Course Title: **M3 (for upcoming UG2)**

B .Tech Compulsory Mathematics Course
L-T-P-C: 3 - 1 - 0 – 4
Course Instructors: Prasannalakshmi Manigandla, Srivalli Kiranmayee, Mainak Thakur
Prerequisite: No prerequisite
1. Outline: A course for introducing real analysis, ordinary differential equations and numerical analysis
2. Objectives: At the end of this class, we expect the students to be able to
i. Develop basic ideas on sequence, series, limit, continuity, differentiation etc.
ii. Solve ordinary differential equations
Iii. Do interpolation and other numerical methods
3. Course Outline (Topics): The following list of topics is tentative. Based on available time slots, some topics may be dropped or added or reordered.

Real Analysis (40%)

1. **Real Number System:** LUB Axiom, Sequences of Real Numbers
2. **Sequence:** Sequences and their limits, convergent sequence, subsequence, Sandwich theorem, monotonic sequence
3. **Series:** Convergence of series, comparison test, Ratio test, Root test, Absolute and conditional convergence, Power series, Sequence and Series of Functions.
4. **Limit and Continuity:** Limit, Continuity and Differentiation.

Ordinary Differential Equations (30%)

5. **ODE:** First order differential equations - exact, linear and Bernoulli's form, second order differential equations with constant coefficients, method of variation of parameters, general linear differential equations with constant coefficients, Euler's equations, Non-homogeneuous ODE, Applications of Differential Equations.

Numerical Analysis (30%)

6. **Numerical Analysis:** Finite Differences, Newton's forward and backward interpolation formulae, central difference interpolation formulae. Trapezoidal and Simpsons 1/3rd rules for numerical integration. Solution of linear equations, solution non-linear equations - bisection, Newton-Raphson and regula-falsi methods.

4. Books/References:

1. K. Ervin, Advanced Engineering Mathematics, tenth edition, New Jersy, John Wiley & Sons.
2. B.S. Grewal, Higher Engineering Mathematics, forty second edition, New Delhi, Khanna Publishers.
3. S.C. Malik & S. Arora. Mathematical Analysis, fifth edition, New Age International
4. M.K. Jain, S.R.K. Iyengar & R.K. Jain, Numerical Methods : For Scientific And Engineering Computation, sixth edition, New Age International
5. E.A. Coddington & N. Levinson, Theory of Ordinary Differential Equations, UK edition, Krieger Publishing Company

5. Grading Policy:

Mid Sem 1: 10%
Mid Sem 2: 10%
Quiz: 30%
Assignment: 30%
End Sem: 20%

6. Industry Impact:

This course is a basic mathematics course which will be useful for advanced level courses in BTech such as Machine Learning.

7. List of Companies Working On Related Topics:

NA

9. Resources:

Books already suggested

10. Course Ethics:

TBD