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

SUBJECT CODE : 11MT/AC/MC14

B. Sc. DEGREE EXAMINATION, NOVEMBER 2014
BRANCH IV - CHEMISTRY
FIRST SEMESTER

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

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

1. Find the eigen values of $\begin{pmatrix} a & h & g \\ 0 & b & 0 \\ 0 & 0 & c \end{pmatrix}$.
2. State Cayley Hamilton Theorem.
3. Solve the equation $x^3 - 12x^2 + 39x - 28 = 0$ whose roots are in A.P.
4. Find the 3 roots of the equation if one root is $\sqrt{2} + \sqrt{5}$.
5. Find the n^{th} derivative of e^{ax}.
6. Find $\frac{dy}{dx}$ if $x = at^2; y = 2at$.
7. If $u = (x - y)(y - z)(z - x)$. Show that $\frac{\partial u}{\partial X} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$.
8. If $u = \log r, r^2 = (x - a)^2 + (y - b)^2$. Find $\frac{\partial u}{\partial x}$.
9. Integrate $3x^3 + 7x^2 - 2x + 1$ with respect to x.
10. Integrate $\tan x$ with respect to x.

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

11. Show that the matrix $A = \begin{pmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$ satisfies the Cayley Hamilton Theorem.
12. Find the characteristic vectors of the matrix $A = \begin{pmatrix} 1 & 2 & 3 \\ 0 & 2 & 3 \\ 0 & 0 & 2 \end{pmatrix}$.
13. Show that $2p^3 - 9pq + 27r = 0$ if the roots of the equation $x^3 + px^2 + qx + r = 0$ are in A.P.
14. Solve the equation $x^4 - 11x^2 + 2x + 12 = 0$ given that $\sqrt{5} - 1$ is a root.
15. Find the n^{th} derivative of $cos^4 x$.
16. (i) If $V = x^3 + y^3 + x^3 - 3xyz$ prove that $x \frac{\partial V}{\partial x} + y \frac{\partial V}{\partial y} + z \frac{\partial V}{\partial z} = 3V$

    (ii) If $r^2 = x^2 + y^2$ show that $\frac{\partial^2 r}{\partial x^2} + \frac{\partial^2 r}{\partial y^2} = \frac{1}{r}$.
17. Evaluate $\int \frac{e^x}{e^{2x} + 3e^x + 2}\, dx$.

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SECTION – C **(2 X 20 = 40)**

ANSWER ANY TWO QUESTIONS

18. Show that the matrix $\begin{pmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{pmatrix}$ is diagondizable.

19. a) Solve the equation $x^4 - 4x^3 - 17x^2 + 24x + 36 = 0$ given that the products of two of the roots is 12.

b) If $y = e^{a\sin^{-1}x}$, show that $(1 - x^2)y_2 - xy_1 - a^2y = 0$. (10+10)

20. (i) Prove $\int_{-a}^{a} f(x)dx = 2\int_{0}^{a} f(x)dx$ if $f(x)$ is an even function

$\int_{-a}^{a} f(x)dx = 0$ if $f(x)$ is an odd function

(ii) Evaluate $\int \frac{2x+2}{\sqrt{x^2+4x+7}}\ dx$ (12+8)

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