

- Part A: Introduction			
Program: Bachelor in Science (Degree/Honors)		Class: B.Sc. Sem. VI	Year: 20224 Session:2024-2025
1	Course Code	MSE-5	
2	Course Title	Special Functions	
3	Course Type	Discipline Specific Elective (DSE)	
4	Course Learning Outcome (CLO)	<p>This Course will enable the students to:</p> <ul style="list-style-type: none"> ➤ Find power series solutions of ordinary differential equations. ➤ Solve Legendre equation and write the Legendre equation of first kind, also find the generating function for Legendre Polynomials, understand the orthogonal properties of Legendre Polynomials. ➤ Solve Bessel equation and write the Bessel equation of first kind of order n, also find the generating function for Bessel function understand the orthogonal properties of Bessel function. ➤ List the Laplace transforms of some standard functions, understand Find the Inverse Laplace Transforms of functions and implement it in Convolution theorem and Heaviside theorem. 	
5	Credit Value	Theory & Tutorial: 4	
6	Total Marks	Maximum Marks : 100 (Ext. 80 + Int. 20)	Minimum Passing Marks:40

Part B: Content of the Course		
UNIT	Topics	No. of Hours
I	Power series solutions of ordinary differential equations: Introduction of power series solutions of ordinary differential equation , Ordinary and singular points, regular and irregular singular points, power series solution.	15
II	Legendre polynomials and functions: Definition, Solution of Legendre's equation, Legendre functions of the first and second kind, Generating functions(first formula), Rodrigue formula for $P_n(x)$, Orthogonality of Legendre polynomials, Recurrence relations for $P_n(x)$, Beltrami's result, Christoffel expansion, Christoffel's summation formula, Relation between $P_n(x)$ and $Q_n(x)$, Laplace first and second integrals for Legendre polynomials.	15
III	Bessel Functions: Bessel's equation and its solution, Properties of Bessels functions Recurrence relations, Generating function, Orthogonality of Bessel's functions Integral representations of Bessel function, Integrals involving Bessel's functions. Sturm liouville's Problem	15
IV	Laplace Transform and Inverse Laplace Transform: The Laplace Transform Definition, Existence of Laplace Transforms, Functions of exponential order, Laplace of some elementary functions, Shifting theorems, change of scale property, Initial and final value theorems, Laplace Transform of the derivative of $F(t)$, n th derivative of $F(t)$, Laplace transform of integrals, Multiplication by powers of t & division by t . Inverse Laplace Transform, linearity property, First and second translation theorems , Change of scale property, Use of partial fractions, Inverse Laplace transforms of derivatives & integrals, Division by powers of p , Heavisides expansion theorem, Convolution theorem..	15

Part C - Learning Resource

Text Books, Reference Books, Other Resources

1. R.K Saxena, D.C.Gokhroo, *Special Functions*, Jaipur Publishing House, 2014.
2. Pathan, VBL.Chaurasia, J. Banerji, S.P.Goyal, *Special Functions and Calculus of Variations*, RBD, Jaipur, 2004.
3. E. D. Rainville, *Special Functions*, Macmillan, New York, 1989.
4. I.N.Sneddon, *Special Functions*, Mc-Graw Hill, New Delhi, 1956.
5. N.N.Lebedev, Richard A.Silverman, *Special Functions and Their Application*, Dover Publications INC, 1972.
6. Z.X. Wang & Guo, *Special Functions*, World Scientific books, 1989.
7. G.E. Andrews, Askey, Roy, *Special Functions*, Cambridge University, 2000.
8. Dr.M.D.Raisinghania, *Ordinary and Partial Differential Equations*, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.
9. J.N.Sharma and Dr.R.K.Gupta, *Differential equations with special functions*, Krishna Prakashan Mandir.
10. Erwin Kreyszig, *Advanced Engineering Mathematics*, 8th edition, Authorized reprint by Wiley Dreamtech India

E-resources: <https://onlinecourses.nptel.ac.in>
<https://epqp.inflibnet.aci.in>
<https://swayam.gov.in>
<https://www.mooc.org>

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks
Continuous Comprehensive Evaluation (CCE): 20 Marks
Semester End Exam (SEE): 80 Marks

Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test -02 of 10 Marks each Assignment/Seminar-01 Of 10 Marks	Better marks out of two test + obtained marks in Assignment shall be considered against 20 marks
Semester End Exam (SEE)	Paper-Two Section-A&B Section-A: Objective and short answer type question-1x10+3x10= 40 Marks Section-B: Descriptive answer type question Module wise- 10x4 =40 Marks	

Amendment or Modification shall may be made by course coordinator as per situation or directed by the department/Examination cell/NEP-20 Scheme coordinator

Name and signature of convener & member of BOS:

