# I B.Sc (Physics)

## Algebra, Analytical Geometry 3D and Trignometry

### Section - A

1) Define Logarithmic Series
2) Use the binomial theorem to find the $7^{th}$ powers of 11.
3) Expand $a^x$ in ascending powers of 'a' being positive.
4) Find the Co-efficient of $x^n$ in the exponential of $e^{a+bx}$
5) Write the formula for binomial Series
6) Show that $\frac{e^2+1}{e^2-1} = \frac{1+1/2! + 1/4! + \cdots + \infty}{1+1/3! + 1/5! + \cdots + \infty}$
7) Define Exponential Series
8) Define Matrix
9) Define Row and Column matrix with example.
10) Find $A^{-1}$, $A = \begin{pmatrix} 2 & -3 \\ 1 & 3 \end{pmatrix}$
11) Write the properties of a Transpose Matrix
12) If $A = \begin{bmatrix} 2 & 5 \\ 6 & 7 \end{bmatrix}$, $B = \begin{bmatrix} -2 & 8 \\ -1 & 3 \end{bmatrix}$ find $2A+3B$
13) Define Cayley Thorem.
14) Define unit Matrix.

15) Define Sphere

16) Define Skewline

17) Find the equation of the sphere with the Centre $(-1/3, 2/3, 1/3)$

18) Find the Co-ordinates of the Centre and radius of the sphere $2x^2+2y^2+2z^2-2x+4y+2z-15=0$

19) Define Plane

20) Find the angle between the plane $2x-y+z=6$, $x+y+2z=3$

21) Write the Expansion of $\tan n\theta$ and $\cos n\theta$

22) P.T $\cos 5\theta = 16\cos^5\theta - 20\cos^3\theta + 5\cos\theta$

23) Write the expansion of $\sin\theta$, $\cos\theta$ & $\tan\theta$ in powers of $\theta$

24) Find the approximate value of $\theta$ in radius $\frac{\sin\theta}{\theta} = \frac{863}{864}$

25) P.T $\tan 7\theta = \dfrac{7\tan\theta - 35\tan^3\theta + 21\tan^5\theta - \tan^7\theta}{1 - 21\tan^2\theta + 35\tan^4\theta - 7\tan^6\theta}$

26) Euler's formula for all values of $\theta$ real or Complex
$e^{i\theta} = \cos\theta + i\sin\theta$

27) Write formula for $\sin\theta$ & $\cos\theta$ in terms of exponential function.

28) P.T $\cosh^2 x - \sinh^2 x = 1$

29) P.T $\cosh^2 x + \sinh^2 x = \cosh 2x$

30) Write the hyperbolic function of $\operatorname{Cosech} x$ and $\coth x$.

## Section - B



1) Write down the middle term in expansion of $\left(2x - 2/x\right)^{15}$

2) To Find Sum of the infinity of the series
$(1 + 1/2) + (1/3 + 1/4) \cdot 1/9 + (1/5 + 1/6) \cdot 1/9^2 + \cdots + \infty$

3) Prove that $\log\left(\frac{n+1}{n-1}\right) = \frac{2n}{n^2+1} + 1/3\left(\frac{2n}{n^2+1}\right)^3 + 1/5\left(\frac{2n}{n^2+1}\right)^5 + \cdots + \infty$

4) Sum of two infinity of the series
$1 + \frac{1+2}{2!} + \frac{1+2+2^2}{3!} + \cdots + \infty$

5) Sum of two infinity of the series
$5 + \frac{2 \cdot 6}{1!} + \frac{3 \cdot 7}{2!} + \frac{4 \cdot 8}{3!} + \cdots + \infty$

6) Prove that $\frac{e-1}{e+1} = \frac{1/2! + 1/4! + 1/6! + \cdots + \infty}{1 + 1/3! + 1/5! + \cdots + \infty}$

7) Find the Characteristic Equation for the matrix
$$A = \begin{pmatrix} 1 & 0 & 2 \\ 0 & 1 & 2 \\ 1 & 2 & 0 \end{pmatrix}$$

8) If $A = \begin{bmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$, S.T $A^3 - 3A^2 - A + 9I = 0$.

9) Verified Cayley's theorem for the matrix
$$A = \begin{pmatrix} 2 & 3 & 1 \\ 0 & 5 & 2 \\ 1 & 0 & 3 \end{pmatrix}$$

10) a) What is null matrix?

b) If $A = \begin{bmatrix} -3 & 5 & 6 \\ 1 & 3 & 2 \\ 6 & 7 & 8 \end{bmatrix}$ $B = \begin{bmatrix} -1 & -2 & -3 \\ 2 & 3 & 4 \\ 5 & 6 & 7 \end{bmatrix}$ find $A+B$, $A-B$

11) Find the equation of sphere which as Centre $(6,1,-2)$ and touches of the plane $2x-y+2z-2=0$

12) Find the equation of sphere whose centre is $(2,3,0)$ and which is posses to the point $(1,0,2)$

13) Find the equation of the sphere passing through four points and determine the radius $(0,0,0)$, $(a,0,0)$, $(0,b,0)$, $(0,0,c)$

14) Find the condition for the plane $lx+my+nz=p$ to be a tangent plane to this sphere $x^2+y^2+z^2=r^2$

