S. S.R. DEGREE COLLEGE, (AUTONOMOUS)
I-SEMESTER INTERNAL ASSESSMENT-I EXAMINATIONS
Course: M.Sc. PHYSICS (Paper – I)
Mathematical physics and Numerical methods
QUESTION BANK

I. Multiple Choice Questions **5 Marks**

1. $X^2\left(\frac{d^2y}{dx}\right)^3+\left(\frac{dy}{dx}\right)^4 + Y^6 = 0$ and degree of above different equation is ( )

   a)1,2 b)2,2 c)3,2 d)2,3

2. The co- efficients as having odd suffixes in legendre polynomial are ( )

   a)0 b)1 c)2 d)None

3. In rodriguez formula N = $\frac{n-1}{2}$ is for ( )

   a)even 'n' b)odd 'n' c)both d)None

4. Bessel function of second kind Y_n (x) is also known as ( )

   a)Neumann's function b)Hermite function

   c) Legendre function d) None

5. The condition of orthogonality of bessel's function 'x' is taken over the interval (A)

   a)-1 to +1 b)o to 1 c)-1 to 0 d)1 to 2

6. In the equation of rodrigue's formula for hermite polynomial the value of n=2 is ( )

   a)1 b)2x c)$4X^2$-2 d)$8X^3$ -12x

7. The generating function of legendre polynomials is (B)

   a)e^{xt} b)$\frac{1}{\sqrt{1-2\,x\,t+t2}}$ c)e^{-x^2} d$(1+t)^X$

8. Poisson bracket of a variable with itself is always (B)

   a)1 b)0 c)∞ d)undefined

9. The differential equation $(1-X^2)$ y – 2xy + n(n+1) y = 0 is known as (C)

   a)Bessel's equation b)Hermite equation c)Legendra equation d)Laguerre equation

10. Hermite polynomials appear in (B)

    a) Free particle b)Harmonic oscillator

    c)Particle in a box d) Colomb potential

11. Legendra differential equation is defined for ( )

    a)|X|>| b)|X|≤ | c) only negative X d) only positive X

12. The laplace transform of 1 is (C)

    a)1 b)s c)1/s d)s^2

13. The laplace transform of e^{at} is (B)

a) 1/(S+a) b)1/(s-a) c)$\frac{a}{(S2+a2)}$ d)S/($S^2 + a^2$)

14. Integration in time domain corresponds to (B)

a)Multiplication by in b) Division by in

c)differentiation d)Convolution

15. If F(x) is real and even, its fourier transform is (A)

a)real and even b)real and odd

c) imaginary and even d)imaginary and odd

16. The inverse fourier transform is used to obtain (B)

a)frequenc spectrum b)time – domain function

c)Laplace transform d) Z transform

17. The Rodrigues formula for Hermite polynomials contains (B)

a)$(X2 - 1)^n$ b)e^{-x^2} c)Sin x d)lnx

18. Hermite polynomials are finite for (A)

a) all real x b)X =0 only c)X=± 1 d)X = 0,1

19. The degree of the legendre polynomial in pn(x) is (B)

a) (n-1) b)n c)n+1 d)2n

20. Legendre plynomicals are finite at X = ± 1 only for (C)

a)all real n b)half – intergar n c) integer n d) complex n

II. Fill In The Blanks 5 X 1 = 5 Marks

1. Legendre function of second kind is denoted by _____
2. In legendre polynomial the value of Pn(1) = _____
3. Bassel's equation is represented by _____
4. Bassel's function of second kind is represented by_____
5. The condition of orthogonality of Hermite polynomial is taken over interval_____
6. In the Hermite polynomial of degree 'n' the value of H1(X) is 2X
7. The value of H_O (X) is 1
8. Legendre polynomials are orthogonal with weight function 1
9. Frobenius method is used near a regular singular point
10. The term 'r' in frobenius series is determined from the indicial equation
11. Bassel functions of the second kind are called **Neumann** functions
12. Hermite polynomials satisfy a **Recurrence** relation
13. Hermite differential equation is solved using the **power series** method

14. Legendre polynomials are denoted by **pn(x)**
15. The Rodrigues formula contains the term $\mathbf{(X^2 - 1)^n}$
16. The fourier transform of the second derivatives of f(X) is $\mathbf{-W^2}$ f(w)
17. The fourier transform of δ(x) is **1**
18. Fourier transform of a constant function gives a **delta** function
19. The convolution theorem converts convolution into multiplication
20. The laplace transform of the first derivative f^{1-} (t) is **S f(s) – f (0)**

III. Answer any two of the following questions **2 X 5 = 10 Marks**

1. Obtain the power series solution of Bessel's differential equation.
2. Solve the hermite differential equation

   $$\frac{dy^2}{dx^2} - 2x\frac{dy}{dx} + 2xy = 0$$

3. Derive legendre's differential equation

   $$(1 - x^2)\frac{dy^2}{dx^2} - 2x\frac{dy}{dx} + n\,(n+1)\,y = 0$$

4. Define fourier transform of a function state and prove the properties of fouries transforms
5. Find $L^{-1}\left\{\frac{1}{5^2}\,(s^2 - a^2)\right\}$ using convolution theorem
6. Write properties of Laplace transforms