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 2017
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's theorem.
2. Find the eigen values of the matrix $\begin{pmatrix} 3 & 2 \\ 2 & 3 \end{pmatrix}$.
3. If $y = \sinh x$ show that $\frac{dy}{dx} = \cosh x$.
4. Find the n^{th} derivative of e^{ax}.
5. Define Beta and Gamma functions.
6. Evaluate $\int_0^\infty e^{-x^2} dx$.
7. Obtain the partial differential equation by eliminating a and b from $z = (x+a)(y+b)$
8. Solve $z = px + qy + pq$
9. Show that $\int_{-a}^{a} f(x)dx = 2\int_0^a f(x)dx$ if $f(x)$ is even.
10. Determine a_0 in the Fourier expansion of the function $f(x) = \pi^2 - x^2, -\pi < x < \pi$.

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

11. Find the eigen values and eigen vectors of the matrix A = $\begin{bmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{bmatrix}$
12. Find y_n when $y = \frac{3}{(x+1)(2x-1)}$
13. Evaluate $\int \sqrt{(x-3)(7-x)}\,dx$
14. Show that $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$.
15. Eliminate the arbitrary functions f and ϕ from the relation $z = f(x+ay) + \varphi(x-ay)$
16. Solve (i) $p = y^2q^2$ (ii) $p + q = x + y$
17. Express $f(x) = x(-\pi < x < \pi)$ as a Fourier series with period 2π.

SECTION – C **(2 X 20 = 40)**

ANSWER ANY TWO QUESTIONS

18. a) Verify Cayley Hamilton theorem for the matrix A = $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ and hence find A^{-1}.

b) If y = a cos(log$x$) + b sin (,log x), prove that $x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0$.

19. a) Evaluate (i) $\int \frac{dx}{(x+1)\sqrt{x^2+x+1}}$ (ii) $\int_0^1 \sin^7\theta \cos^5 \theta d\theta$

b) Express $\int_0^1 x^m (1-x^n)^p dx$ in terms of Gamma functions and hence evaluate the integral $\int_0^1 x^5 (1-x^3)^{10} dx$.

20. a) Find the general solution of $(y+z)p + (z+x)q = x + y$.

b) Express $f(x) = \frac{1}{2}(\pi - x), 0 < x < 2\pi$ as a Fourier series with period 2π to be valid in the interval o to 2π.

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