

Devi Ahilya University, Indore, India Institute of Engineering & Technology				MSc – I Year (<u>Applied Mathematics</u>) with Specialization in Computing & <u>Informatics</u>				
				Semester- I				
Subject Code & Name		Instructions Hours per Week		Credits				
AM1GE2: Advanced Special Functions		L	T	P	L	T	P	Total
		3	1	-	3	1	-	4
Duration of Theory Paper: 3 Hours								

Objective: To study mathematical functions which are useful in mathematical analysis, physics, engineering fields and so on.

Prerequisites: Nil.

COURSE OF CONTENTS

UNIT I

Orthogonal polynomials: Simple set, orthogonal set, orthogonal polynomials, zeros of orthogonal polynomials.

The Gamma and Beta functions: Gamma function, Euler or Mascheroni constant γ , a series for $\Gamma'(z)/\Gamma(z)$, the Euler product for $\Gamma(z)$, Beta function, the value of $\Gamma(z)\Gamma(1-z)$, Factorial function, Gauss multiplication theorem, Legendre's duplication formula.

UNIT II

The Hyper geometric functions: A simple integral form, evaluation of $F(a, b, c, 1)$, the contiguous function relations, the hyper geometric differential equations, simple transformations.

Generalized Hyper geometric functions: The function ${}_2F_1$, Saalschutz's theorem, Whipple's theorem, Dixon's theorem, Confluent Hyper geometric function, basic properties of ${}_1F_1$, Kummer's theorems, Ramanujan's theorem.

UNIT III

Bessel's functions: Definition of $J_n(x)$, generating function, Bessel's differential equation, recurrence relations, Bessel's integral.

Legendre's Polynomial: Generating functions for Legendre's polynomials, recurrence relation, Rodrigue's formula, Murphy's formula, hyper geometric forms of $P_n(x)$, Bateman's generating function, Laplace's first integral form, orthogonality.

UNIT IV

Hermite polynomials: Hermite differential equation, definition of Hermite polynomials $H_n(x)$, generating functions, Rodrigue's formula, recurrence relation, orthogonality, expansion of polynomials, more generating functions.

Laguerre Polynomials: Laguerre polynomials $L_n(x)$, generating functions, Rodrigue's formula, recurrence relations, orthogonality, expansion of polynomials.

UNIT V

Chebyshev polynomial: Independent solution of Chebyshev's equation, generating function, recurrence relations, orthogonal properties.

Jacobi polynomial: Jacobi polynomials, Batemans generating function, Rodrigue's formula, orthogonal properties.

BOOKS RECOMMENDED:

[1] Rainville, E.D., Special functions, the Macmillan Co., New York 1971.

[2] Saran, N., Sharma S.D., Trivedi T.N., Special Functions, Pragati Prakashan, 1982.

[3] Labder N.N., Special functions and their applications, Prentice Hall, New Jersey, USA, 1995.