



K. S. INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU, Approved by AICTE

Department of Mathematics

SECOND SEMESTER SYLLABUS

Course: Applied Mathematics-II for ECE Stream: Calculus, Laplace Transform and Numerical Techniques		Semester	II
Course Code	25BMAEC201	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40 Hours Theory+20 Hours Tutorials	Total Marks	100
Credits	04	Exam Hours	03
Examination type (SEE)	Theory		

Course Objectives (Course Skill Set):

The goal of the course **Applied Mathematics-II for ECE Stream** is to

1. **Familiarize** the importance of Integral calculus and Vector calculus, for Electrical and Communication Engineering.
2. **Utilize** the Laplace Transform to solve the ordinary differential equations.
3. **Develop** the knowledge of solving Electrical and Communication Engineering problems numerically.

Module-1: Integral Calculus and its Applications

Multiple Integrals: Evaluation of double and triple integrals, change of order of integration, changing to polar coordinates. Area and volume using double and triple integrals. Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions.
(Text 1: Ch-7(7.1 to 7.5, 7.6(1,2), 7.7(1), 7.14 to 7.16))

Number of Hours: (8 Hours Theory+4 Hours Tutorials)

Module-2: Vector Calculus and its Applications

Vector Differentiation: Scalar and vector fields, gradient of a scalar field, directional derivatives, divergence of a vector field, solenoidal vector, curl of a vector field, irrotational vector, physical interpretation of gradient, divergence and curl and scalar potential.

Vector Integration: Line integrals and Surface integrals, Statement of Green's and Stokes' theorem without verification problems.

(Text 1: Ch-8(8.4 to 8.7,8.11 to 8.14))

Number of Hours: (8 Hours Theory+4 Hours Tutorials)

Module-3: Numerical Methods -1

Solution of algebraic and transcendental equations: Regula-Falsi method and Newton-Raphson method.

Finite Differences and Interpolation: Forward and backward differences, Interpolation, Newton forward and backward interpolation formulae, Newton's divided difference interpolation formula and Lagrange's interpolation formula.

Numerical Integration: Trapezoidal rule, Simpson's 1/3rd rule and Simpson's 3/8th rule, Weddle's rule.

(Text 1: Ch-28(28.2(2,3)), Ch-29(29.1(1,2),29.6(1,2), 29.9 to 29.12), Ch-30(30.4, 30.6, 30.7,30.8, 30.10))

Number of Hours: (8 Hours Theory+4 Hours Tutorials)

Module-4: Numerical Methods – 2

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 and Milne's predictor corrector method and Adam-Bashforth predictor-corrector method.

(Text 1: Ch-32(32.1, 32.3, 32.5, 32.7, 32.9, 32.10))

Number of Hours: (8 Hours Theory+4 Hours Tutorials)

Module-5: Laplace Transform

Laplace transform (LT): Definition and Formulae of Laplace Transform, LT of elementary functions. Properties—linearity, scaling, shifting property, differentiation in the s domain, division by t. LT of periodic functions, square wave, saw-tooth wave, triangular wave, full and half wave rectifier, Heaviside Unit step function.

Inverse Laplace Transforms: Definition, properties, evaluation using different methods, and applications to solve ordinary differential equations.

(Text 1: Ch-21(21.1 to 21.4, 21.7 to 21.10), Text 2: Ch-6(6.1,6.2.6.3), Text 1: Ch-21(21.5, 21.17, 21.12, 21.13, 21.15))

Number of Hours: (8 Hours Theory+4 Hours Tutorials)

Course outcome (Course Skill Set)

CO1: Apply the concepts of integral calculus to solve problems in engineering applications such as area, volume.

CO2: Apply the vector calculus to compute derivatives.

CO3: Apply appropriate numerical methods to find approximate solutions of algebraic, transcendental, and ordinary differential equations and to perform interpolation and numerical integration in engineering contexts.

CO4: Apply Laplace transform techniques for time domain, wave forms, periodic functions and solving differential equations.

