B. Sc. DEGREE EXAMINATION, NOVEMBER 2012
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 theorem.

2. Define similar matrices.

3. Find the n$^{\text{th}}$ derivative of $\log(ax + b)$.

4. If $U = e^{xyz}$ find the value of $\dfrac{\partial^2 u}{\partial y \partial z}$.

5. Evaluate $\int (2x + 1)^3 \ dx$.

6. Evaluate $\int \dfrac{dx}{16 - x^6} \ dx$.

7. Evaluate $\int \dfrac{x^5}{a^6 + x^6} \ dx$.

8. Evaluate $\int \sqrt{x^2 + 2x + 5} \ dx$.

9. Evaluate $\int x^2 \sin 2x \ dx$.

10. Evaluate $\int_0^{\pi/2} \dfrac{\sin x}{\sin x + \cos x} \ dx$.

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

11. Find the eigen values and eigen vectors of the matrix $A = \begin{pmatrix} 4 & 1 \\ 3 & 2 \end{pmatrix}$.

12. Verify Cayley-Hamilton theorem for $A = \begin{pmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{pmatrix}$. Hence find its inverse.

13. If $y = a \cos(\log x) + b \sin(\log x)$ show that $x^2 y_2 + xy_1 + y = 0$ and
    $x^2 y_{n+2} + (2n + 1)xy_{n+1} + (n^2 + 1)y_n = 0$.

14. Find n^{th} derivative of $\dfrac{x^2 - 4}{(x+1)(x+4)}$.

15. Evaluate (i) $\int sec^2 x(1 - \tan x)^n \, dx$

     (ii) $\int \frac{\cos x}{1+\cos x} \, dx$

16. Evaluate $\int (3x - 5)\sqrt{2x^2 - 4x + 5} \, dx.$

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

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

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18. Diagonalize the matrix $\begin{pmatrix} 1 & 1 & 1 \\ 0 & 2 & 1 \\ -4 & 4 & 3 \end{pmatrix}.$

19. (i) If $u = \log(x^2 + y^2 + z^2)$ prove that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = \frac{2}{x^2+y^2+z^2}.$

     (ii) If $y = \left(x + \sqrt{1 + x^2}\right)^m$ show that

        $(1 + x^2)y_{n+2} + (2n + 1)xy_{n+1} + (n^2 - m^2)y_n = 0.$ (10+10)

20. (i) Evaluate $\int \frac{3x+1}{2x^2-x+5} \, dx.$

     (ii) Evaluate $\int \frac{3x-4}{3x^2+4x+7} \, dx$ (10+10)

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