III Semester

MTE 501	Differential Equations and Applications	3 Credits (36 hours)

Prerequisite: Basic Mathematics up to XII/PU.

Course Outcome: Students will have the knowledge and skills to apply the theory of differential equations in formulating many fundamental laws of physics and chemistry, set up second order differential equations in different models to describe damped/undamped vibrations and forced vibrations and derive properties of Special Functions of Mathematical Physics like Bessel functions, Legendre polynomials, etc.

Course Specific Outcome: At the end of the course Students will have the knowledge and skills to

- Illustrate the applications of theory of differential equations in economics and biology to model the behaviour of complex systems
- Create and analyze mathematical models using first and second order differential equations to solve application problems such as mixture problems, population modeling harmonic oscillator and LCR circuits
- Describe solutions of differential equations by the use of Laplace transforms and study the properties of special functions of mathematical physics through series solutions.

Unit I

Recapitulation of methods of solutions of first order differential equations, Applications of First Order Ordinary Differential Equations - Simple problems of dynamics - falling bodies and other motion problems, Simple problems of Chemical reactions and mixing, Simple problems of growth and decay.

(10 Hours)

Unit II

Applications of Second Order Ordinary Differential Equations - Undamped simple harmonic motion, damped vibrations, Forced vibrations, Problems on simple electric circuits – Laplace transforms.

(10 Hours)

Unit III

Power series solutions of Second Order Linear Differential Equations, their mathematical properties. Special Functions of Mathematical Physics - Bessel functions, Legendre polynomials, Chebyshev polynomials, Hermite polynomials and Laguerre polynomials.

(16 Hours)

References

[1] G. F. Simmons, *Differential Equations with Applications and Historical Notes*, Tata McGraw-Hill, New Delhi, 1991.

[2] D. Rainville and P. Bedient, *Elementary course on Ordinary Differential Equations*, Macmillan, New York, 1972.

[3] R. Courant and D. Hilbert, *Methods of Mathematical Physics*, Vol. I, Tata McGraw Hill, New Delhi, 1975.

MTE 512	Mathematical Finance	3 Credits (36 hours)

Course Outcome: To introduce the concepts and to develop working knowledge on fundamentals of Mathematical Finance. Students will have the knowledge and skills to apply the concepts of the course in Banking activities and Economical sectors.

Course Specific Outcome: At the end of the course students will have the knowledge and skills to understand, explain in depth and apply the fundamental concepts-

- In Mathematical Background
- Simple interest, Bank Discount, Compound Interest, Annuities.