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

SUBJECT CODE : 15MT/AC/MP15

B. Sc. DEGREE EXAMINATION, NOVEMBER 2018
BRANCH III - PHYSICS
FIRST SEMESTER

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

SECTION – A **(10 X 2 = 20)**
ANSWER ALL THE QUESTIONS

1. State Cayley – Hamilton theorem.
2. Find the eigen values of the matrix.
$$\begin{vmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{vmatrix}$$
3. Differentiate with respect to x of $sin^{-1}(cos\, x)$.
4. Find the nth derivative of $y = log(ax + b)$.
5. Prove that $\Gamma(n+1) = n\,!$
6. Prove that $\Gamma\frac{1}{2} = \sqrt{\pi}$
7. Eliminate the arbitrary function from the following $z = e^y f(x+y)$.
8. Define Complete integral.
9. Find a constant a_0 of the fourier series for the function $f(x) = x$ in $0 \le x \le 2\pi$.
10. Find a sine series for the function $f(x) = x\ in\ (0, \pi)$.

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

11. Find the characteristic equation of the matrix and hence determine its inverse.
$$\begin{vmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{vmatrix}$$
12. Calculate A^4 when A = $\begin{vmatrix} -1 & 3 \\ -1 & 4 \end{vmatrix}$.
13. Find the n^{th}derivative of $sinx\, sin2x\, sin3x$.
14. If $x = a(t - sint)$, $y = a(1 + cost)$ find $\frac{d^2y}{dx^2}$ as a function of t.
15. (i) Evaluate $\int_0^1 x^m (log\frac{1}{x})^n\, dx$
 (ii) Evaluate $\int_0^\infty e^{-x^2}\, dx$.
16. (i) Solve $p(1+q) = qz$.
 (ii) Find the Complete integral of $(1-x)\,p + (2-y)\,q = 3-z$.
17. Find the Fourier series for $f(x)$ in $[-\pi, \pi]$
 If $f(x) = \begin{Bmatrix} -\pi & -\pi < x < 0 \\ x & 0 < x < \pi \end{Bmatrix}$.

SECTION – C **(2 X 20 = 40)**

ANSWER ANY TWO QUESTIONS

18. Diagonalise the matrix.

$$\begin{vmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{vmatrix}$$

19. Using Beta Gamma function

(i) Prove that $\int_2^3 \sqrt{(x-2)(3-x)} \;=\; \frac{\pi}{8}$.

(ii) Evaluate $\int_0^{\frac{\pi}{2}} \frac{dx}{\sqrt{\cos x}}$.

20. (i) Solve $(x^2 - yz)\, p + (y^2 - zx)\, q = z^2 - xy$.

(ii) Show that as a sine series in the half range 0 to π

$$cos\ x = \frac{4}{\pi}\left(\frac{2sin2x}{2^2-1} + \frac{4sin4x}{4^2-1} + \cdots\right).$$

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