15) Find the equation of the plane through the points $(1,-2,3)$ and the intersection of the plane $2x-y+4z=1$, $x+2y-3z+8=0$

16) Solve $\sin 5\theta = 5\sin\theta - 20\sin^3\theta + 16\sin^5\theta$

17) Solve $2^4\cos^5\pi = \cos 5\pi + 5\cos 3\pi + 10\cos\pi$

18) Solve $\cos^5\phi \sin^4\phi = \frac{1}{2^8}\left[\cos 9\phi + \cos 7\phi + 6\cos\phi - 4\cos 5\phi - 4\cos 3\phi + 6\cos\phi\right]$

19) Solve approximately values of $\theta$ in radius $\frac{\sin\theta}{\theta} = \frac{19493}{19494}$

20) Solve approximately $\cos\left(\pi/3+\theta\right) = 0.49$

21) Solve approximately $\frac{\tan\theta}{\theta} = \frac{2524}{2523}$

22) Prove that $\sinh^{-1}(x) = \log\left(x+\sqrt{x^2+1}\right)$

23) Prove that $\tanh^{-1}(x) = \frac{1}{2}\log\left(\frac{1+x}{1-x}\right)$

24) Prove that $\frac{1+\tanh x}{1-\tanh x} = \cosh 2x + \sinh 2x$.

25) If $\tan(a+ib) = x+iy$, Prove that $x/y = \frac{\sin 2a}{\sinh 2b}$

26) Prove that $u = \log(\pi/4 + \theta/2)$ if $\cosh u = \sec\theta$

## Section - C

1) Find the co-efficient of $x^6$ in expansion of $\left(ax^2 + \frac{1}{bx^2}\right)$

2) Find the Sum of two infinites of the series

$$S = \frac{4}{2.4} + \frac{4.5}{2.4.6} + \frac{4.5.6}{2.4.6.8} + \cdots + \infty$$

3) Find the Sum of infinity of the series

$$\frac{1^2}{1!} + \frac{1^2+2^2}{2!} + \frac{1+2^2+3^2}{3!} + \cdots + \infty$$

4) Sum of infinity of a series $1 + \frac{2^4}{2!} + \frac{3^4}{3!} + \frac{4^4}{4!} + \cdots + \infty$

5) Find the sum of two infinity of the series

$$S = \frac{1.3}{2.4.6.8} + \frac{1.3.5}{2.4.6.8.10} + \cdots + \infty$$

6) Find the eigen values and eigen vectors of the matrix

$$\begin{pmatrix} 2 & 0 & -1 \\ 0 & 2 & -2 \\ 1 & -1 & 2 \end{pmatrix}$$

7) Find the given matrix is Singular or non-Singular

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 4 & 5 \end{pmatrix}$$

8) Find $A^{-1}$ when $A = \begin{bmatrix} 3 & -1 & 1 \\ -5 & 6 & -5 \\ 5 & -2 & 2 \end{bmatrix}$

9) If $A = \begin{bmatrix} 1 & 3 & 2 \\ 2 & 0 & -1 \\ 1 & 2 & 3 \end{bmatrix}$ then P.T $A^3 - 4A^2 - 3A + 11I = 0$.

10) Verify Cayley Hamilton theorem, $A = \begin{bmatrix} 1 & -1 & 4 \\ 3 & 2 & -1 \\ 2 & 1 & -1 \end{bmatrix}$

11) Find the shortest distance between the lines $\frac{x-3}{3} = \frac{y-8}{-1} = \frac{z-3}{1}$ and $\frac{x+3}{-3} = \frac{y+7}{2} = \frac{z-3}{4}$

12) Find the Equation of sphere with the Centre
   i) $(-1, 2, 3)$ & radius 3 units
   ii) $(3, 4, 2)$ & radius 5 units
   iii) $(3, 1, 4)$ & radius 6 units

13) Find the Eqn of the sphere passing through the 4 points $(2,3,1)$, $(5,-1,2)$, $(4,3,-1)$ & $(2,5,3)$

14) Find the Condition that the plane $lx+my+nz=p$ if should be such that the sphere is $x^2+y^2+z^2+2ux+2vy+2wz+d=0$.

15) P.T $\frac{\sin 7\theta}{\sin\theta} = 7 - 56\sin^2\theta + 112\sin^4\theta - 64\sin^6\theta$

16) P.T $\sin^6\theta = \frac{-1}{2^5}\left[\cos^6\theta - 6\cos^4\theta + 15\cos^2\theta - 10\right]$

17) Expand $\cos^6\theta \sin^3\theta$ in a series of sin is multiple of $\theta$.

18) a) Solve approximately $\sin(\pi/2 + \theta) = 0.51$
   b) Solve approximately $\cos(\pi/3 + \theta) = 0.49$

19) S.T $\lim_{x \to 0} \frac{3 \sin x - \sin 3x}{x - \sin x}$ (7)

20) If $\cos(x+iy) = \cos\alpha + i\sin\alpha$, P.T $y = \frac{1}{2}\log\left[\frac{\sin(x-\alpha)}{\sin(x+\alpha)}\right]$

21) If $x+iy = \sin(A+iB)$, P.T $\frac{x^2}{\sin^2 A} - \frac{y^2}{\cos^2 A} = 1$.