LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **PHYSICS**

FIRST SEMESTER – **NOVEMBER 2016**

16UMT1AL01 – MATHEMATICS FOR PHYSICS - I

Date: 09-11-2016 Dept. No. Max. : 100 Marks

Time: 01:00-04:00

Part A

Answer all Questions: **(10 x 2 = 20)**

1. Write the nth derivative of $y = sin(ax + b)$.
2. Show that the parabola $y^2 = 4ax$, the sub tangent at any point is double the abscissa and the subnormal is constant.
3. Define D' Alembert's ratio test.
4. Write the expansion of $log(1-x)$.
5. Find the value of $L^{-1}\left[\frac{1}{s(s+a)}\right]$.
6. Find $L\,[t^2 + 2t + 3]$.
7. Define Skew Hermitan Matrix with example.
8. Find characteristic equation of $A = \begin{bmatrix} 1 & 2 \\ -3 & 4 \end{bmatrix}$
9. What is the chance that the leap year selected at random will contain 53 Sundays?
10. Define Rank correlation.

Part B

Answer any FIVE questions: **(5 × 8 = 40)**

11. Find the angle of intersection of the coordinates $r = a\,(1 + cos\,\theta)$ and $r = b\,(1 - cos\,\theta)$.
12. Find Maxima minima of the function $2x^3 - 3x^2 - 36x + 10$.
13. Test the convergence of the series $\frac{1}{1.2.3} + \frac{3}{2.3.4} + \frac{5}{3.4.5} + \cdots + \infty$.
14. Find sum to infinity of the series $1 + \frac{3}{4} + \frac{3}{4}\frac{5}{8} + \frac{3}{4}\frac{5}{8}\frac{7}{12} + \ldots\ldots$
15. Find the transform of the rectangular wave whose function is given as:

$$f(x) = \begin{cases} 1, & 0 \le t \le b \\ -1, & b \le t \le 2b. \end{cases}$$

16. Find the value of $L^{-1}\left[\frac{s}{s^2+2s+5}\right]$.
17. Verify Cayley – Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$ and find A^{-1}.
18. The rank of the same 16 students in mathematics and physics are as follows. Two numbers with in the bracket denote the ranks of the student in mathematics and physics: (1,1), (2,10), (3,3),(4,4), (5,5), (6,7), (7,2), (8,6), (9,8), (10,11), (11,15), (12,9), (13,14), (14,12), (15,16), (16,13).Calculate the rank of the correlation co-efficient for the proficiencies of this group in mathematics and physics.

Part C

Answer any TWO questions: **(2 × 20 = 40)**

19. (a) Find the nth differential co efficient of $x^2 logx$.

(b) If $y = \left(x + \sqrt{1+x^2}\right)^m$ then prove that $(1+x^2)y'' + xy' - m^2 y = 0$ and $\left(1+x^2\right)y_{n+2} + (2n+1)xy_{n+1} + \left(n^2 - m^2\right)y_n = 0$.

(6 +14)

20. (a) Solve the equation $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + 5y = 4e^{-t}$ given y(0) =0 and y'(0) =0 using Laplace transforms.

(b) Evaluate $\int_0^\infty \frac{e^{-t} - e^{-2t}}{t} dt$.

(12+8)

21. (a) Find the Eigen values Eigen vectors of the matrix $\begin{pmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{pmatrix}$.

(b) Find the inverse of $A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{pmatrix}$.

(10+10)

22. (a) Calculate the mean and standard deviation for the following table giving the age distribution of 542 members:

Age in years	20-30	30-40	40-50	50-60	60-780	70-80	80-90
Number of members	3	61	132	153	140	51	2

(b) Sum the series $1 + \frac{1+3}{2!} + \frac{1+3+3^2}{3!} + \cdots + \infty$.

(10+10)

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