III SEMESTER

Course Title	**Mathematics for Electronics and communication Engineering.**		
Course Code	**22MATE31**	**CIE Marks**	**50**
Course Type	**Theory**	**SEE Marks**	**50**
Teaching Hours/Week (L: T: P: S)	**2:2:0:0**	**Total Marks**	**100**
Total Hours of Pedagogy	**40 hours**	**Exam Hours**	**03**
		Credits	**03**

Course objectives:

The goal of the course **Mathematics** for Electronics and communication Engineering is to,

- 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.
- Analyze signals in terms of Fourier transforms and Z-Transform
- Have an insight into solving ordinary differential equations by using Laplace transform techniques.
- To find the association between attributes and the correlation between two variables

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher 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 also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for 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

Fourier series and practical harmonic analysis:

Periodic functions, Dirichlet's condition. Fourier series expansion of functions with period 2π and with arbitrary period: periodic rectangular wave, Half-wave rectifier, rectangular pulse, Saw tooth wave. Half-range Fourier series. Triangle and half range expansions, Practical harmonic analysis, and variation

of periodic current. **8 Hours.**

[Text 1: 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7, 10.11]

[RBT Levels: L1, L2 and L3]

Self-Study: Complex form Fourier series**.**

Applications: Signal filtering, noise removal, compression of audio signals and speech recognition.

Module-2

Infinite Fourier Transforms:

Infinite Fourier transforms, Fourier cosine and sine transforms, Inverse Fourier transforms, Inverse Fourier cosine and sine transforms, discrete Fourier transform (DFT), Fast Fourier transform (FFT). **8 Hours.**

[Text 1: 22.1, 22.2, 22.4] [Text 2: 11.9]

[RBT Levels: L1, L2 and L3]

Self-Study: Properties of Fourier transforms.

Applications: Signal processing, image processing, modulation and demodulation of signals.

Module-3

Z -Transforms:

Definition, Z-transforms of basic sequences and standard functions. Properties: Linearity, scaling, first and second shifting properties, multiplication by n. Initial and final value theorem. Inverse Z- transforms. Application to difference equations. **8 Hours.**

[Text 1: 23.1, 23.2, 23.3, 23.4, 23.5, 23.6, 23.7, 23.8, 23.9, 23.15, 23.16, 31.1, 31.2]

[RBT Levels: L1, L2 and L3]

Self-Study:

Applications: Digital signal processing, analyze and process digital data.

Module-4

Laplace Transform:

Existence and Uniqueness of Laplace transform, transform of elementary functions. Properties–Linearity, Scaling, t-shift property, s-domain shift, differentiation in the s-domain, division by t. Laplace transform of periodic functions (square wave, saw-tooth wave, triangular wave, full & half wave rectifier), Heaviside Unit step function and Unit impulse function.

Inverse Laplace Transforms: Definition, properties, evaluation using different methods, convolution theorem (without proof), problems, and applications to solve ordinary differential equations. **8 Hours.**

[Text 1: 21.1, 21.2, 21.3, 21.4, 21.5, 21.7, 21.9, 21.10,21.12, 21.13, 21.14, 21.15, 21.17, 21.18**]**

[RBT Levels: L1, L2 and L3]

Self-Study: Verification of convolution theorem. Solution of simultaneous first-order differential equations.

Applications: Signals and systems, Control systems, LR, CR and LCR circuits.

Module-5

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, Coefficient of correlation, Lines of regression, Angle between regression lines, standard error of estimate, rank correlation. **8 Hours.**

[Text 1: 24.1, 24.4, 24.5, 24.6, 25.12, 25.13, 25.14, 25.16]

[RBT Levels: L1, L2 and L3]

Self-Study: **Fitting of the curves y = ab^x and y = ae^{bx}.**

Applications: Data visualization, Lighting control, comparison and estimation.

Teaching-Learning Process for all modules	**Chalk and Talk/PowerPoint presentation/YouTube videos.**

Course Outcomes(Course Skill Set):

After successfully completing the course, the students will be able to:

1. Demonstrate the Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing, and field theory.
2. Use Fourier transforms to analyze problems involving continuous-time signals
3. Apply Z-Transform techniques to solve difference equations
4. Understand the concept of Laplace transform and to solve initial value problems.
5. Make use of correlation and regression analysis to fit a suitable mathematical model for statistical data

Evaluation Details:

<table>
<tr><th colspan="2">Evaluation Type</th><th>Component</th><th>Max Marks</th><th>Marks Reduced to</th><th>Min. Marks</th><th>Evaluation Details</th></tr>
<tr><td rowspan="4">Theory Component</td><td rowspan="2">Internal Assessment Tests (IAT)</td><td>IAT-1</td><td>25</td><td rowspan="2">25</td><td rowspan="3">20</td><td rowspan="2">Average of two IATs, Scaled down to 25 marks</td></tr>
<tr><td>IAT-2</td><td>25</td></tr>
<tr><td rowspan="2">Comprehensive Continuous Evaluations (CCE)</td><td>CCE-1</td><td>25</td><td rowspan="2">25</td><td rowspan="2">Any two Assessment methods as per 22OB4.2 of regulations. Average of two CCEs, scaled down to 25 marks</td></tr>
<tr><td>CCE-2</td><td>25</td></tr>
<tr><td></td><td colspan="2">Total CIE -Theory</td><td></td><td>50</td><td>20</td><td></td></tr>
<tr><td colspan="3">SEE</td><td>100</td><td>50</td><td>18</td><td>Conducted for 100 marks And scaled down to 50.</td></tr>
<tr><td colspan="3">CIE + SEE</td><td></td><td>100</td><td>40</td><td></td></tr>
</table>

Suggested Learning Resources:

Text Books:

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2018.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed. (Reprint), 2016.

Reference Books:

1. **B.V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed.
2. **Srimanta Pal & Subodh C.** Bhunia: "Engineering Mathematics" Oxford University Press, 3rd reprint, 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. Newyork, 6th Ed., 2017.
5. **Gupta C.B, Sing S.R and Mukesh Kumar:** "Engineering Mathematic for Semester I and II", Mc-Graw 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 edition, 4th Reprint 2019.

E-Resources:

- http://.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
- Seminars

CO- PO Mapping :

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22MATE31.1	3	3	1									
22MATE31.2	3	3	2									
22MATE31.3	3	3										
22MATE31.4	3	3										
22MATE31.5	2	3	1									
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped												