

Q: (1) The differential equation  $\frac{d}{dx} \{ (1-x^2) \frac{dy}{dx} \} + n(n+1)y = 0$  where  $n$  is a real number, is

(a) Legendre's differential equation (D.E.)

(b) Bessel's D.E.

(c) Chebyshev's D.E.

(d) None of these

Q: (2) The D.E.  $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + (n^2 - n^2)y = 0$

where  $n$  is a free constant is

(a) Chebyshev's D.E.

(b) Bessel's D.E.

(c) Hermite D.E.

(d) Legendre's D.E.

Q: (3) The value of  $P_n(1)$  is

(a) 0      ~~(c)~~ (b)

(b) -1      (d)  $P_n(-2)$

Q: (4) Generating function for  $P_n(x)$  is

(a)  $(1+2xh+h^2)^{-\frac{1}{2}}$

(b)  $(1-2hx+h^2)^{\frac{1}{2}}$

(c)  $(1-2hx+h^2)^{-\frac{1}{2}}$

(d)  $(1+2hx+h^2)^{\frac{1}{2}}$

Q: (5)  $P_n(x)$  is a

- (a) non-terminating series
- (b) oscillatory series
- ~~(c) terminating series~~
- (d) none of these

Q: (6)  $Q_n(x)$  is a

- (a) terminating series
- ~~(b) non-terminating series~~
- (c) oscillatory series
- (d) none of these

Q: (7) value of  $P_n(1)$  is

- |               |                                    |
|---------------|------------------------------------|
| (a) $-\infty$ | (c) 1                              |
| (b) 0         | <del>(d) <math>(-1)^n</math></del> |

Q: (8) value of  $P_3(x)$  is

- |                                                    |                              |
|----------------------------------------------------|------------------------------|
| <del>(a) <math>\frac{1}{2}(5x^2 - 3x)</math></del> | (c) $\frac{1}{3}(3x - 5x^2)$ |
| (b) $5x^2 - 3x$                                    | (d) $\frac{1}{2}(3x^2 - 1)$  |

Q: (9)  $\int_{-1}^1 P_m(x) P_n(x) dx = 0$  if

- |                                      |                       |
|--------------------------------------|-----------------------|
| (a) $m=n$                            | (c) $m=n=1$           |
| <del>(b) <math>m \neq n</math></del> | (d) $m \neq n \neq 1$ |

Q: (10) All the roots of  $P_n(x)$  are

- |                    |                                        |
|--------------------|----------------------------------------|
| (a) Imaginary      | <del>(c) real and lies between -</del> |
| (b) real and equal | (d) none of these                      |

Q: (11) The value of  $J_0(0)$  is

(a) 0      ~~(c)~~ 1

(b) -1      (d) None of these.

