	Mathematics-III for Electronics & Computer Engineering		Semester	III
	Course Code	**BUE301**	CIE Marks	50
	Teaching Hours/Week (L:T:P: S)	3:1:0:0	SEE Marks	50
	Total Hours of Pedagogy	40	Total Marks	100
	Credits	03	Exam Hours	03
	Examination type (SEE)	Theory		

Course objectives:

- To acquaint the students with differential equations and their applications in Electronics & CS engineering.
- Learn to use the Fourier series to represent periodical physical phenomena in engineering analysis and to enable the student to express non-periodic functions to periodic functions using the Fourier series and Fourier transforms.
- To find the association between attributes and the correlation between two variables
- To learn the basic ideas of the theory of probability and random signals.

Teaching-Learning Process

Pedagogy (General Instructions):

These are sample Strategies, teachers can use to accelerate the attainment of the various 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 assign 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).

Module-1: Ordinary Differential Equations of Higher Order (8 hours)

Importance of higher-order ordinary differential equations in Electrical & Electronics Engineering applications.

Higher-order linear ODEs with constant coefficients - Inverse differential operator, method of variation of parameters, problems. Linear differential equations with variable Coefficients- Cauchy's and Legendre's differential equations - Problems.

Applications: Application of linear differential equations to L-C circuit and L-C-R circuit.

Self-Study: Finding the solution by the method of undetermined coefficients.

(RBT Levels: L1, L2 and L3)

Module-2: Fourier series.

	Periodic functions, Dirchlet's condition, conditions for a Fourier series expansion, Fourier series of functions with period 2π and with arbitrary period. Half rang Fourier series. Practical harmonic analysis. **Application to variation of periodic current.** **Self-study:** Typical waveforms, complex form of Fourier series
	Module-3: Fourier transforms and Z –transforms
	Infinite Fourier transforms: Definition, Fourier sine, and cosine transform. Inverse Fourier transforms Inverse Fourier cosine and sine transforms. Problems. **Z-transforms:** Definition, Standard z-transforms, Damping, and shifting rules, Problems. Inverse z-transform and applications to solve difference equations **Self-study**: Convolution theorems of Fourier and z-transforms
	Module-4: Curve fitting, Correlation, and Regressions
	Principles of least squares, Curve fitting by the method of least squares in the form $y = a + bx$, $y = a + bx + cx^2$, and $y = ax^b$. Correlation, Co-efficient of correlation, Lines of regression, Angle between regression lines, standard error of estimate, rank correlation **Self-study:** Fitting of curves in the form $y = a\, e^{bx}$
	Module-5: Probability distributions
	Review of basic probability theory, Random variables-discrete and continuous Probability distribution function, cumulative distribution function, Mathematical Expectation, mean and variance, Binomial, Poisson, and Normal distribution (without proofs for mean and SD) – Problems. **Joint probability distribution**: Joint Probability distribution for two discrete random variables, expectation, covariance and correlation. **Self-study:** Exponential distribution.

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:

1. Understand that physical systems can be described by differential equations and solve such equations
2. Demonstrate the Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing, and field theory.
3. To use Fourier transforms to analyze problems involving continuous-time signals and to apply Z-Transform techniques to solve difference equations
4. Make use of correlation and regression analysis to fit a suitable mathematical model for statistical data. Make use of correlation and regression analysis to fit a suitable mathematical model for the statistical data.
5. Apply discrete and continuous probability distributions in analyzing the probability models arising in the engineering field. Construct joint probability distributions.

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) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures 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:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. 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.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books (Name of the author/Title of the Book/ Name of the publisher/Edition and Year)

Text Books:

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna Publishers, 44th Ed., 2021.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

Reference Books:

1. **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. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics" McGraw – Hill Book Co., New York, 6th Ed., 2017.
5. **Gupta C.B, Sing S.R and Mukesh Kumar:** "Engineering Mathematic for Semester I and II", McGraw Hill Education(India) Pvt. Ltd 2015.
6. **H.K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed.,2014.
7. **James Stewart: "**Calculus" Cengage Publications, 7th Ed., 2019.

Web links and Video Lectures (e-Resources):

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program.

Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning

- Quizzes
- Assignments
- Seminar