CO5: Demonstrate the applications of electrical engineering and allied engineering science using modern ICT tools.

Suggested Learning Resources: (Textbook/Reference Book):

Textbooks:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2021.
2. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2018.
3. 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. B.V. Ramana, Higher Engineering Mathematics, McGraw-Hill Education, 11th Ed., 2017
2. Srimanta Pal & Subodh C.Bhunia, Engineering Mathematics, Oxford University Press, 3rd Ed., 2016.
3. N. P. Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications, 10th Ed., 2022.
4. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Publication, 3rd Ed., 2014.
5. Steven V. Chapra and Raymond P. Canale, Applied Numerical Methods with Matlab for Engineers and Scientists, McGraw-Hill, 3rd Ed., 2011.
6. Richard L. Burden, Douglas J. Faires and A. M. Burden, Numerical Analysis, 10th Ed., 2010, Cengage Publishers.
7. S.S. Sastry, "Introductory Methods of Numerical Analysis", PHI Learning Private Limited, 5th Ed., 2012.

Web links and Video Lectures (e-Resources):

- <http://academicearth.org/>
- [VTU e-Shikshana Program](#)
- [VTU EDUSAT Program](#)
- <https://nptel.ac.in/courses/111105160>
- <https://nptel.ac.in/courses/127106019>
- <https://ocw.mit.edu/courses/18-335j-introduction-to-numerical-methods-spring-2019/>
- <https://ocw.mit.edu/courses/18-330-introduction-to-numerical-analysis-spring-2012/pages/syllabus/>

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.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students' for self-study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students to group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
 - As an introduction to new topics (pre-lecture activity).
 - As a revision of topics (post-lecture activity).
 - As additional examples (post-lecture activity).
 - As an additional material of challenging topics (pre-and post-lecture activity).
 - As a model solution of some exercises (post-lecture activity).

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

- Three Tests each of 25 Marks;
 - 1st, 2nd, and 3rd tests shall be conducted after completion of the syllabus of 30-35%, 70-75%, and 90-100% of the course/s respectively. Average of three tests will be scaled down to 25 marks.
 - Continuous Comprehensive Assessments will be conducted with a total of 25 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.
- Learning Activity-1:** Practicing problems (Lab Activities/Surprise Test/ Seminar for 15 Marks)
Execute the following lab exercises with the aid of any modern technological tool (Matlab/

Mathematica/ Scilab/ Python/ Maxima, etc).

Learning Activity-2: Assignments (Marks-10).

List of Lab Activities:

- 1) Evaluate double integration and compute area and volume,
- 2) Evaluate triple integration and compute volume,
- 3) Finding gradient, divergence and curl,
- 4) Evaluate line integrals,
- 5) Regula Falsi and Newton Raphson method,
- 6) Interpolation,
- 7) Numerical integration,
- 8) Modified Euler's method, Fourth order Runge -Kutta method,
- 9) Laplace transform,
- 10) Inverse Laplace transform.

Total CIE marks will be the sum of average of three tests (25 marks) and Continuous Comprehensive Assessments (25 marks) which will be scaled down to 50 marks.

Semester End Examination(SEE):

Theory SEE will be conducted by KSIT as per the scheduled timetable, with common question papers for the subject (duration 03 hours)

- The question paper shall be set for 100 marks. The medium of the question paper shall be English). The duration of SEE is 03 hours.
- The question paper will have 10 questions. Two questions per module. Each question is set for 20 marks. The students have to answer 5 full questions, selecting one full question from each module. The student has to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

Suggested Learning Activities may include (but are not limited to):

- Course Project
- Case Study Presentation
- Programming Assignment
- Tool/Software Exploration
- Literature Review
- Open Book Test (preferably at RBL4 and RBL5 levels)
- GATE-based Aptitude Test
- Assignment (at RBL3, RBL4, or RBL5 levels)
- Any other relevant and innovative academic activity
- Use of MOOCs and Online Platforms

Suggested Innovative Delivery Methods may include (but are not limited to):

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching
- Role Play