**Course Objective:**

The objective of the course is to study some important special functions and thereby to study a variety of different methods for discovering the properties of such functions.

| Special Functions (18BSM 506) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Teaching Scheme | | | | | Examination Scheme | | | | | |
| L | T | P | C | Hrs/Week | Theory | | | Practical | | Total Marks |
| | | | | | MS | ES | IA | LW | LE/Viva | |
| 3 | 1 | -- | 4 | 4 | 25 | 50 | 25 | -- | -- | 100 |

**UNIT I** **9 hours**

Ordinary and singular points: Definitions, Series solutions of differential equations: Power series solution in powers of $(x-x_0)$. Series solution about regular singular point $x=0$, Frobenius method.

**UNIT II** **10 hours**

Bessel equation and its solution, Bessel function of first and second kind of order *n*. Recurrence relations, Generating function, Orthogonalityof Bessel's function.

**UNIT III** **10 hours**

Legendre equation and its solution. Legendre's polynomial of degree *n*. Recurrence relations, orthogonal properties of Legendre's polynomial.Rodrigue's formula. Legendre's polynomial of second kind.

**UNIT IV** **10 hours**

Hermite Polynomial, Laguerre Polynomial and Chebyshev polynomial and their orthogonal properties. Hypergeometric functions and their properties.

**APPROXIMATE TOTAL 39 Hours**

**Text and Reference books**


1. M.D. Raisinghania, Advanced differential equations, S Chand, (19th edition)
2. L.C. Andrews ,Special Functions of Mathematics for Engineers, SPIE Press, 1992.
3. L.J. Slater,Generalized Hypergeometric Functions , Cambridge University Press; Reissue edition ,2008.
4. Z. X. Wang and D. R. Guo, Special Functions, World Scientific publishing Co., 1989.
5. Gabor Szego, Orthogonal Polynomials, American mathematical society, 1939.
6. L. Debnath, Integral transforms and their Applications, CRC Press, New YorkLondon-Tokyo, 1995.
7. Mathematical Methods for Physics George B. Arfken and Hans J. Weber, Academic Press, INC(Forth Edition)

**Course Outcomes:** After completion of this course, student will be able to

- Understand the infinite product and properties of Beta and Gamma functions
- Analyze the properties of Hypergeometric functions.
- Perform operations with Bessel, Hermite and Legendre differential equations along with the corresponding recurrence formulas of different functions.
- Demonstrate their understanding of how physical phenomena are modeled using special functions.
- Explain the applications and the usefulness of special functions.