Q: (12) The Rodrigues formula for Legendre polynomial  $P_n(x)$  is given by

~~(a)~~ 
$$P_n = \frac{1}{n! 2^n} \cdot \frac{d^n}{dx^n} (x^2 - 1)^n$$

~~(b)~~ 
$$P_n(x) = \frac{n!}{2^n} \cdot \frac{d^n}{dx^n} (x^2 - 1)^{n-1}$$

~~(c)~~ 
$$P_n(x) = \frac{n!}{2^{n-1}} \cdot \frac{d^n}{dx^n} (x^2 - 1)^{n-1}$$

~~(d)~~ 
$$P_n(x) = \frac{1}{n! 2^n} (x^2 - 1)^n$$

Q: (13) The polynomial  $2x^3 + x + 3$  in terms of Legendre polynomials is

~~(a)~~ 
$$\frac{1}{3}(4P_2 - 3P_1 + 11P_0)$$

~~(b)~~ 
$$\frac{1}{3}(4P_2 + 3P_1 - 11P_0)$$

~~(c)~~ 
$$\frac{1}{3}(4P_2 + 3P_1 + 11P_0)$$

~~(d)~~ 
$$\frac{1}{3}(4P_2 - 3P_1 - 11P_0)$$

Q: (14)  $J_{1/2}(x)$  is given by

~~(a)~~ 
$$\sqrt{\frac{2\pi}{n}} \sin x$$

~~(c)~~ 
$$\sqrt{\frac{\pi}{2n}} \cos x$$

~~(b)~~ 
$$\sqrt{\frac{2\pi}{n}} \cos x$$

~~(d)~~ 
$$\sqrt{\frac{2}{\pi n}} \sin x$$

Q. (15) The series  $1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$  equals

(a)  $\sin x$     ~~(c)  $e^x$~~

(b)  $\cos x$     (d)  $\tan x$

Q. (16) The method which gives solution of the form of power series is called

(a) Logarithmic method

(b) Laplace method

~~(c) Power Series method~~

(d) Linear method

Q. (17) Power series method is the standard method for solving linear ODEs with

(a) constant coefficients

(b) logarithmic coefficients

(c) string coefficients

~~(d) variable coefficients~~

Q. (18) Two power series can multiplied

(a) over lapping

~~(b) term by term~~

(c) randomly

(d) exponentially

Q. (19)  $J_{-1/2}(x)$  is given by

- (a)  $\sqrt{\frac{2}{\pi x}} \sin x$       (c)  $\sqrt{\frac{2}{\pi x}} \cos x$   
 (b)  $\frac{2}{\pi x} \cos x$       (d)  $\sqrt{\frac{2}{\pi x}} \tan x$

Q. (20) The general solution of Bessel's equation  
is \_\_\_\_\_

- (a)  $A J_n(x) + B J_n'(x)$   
 (b)  ~~$A J_n(x) + B J_{-n}(x)$~~   
 (c)  $A J_n(x) - B J_n'(x)$   
 (d)  $A J_n(x) - B J_{-n}(x)$

Q. (21) The power series formulae be

- (a)  $\sum_{n=0}^{\infty} c_n (x+x_0)^n$       (c)  $\sum_{n=1}^{\infty} c_n (x-x_0)^n$   
 (b)  $\sum_{n=0}^{\infty} c_n (x-x_0)^n$       (d)  ~~$\sum_{n=0}^{\infty} c_n (x-x_0)^n$~~

Q. (22) A point  $x=x_0$  is called an ordinary point of the D.E. If

- (a) Both  $P(n)$  &  $Q(n)$  are not analytic at  $x_0$ .

~~(b) Both  $P(x)$  &  $Q(x)$  are analytic at  $x_0$ .~~

(c)  $P(n)$  is analytic at  $x_0$ .

(d)  $Q(n)$  is analytic at  $x_0$ .

Q. (Q3) A point  $x_0$  is said to be a singular point if

- (a) Both  $P(n)$  &  $Q(n)$  are analytic  
(b)  $P(n)$  are analytic  
~~(c) Both  $P(n)$  and  $Q(n)$  are not analytic~~  
(d) None of these

Q. (Q4)  $[J_{1/2}(n)]^2 + [J_{-1/2}(n)]^2 =$

(a)  $\frac{2}{\sqrt{\pi n}}$       (c)  $\frac{2^n}{\pi}$

(b)  $\frac{2\pi}{n}$       ~~(d)~~  $\frac{2}{\pi n}$

Q. (Q5) The polynomial  $4x^3 + 6x^2 + 7x + 2$  has terms of Legendre polynomials. If

(a)  $\frac{8}{5}P_3(x) + 4P_2(x) + \frac{47}{5}P_1(n) + 4P_0(n)$

(b)  $\frac{8}{7}P_3(x) + P_2(x) + \frac{27}{5}P_1(n) + 3P_0(n)$

(c)  $\frac{2}{7}P_3(x) + 5P_2(x) + \frac{23}{5}P_1(n) + 5P_0(n)$

(d) None of these