Mathematics for Computer & Communication Engineering		Semester	3
Course Code	**BCM301**	CIE Marks	50
Teaching Hours/Week (L: T: P: S)	3:2:0:0	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	04	Exam Hours	3
Examination type (SEE)	Theory		

Course objectives: This course will enable the students to:

1. 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.
2. To find the association between attributes and the correlation between two variables
3. To introduce the concept of random variables, probability distributions, and specific discrete and continuous distributions with practical application in Computer Science Engineering and social life situations.
4. Provide the principles of statistical inferences and the basics of hypothesis testing with emphasis on some commonly encountered hypotheses.

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: 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**.** **(10 Hours)**

(RBT Levels: L1, L2 and L3)

Pedagogy	Chalk and Board, Problem-based learning

Module-2: 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. **(10 Hours)**

(RBT Levels: L1, L2 and L3)

Pedagogy	Chalk and Board, Problem-based learning

Module-3: Curve fitting, Correlation, and Regressions

Principles of least squares, Curve fitting by the method of least squares in the form $y = a + bx$, $y = a + bx + cx^2$, $y = a\,e^{bx}$ and $y = ax^b$. Correlation, Coefficient of correlation, Lines of regression, Angle between regression lines, standard error of estimate, and rank correlation. **(10 Hours)**

(RBT Levels: L1, L2 and L3)

Pedagogy	Chalk and Board, Problem-based learning

Module-4: Probability Distributions

Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson, Exponential and normal distributions- problems (derivations for mean and standard deviation for Binomial and Poisson distributions only)- Illustrative examples. **(10 Hours)**

(RBT Levels: L1, L2 and L3)

Pedagogy	Chalk and Board, Problem-based learning

Module-5: Joint probability distribution & Sampling Theory

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance and correlation.

Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. **(10 Hours)**

(RBT Levels: L1, L2 and L3)

Pedagogy	Chalk and Board, Problem-based learning

Course outcome (Course Skill Set)

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

1. Demonstrate the Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing, and field theory.
2. To use Fourier transforms to analyze problems involving continuous-time signals and to apply Z-transform techniques to solve difference equations
3. Make use of correlation and regression analysis to fit a suitable mathematical model for the statistical data.
4. Apply discrete and continuous probability distributions in analysing the probability models arising in the engineering field.
5. Construct joint probability distributions and demonstrate the validity of testing the hypothesis.

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). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student 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:

For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.

The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered

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 teacher should not conduct two assignments at the end of the semester if two assignments are planned.

For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

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).**

The question paper will have ten questions. Each question is set for 20 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.

The students have to answer 5 full questions, selecting one full question from each module.

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.
3. **V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017

Reference Books:

1. **Srimanta Pal & Subodh C. Bhunia**: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
2. **N.P Bali and Manish Goyal**: "A Textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
3. **H.K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed.,2014.
4. **Irwin Miller & Marylees Miller**, John E. Freund's "Mathematical Statistics with Applications", Pearson. Dorling Kindersley Pvt. Ltd. India, 8th edition, 2014.
5. **S C Gupta and V K Kapoor**, "Fundamentals of Mathematical Statistics", S Chand and Company, Latest edition.
6. **Robert V. Hogg, Joseph W. McKean & Allen T. Craig,** "Introduction to Mathematical Statistics", Pearson Education, 7th edition, 2013.
7. **Sheldon M. Ross**, "Introduction to Probability Models" Elsevier, 11th edition. 2014.
8. **S. Ross**, "A First Course in Probability", Pearson Education India, 6th Ed., 2002.
9. **W. Feller**, "An Introduction to Probability Theory and its Applications", Vol. 1, Wiley, 3rd Ed., 1968.

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/
http://www.bookstreet.in.
VTU EDUSAT PROGRAMME – 20
VTU e-Shikshana Program

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

- Quizzes
- Assignments
- Seminars