SUBJECT CODE : 15MT/AC/MP15

**B. Sc. DEGREE EXAMINATION, NOVEMBER 2015**
**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.  If 2 and 3 are the eigen values of $A = \begin{pmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{pmatrix}$, find the eigen values of $A^{-1}$ and $A^{3}$.

2.  Use Cayley-Hamilton theorem to find the inverse of $A = \begin{bmatrix} 7 & 3 \\ 2 & 6 \end{bmatrix}$

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

4.  Differentiate with respect to x: $\log \operatorname{sech}(7x)$

5.  Form the partial differential equation by eliminating the arbitrary function from $z = f(x^2 - y^2)$

6.  Find the complete integral of $(1 - x)p + (2 - y)q = 3 - z$

7.  Prove that $\beta(m, n) = \beta(n, m)$.

8.  Prove $\Gamma(n + 1) = n!$ using the recurrence formula

9.  Define Periodic Function and give an example with period $2\pi$

10. Find $a_0$ of the Fourier series for $f(x)$ where $f(x) = |x|$ in $(-\pi, \pi)$

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

11. Verify Cayley-Hamilton theorem for the matrix $A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 1 & -1 \end{pmatrix}$ and hence find $A^3$

12. Find $y_n$ where $y = \dfrac{x^2}{(x-1)^2(x+2)}$

13. Evaluate $\int \dfrac{dx}{(3+x)\sqrt{x}}$.

14. Solve $p^2 + pq = z^2$   .

15. Write down the relation between beta and gamma functions and hence deduce $\Gamma\left(\frac{1}{2}\right)$.

16. Express $\int_0^1 x^m(1 - x^n)^p dx$ in terms of Gamma functions and evaluate the integral $\int_0^1 x^3(1 - x^2)^9 dx$

17. Prove that for $-\pi < x < \pi$, $\dfrac{x(\pi^2 - x^2)}{12} = \dfrac{\sin x}{1^3} - \dfrac{\sin 2x}{2^3} + \dfrac{\sin 3x}{3^3} \dots$

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

18. a)State and prove Cayley-Hamilton theorem

  b) Find the eigen values and eigen vectors of $\begin{pmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{pmatrix}$.                   (10+10)

19. a) If $y = sin(m\ sin^{-1}x)$ show that $(1 - x^2)y_2 - xy_1 + m^2y = 0$.

  b) (i) Evaluate $\int \frac{dx}{(x+1)\sqrt{x^2+x+1}}$          (ii) $\int_0^{\frac{\pi}{2}} sin^7\theta cos^5\theta\ d\theta$          (7+7+6)

20. (a) Solve $px + qy = z$

  (b) Show that $(\pi - x)^2 = \frac{\pi^2}{3} + 4\sum_{n=1}^{\infty}\frac{cos\ nx}{n^2}$ in the interval $(0,2\pi)$. Hence show that

  $1 + \frac{1}{2^2} + \frac{1}{3^2} + \cdots = \frac{\pi^2}{6}$          (8+12)

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