IV Semester

Course Title:	**Additional Mathematics -II (Common to all Branches)**		
Course Code:	**1BMATDIP410**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	NCMC	MCQ online exam Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Exam Hours	-
Total Hours of Pedagogy	42 hours Theory	Credits	0

Course objectives: The goal of the course **Additional Mathematics -II (Common to all branches) 1BMATDIP410** is to

CO-1: Provide the requisite and relevant background necessary to understand the other important engineering mathematics courses offered for the Engineers and Scientists.

CO-2: Familiarize the importance of calculus associated with higher order differential equation with constant coefficients for all branches of the engineering.

CO-3: Apply the knowledge to find nonlinear differential equations and their respective solutions.

CO-4: Develop the knowledge of numerical methods to solve equations.

CO-5: Analyze the numerical methods by applying Ordinary Differential Equations.

CO-6: Understand and explain basic probability concepts**.**

Module-1: Ordinary Differential Equations (9 hours)

Higher order ODE's: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous and non-homogeneous equations. Inverse differential operators $e^{ax}, \sin(bx+c), \cos(bx+c)$ and polynomials. Solutions to the initial value problems. **(RBT Levels: L1, L2 and L3)**

Module-2: Non-linear differential equations (8 hours)

Non-linear differential equations: Introduction to general and singular solutions, solvable for p. Clairaut's equations, reducible to Clairaut's equations.

(RBT Levels: L1, L2 and L3)

Module-3: N**umerical methods-1 (9 hours)**

Introduction to the numerical methods (All formulae without proof)**:** Finite differences, Problems on Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula and Lagrange's interpolation formula.

Numerical integration: Problems on Trapezoidal, Simpson's $(1/3)^{rd}$ and Simpson's $(3/8)^{th}$ rules. **(RBT Levels: L1, L2 and L3).**

Module-4: Numerical Methods-2 (8 hours)

Solutions of algebraic and transcendental equations: Problems on Regula-Falsi and Newton-Raphson methods (only formulae).

Numerical Solution of Ordinary Differential Equations (ODE's): Numerical solution of ordinary differential equations of first order and first degree - Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order (No derivations) and problems.

(RBT Levels: L1, L2 and L3)

Module-5: Probability (8 hours)

Probability: Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability – illustrative examples. Bayes's theorem examples.

(RBT Levels: L1, L2 and L3)

Suggested Learning Resources

Textbooks:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2021
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, 8thEd., 2022.

Reference Books:

1. H K Das and Rajaneesh Varma, Higher Engineering Mathematics, S. Chand.
2. B. V. Ramana Higher Engineering Mathematics, McGraw Hill.
3. Mangey Ram, Mathematics in Engineering Sciences, CRC Press
4. N. P. Bali, Manish Goyal - A Textbook of Engineering Mathematics, Laxmi Publications
5. Erwin Kreyszig. Advanced Engineering Mathematics, Wiley.

Web links and e-Resources:

- NPTEL (National Programme on Technology Enhanced Learning) – Mathematics: https://nptel.ac.in/.
- SWAYAM learning modules on Engineering mathematics .
- https://www.coursera.org/ Mathematics for Engineering Specialization.

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.
Suggested Innovative Delivery Methods may include (but are not limited to):

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- ICT-Enabled Teaching.

Assessment Structure:

For courses offered by the Department of Mathematics, the **Continuous Internal Evaluation (CIE)** shall be conducted by the concerned course teacher. The CIE may comprise tests, assignments, quizzes, seminars, or other academic activities, as decided by the concerned teacher. The distribution of marks among these activities shall be determined by the course teacher. The total marks awarded for all CIE activities shall be **100 marks**.

The concerned teacher shall upload the CIE marks to the VTU web portal whenever notified by the University.

Online Mode of Offering for 1BMATDIP301 and 1BMATDIP401

The lecture sessions for 1BMATDIP301 and 1BMATDIP401 shall also be made available through the **vtu.online.ac.in** platform.

1. If all the students admitted to the 3rd and 4th semesters of a college opt to pursue these courses in online mode, the entire course shall be offered online. In such cases, the Centre for Online Education, Mysuru shall conduct the **Continuous Internal Evaluation (CIE)** for **100 marks** and submit the CIE marks to the

University, with a copy to the concerned college.

2. Within the **same college/department**, all admitted students shall follow a single mode of learning for these courses. A situation where a part of the students opts for the online mode and the remaining students opt for the offline mode **shall not be permitted**.
3. A college intending to offer these courses through the online mode shall submit the **list of eligible students** to the Registrar, Visvesvaraya Technological University (VTU), Belagavi, for approval. Only after obtaining the approval of the University shall the students be permitted to enrol for the online course through the vtu.online.ac.in platform**.**

Notwithstanding the above, a student is considered to have **passed the course,** provided the total of **CIE online** examination is at least 40 out of 100 marks.