STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086
(For candidates admitted during the academic year 2011 – 12 & thereafter)

SUBJECT CODE : 11MT/AC/MP14

B. Sc. DEGREE EXAMINATION, NOVEMBER 2013
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 Caylay – Hamilton theorem
2. Find the characteristic equation of $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$
3. Find the nth derivate of $\sin 2x\, cosx$.
4. Find the partial differential coefficients of $u = sin\,(ax + by + cz)$
5. Evaluate $\int \frac{\left(1+\sqrt{x}\right)^n}{\sqrt{x}} dx$
6. Evaluate $\int \cos^2 2x\, dx$
7. Evaluate $\int \sqrt{x^2+2x+10}\, dx$
8. Evaluate $\int \frac{dx}{(x+1)\sqrt{1-x^2}}$
9. Integrate : $logx$
10. Evaluate $\int_0^{\frac{\pi}{2}} sin^2x\, dx.$

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

11. Find all the eigenvalues and eigenvectors of the matrix
$\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$
12. Verify Cayley Hamilton theorem for the matrix $\begin{bmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{bmatrix}$

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

14. If $r^2 = x^2 + y^2$ then show that $\frac{\partial^2 r}{\partial x^2} + \frac{\partial^2 r}{\partial y^2} = \frac{1}{r}\left[\left(\frac{\partial r}{\partial x}\right)^2 + \left(\frac{\partial r}{\partial y}\right)^2\right]$

15. Evaluate $\int (\sin x)^{\frac{5}{2}} \cos^3 x \, dx$

16. Evaluate $\int \frac{3x+1}{2x^2 - x + 5} dx$

17. Evaluate $\int \sqrt{\frac{5-x}{x-2}} \, dx$

SECTION – C **(2 X 20 = 40)**

ANSWER ANY TWO QUESTIONS

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

19. (i) *If* $u = \sin^{-1}\left(\frac{x^2 + y^2}{x + y}\right)$, *show that* $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \tan u.$

(ii) If $y = a\cos(\log x) + b\sin(\log x)$ prove that
$x^2 y_{n+2} + (2n+1)\, x y_{n+1} + (n^2 + 1)\, y_n = 0$ (10 + 10)

20. (i) Evaluate $\int \frac{dx}{(x-1)\sqrt{x^2 + 2x - 8}}$

(ii) Evaluate $\int_0^{\frac{\pi}{2}} \log(\sin x)\, dx$ (10 + 10)

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