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 2016
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 $A=\begin{bmatrix}5 & 3\\ 1 & 3\end{bmatrix}$
3. Find the nth derivative of $cos^3 x$.
4. If $xy = ae^x + be^{-x}$. Prove that $x\frac{d^2y}{dx^2}+2\frac{dy}{dx}-xy=0$.
5. Define Beta function and Gamma function.
6. Find $\Gamma\ \frac{1}{2}$.
7. Solve $p = y^2q^2$.
8. Solve the equation $p + q = x + y$.
9. Define Fourier Series.
10. Find a_0 for the fourier expansion of $f\ x\ = x$ in the interval $-\pi < x < \pi$.

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

11. Calculate A^4 when $= \begin{matrix}-1 & 3\\ -1 & 4\end{matrix}$.
12. Find the eigen values and eigen vectors of the Matrix $\begin{bmatrix}5 & 1 & -1\\ 1 & 3 & -1\\ -1 & -1 & 3\end{bmatrix}$.
13. If $y = \left(x + \sqrt{1+x^2}\right)^m$ Prove that $(1+x^2)\frac{d^2y}{dx^2}+x\frac{dy}{dx}-m^2y=0$.
14. Evaluate $\int \frac{dx}{(x-1)\sqrt{5x-2-2x^2}}$.
15. Using recurrence formula of Gamma function prove that $\Gamma\ n+1\ = n!$
16. Solve $p^2 + q^2 = x + y$.
17. Express $f(x)=\frac{1}{2}(\pi - x)$ as a fourier series with period 2π to be valid in the interval 0 to 2π.

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SECTION – C (2 X 20 = 40)
ANSWER ANY TWO QUESTIONS

18. a. Diagonalize the matrix $\begin{bmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{bmatrix}$.

b. Evaluate $\int \sqrt{(x-3)(7-x)}\ dx$.

19. a. Prove that $m,n = \frac{\Gamma m\ \Gamma n}{\Gamma(m+n)}$.

b. Solve $x^2 \frac{\partial z}{\partial x} + y^2 \frac{\partial z}{\partial y} = (x+y)z$.

20. a. If $f(x) = -x$ in $-\pi < x < 0$.

$= x$ in $0 < x < \pi$. Expand $f(x)$ as a fourier series in the interval $-\pi$ to π.

Deduce that $\frac{\pi^2}{8} = 1 + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \ldots$

b. Find a Coine series in the range 0 to π for

$f(x) = x \qquad 0 < x < \frac{\pi}{2}$

$= \pi - x \qquad \frac{\pi}{2} < x < \pi.$

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