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 2012
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. Show that the characteristic equations of a square matrix and its transpose are identical.
2. State Cayley Hamilton theorem.
3. One of the roots of the equation $3x^5 - 4x^4 - 42x^3 + 56x^2 + 27x - 36 = 0$ is $\sqrt{2} + \sqrt{5}$. Find the other roots.
4. If α, β, γ are the roots of the equation $x^3 + qx + r = 0$ then find $\sum \alpha^2$.
5. Differentiate $\tan^{-1}(\log x)$ with respect to x.
6. Find the n^{th} differential coefficient of $e^x \sin x$.
7. Find $\frac{dy}{dx}$ when x and y are connected by the relation $x^2 + y^2 = a^2$.
8. Find the partial differential coefficient of $u = \log(x^2 + y^2 + z^2)$.
9. Evaluate $\int \tan^2 x \, dx$.
10. Evaluate $\int \frac{x^2}{1 - x^3} dx$.

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

11. Verify that the matrix $A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & -1 \\ 3 & -1 & 1 \end{bmatrix}$ satisfies its characteristic equation and find A^{-1}.
12. Given $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ express $A^5 - 4A^4 - 7A^3 + 11A - A - 10I$ as a polynomial in A and hence evaluate.
13. Solve the equation $x^4 - 8x^3 + 7x^2 + 36x - 36 = 0$ given that the product of two roots is equal in magnitude but opposite in sign to the product of the other two.

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14. If $x^y = y^x$, prove that $\frac{dy}{dx} = \frac{y(y - x\log y)}{x(x - y\log x)}$.

15. a) Find $\frac{du}{dx}$ when $u = xyz, x = e^{-t}, y = e^{-t}\sin^2 t, z = \sin t$.

b) Find y_n when $y = \frac{x+1}{(2x-1)(2x+3)}$.

16. If $V = f\left(\frac{x}{z}, \frac{y}{z}\right)$ prove that $x\frac{\partial V}{\partial x} + y\frac{\partial V}{\partial y} + z\frac{\partial V}{\partial z} = 0$.

17. Prove that $\int_0^{\pi/4} \log(1+\tan\theta)d\theta = \frac{\pi}{8}\log 2$.

SECTION – C **(2 X 20 = 40)**

ANSWER ANY TWO QUESTIONS

18. Diagonalise $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$.

19. a) Solve the equation $x^4 + 2x^3 - 4x^2 - 22x + 40 = 0$ given that its roots are in A.P.

b) If $\alpha, \beta, \gamma, \delta$ are the roots of the equation $x^4 + px^3 + qx^2 + rx + s = 0$ then find $\sum(\beta + \gamma + \delta)^2$.

20. a) If $y = \left(x + \sqrt{1+x^2}\right)^m$ show that $(1+x^2)y_2 + xy_1 - m^2 y = 0$.

b) Evaluate $\int \frac{2x+3}{x^2+x+1}dx$.

c) Evaluate $\int \frac{1}{(1+e^x)(1+e^{-x})}dx$.

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