x_1 + 4x_2 + 5x_3 &\leq 600 \\ 2x_1 + 2x_2 + 6x_3 &\leq 300 \\ x_1, x_2, x_3 &\geq 0 \end{aligned}$$



