

A-1038

Total Pages : 3

Roll No.

MT-508

M.A./M.Sc. Mathematics (MAMT/MSCMT)

Special Functions

Examination, 2026 (Feb.)

Time : 2:00 Hrs.

Max. Marks : 70

Note :- This paper is of Seventy (70) marks divided into Two (02) Sections 'A' and 'B'. Attempt the questions contained in these Sections according to the detailed instructions given therein. *Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.*

Section-A

Long Answer Type Questions $2 \times 19 = 38$

Note :- Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any *two* (02) questions only.

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(1)

P.T.O.

1. Explain the method of Frobenius for solving a second order linear differential equation near a regular singular point. Discuss the different cases arising from the indicial equation and obtain the general series solution.
2. Write detailed notes on any two of the following:
 - (a) Bessel functions $J_n(x)$ and their recurrence relations
 - (b) Hermite polynomials $H_n(x)$ and generating function
 - (c) Laguerre and Associated Laguerre polynomials
3. Solve the differential equation :

$$\Rightarrow x^2 + xy' + (x^2 - 1)y = 0$$

by the method of Frobenius about the point $x = 0$.
Obtain two linearly independent solutions.

4. Solve the differential equation :

$$xy'' + (2 - x)y' - y = 0$$

and express the solution in terms of Kummer's-confluent hypergeometric function.

5. Solve :

$$x^2y'' + xy' + (x^2 - 4)y = 0$$

and obtain the solution in terms of Bessel functions $J_2(x)$.

Section–B

Short Answer Type Questions 4×8=32

Note :- Section ‘B’ contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *four* (04) questions only.

1. State any two properties of hypergeometric functions.
2. Define Legendre polynomial and write the first three polynomials.
3. Define Hermite polynomials and write their generating function.
4. Write the integral representation of the confluent hypergeometric function.
5. Prove that :

$$P_n(1) = 1 \text{ and } P_n(-1) = (-1)^n$$

6. Find the series solution of Bessel's equation of order zero up to x^4 .
7. Using the generating function, obtain $H_2(x)$.
8. Define Associated Laguerre polynomials and mention one important property.
