Lesson Plan

Branch: Computer Engineering (Batch-A)
Semester: III Year: 2022-23

Course Title: Engineering Mathematics III	SEE: 3 Hours – Theory
Total Contact Hours: 32 (Theory) + 06 (Tutorial) Hours	Duration of SEE: 3 Hours
SEE Marks: 80 (Theory) + 20 (IA)	
Lesson Plan Author: Prasad Lalit	Date: 10/08/2022
Checked By:	Date:

Syllabus:

Pre-requisite: Engineering Mathematics-I, Engineering Mathematics-II	
Course Objectives: The course aims:	
1	To learn the Laplace Transform, Inverse Laplace Transform of various functions, its applications.
2	To understand the concept of Fourier Series, its complex form and enhance the problem-solving skills.
3	To understand the concept of complex variables, C-R equations with applications.
4	To understand the basic techniques of statistics like correlation, regression, and curve fitting for data analysis, Machine learning, and AI.
5	To understand some advanced topics of probability, random variables with their distributions and expectations.
Course Outcomes: On successful completion, of course, learner/student will be able to:	
1	Understand the concept of Laplace transform and its application to solve the real integrals in engineering problems.
2	Understand the concept of inverse Laplace transform of various functions and its applications in engineering problems.
3	Expand the periodic function by using the Fourier series for real-life problems and complex engineering problems.
4	Understand complex variable theory, application of harmonic conjugate to get orthogonal trajectories and analytic functions.
5	Apply the concept of Correlation and Regression to the engineering problems in data science, machine learning, and AI.
6	Understand the concepts of probability and expectation for getting the spread of the data and distribution of probabilities.

Module	Detailed Contents		Hours
1	**Laplace Transform**		7
	1.1	Definition of Laplace transform, Condition of Existence of Laplace transform.	
	1.2	Laplace Transform (L) of standard functions like $e^{at}, sin(at), cos(at), sinh(at), cosh(at)$ and $t^n, n \geq 0$.	
	1.3	Properties of Laplace Transform: Linearity, First Shifting Theorem, Second Shifting Theorem, Change of Scale, Multiplication by t, Division by t, Laplace Transform of derivatives and integrals (Properties without proof).	
	1.4	Evaluation of real improper integrals by using Laplace Transformation.	
	1.5	**Self-learning Topics:** Laplace Transform: Periodic functions, Heaviside's Unit Step function, Dirac Delta Function, Special functions (Error and Bessel)	
2	**Inverse Laplace Transform**		7
	2.1	Definition of Inverse Laplace Transform, Linearity property, Inverse Laplace Transform of standard functions, Inverse Laplace transform using derivatives.	
	2.2	Partial fractions method to find Inverse Laplace transform.	
	2.3	Inverse Laplace transform using Convolution theorem (without proof)	
	2.4	**Self-learning Topics:** Applications to solve initial and boundary value	
3	**Fourier Series:**		7
	3.1	Dirichlet's conditions, Definition of Fourier series and Parseval's Identity (without proof).	
	3.2	Fourier series of periodic function with period 2π and $2l$.	
	3.3	Fourier series of even and odd functions.	
	3.4	Half range Sine and Cosine Series.	
	3.5	**Self-learning Topics:** Orthogonal and orthonormal set of functions, Complex form of Fourier Series, Fourier Transforms.	
4	**Complex Variables:**		7
	4.1	Function *f(z)* of complex variable, Limit, Continuity and Differentiability of *f(z)*, Analytic function: Necessary and sufficient conditions for *f(z)* to be analytic (without proof).	
	4.2	Cauchy-Riemann equations in Cartesian coordinates (without proof).	
	4.3	Milne-Thomson method: Determine analytic function *f(z)* when real part (u), imaginary part (v) or its combination (u+v / u-v) is given.	
	4.4	Harmonic function, Harmonic conjugate and Orthogonal trajectories.	
	4.5	**Self-learning Topics:** Conformal mapping, Linear and Bilinear mappings, cross ratio, fixed points and standard transformations.	

5	**Statistical Techniques**		6
	5.1	Karl Pearson's coefficient of correlation (r)	
	5.2	Spearman's Rank correlation coefficient (R) (with repeated and non-repeated ranks)	
	5.3	Lines of regression	
	5.4	Fitting of first- and second-degree curves.	
	5.5	**Self-learning Topics:** Covariance, fitting of exponential curve.	
6	**Probability**		6
	6.1	Definition and basics of probability, conditional probability.	
	6.2	Total Probability theorem and Bayes' theorem.	
	6.3	Discrete and continuous random variable with probability distribution and probability density function.	
	6.4	Expectation, Variance, Moment generating function, Raw and central moments up to 4^{th} order.	
	6.5	**Self-learning Topics:** Skewness and Kurtosis of distribution (data).	

References:	
1	Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication.
2	Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited.
3	Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa Publication.
4	Complex Variables and Applications, Brown and Churchill, McGraw-Hill Education.
5	Probability, Statistics and Random Processes, T. Veerarajan, McGraw-Hill Education.
6	Theory and Problems of Fourier Analysis with applications to BVP, Murray Spiegel, Schaum's Outline Series.

Term Work:	
General Instructions:	
1	Batch wise tutorials have to be conducted. The number of students per batch will be as per University pattern for practical.
2	Students must be encouraged to write at least 6 class tutorials on the entire syllabus.
3	A group of 4-6 students should be assigned a self-learning topic. Students should prepare a presentation/problem solving of 10-15 minutes. This will be considered as a mini project in Engineering Mathematics. This project will be graded out of 10 marks depending on the performance of the students.

The distribution of Term Work marks will be as follows:		
1	Attendance (Theory and Tutorial)	05 marks
2	Class Tutorials on entire syllabus	10 marks
3	Mini project	10 marks

Assessment:

Internal Assessment Test:

The assessment consists of two class tests of 20 marks each. The 1stclass test (Internal Assessment I) has to be conducted when approximately 40% of the syllabus is completed. The 2^{nd} class test has to be conducted (Internal Assessment II) when an additional 35% syllabus is completed. The duration of each test will be for one hour.

End Semester Theory Examination:	
1	The question paper will comprise a total of 6 questions, each carrying 20 marks.
2	Out of the 6 questions, 4 questions have to be attempted.
3	Question 1, based on the entire syllabus, will have 4sub-questions of 5 marks each and is compulsory.
4	Question 2 to Question 6 will have 3 sub-questions, each of 6, 6, and 8 marks, respectively.
5	Each sub-question in (4) will be from different modules of the syllabus.
6	Weightage of each module will be proportional to the number of lecture hours, as mentioned in the syllabus.

Course Outcomes (CO):

On successful completion of the course learner will be able to:

CSC301.1. Obtain the Laplace Transform of given functions and evaluate the integral (in standard form) using Laplace Transform
CSC301.2. Obtain inverse Laplace Transform of given functions
CSC301.3. Expand the given periodic function in terms of sine and cosine terms in the given interval
CSC301.4. Construct the analytic function and also determine the orthogonal trajectories of the given family of curves
CSC301.5. Obtain the best estimate for the dependent variable using regression lines and determining the trend between the given aspects
CSC301.6. Able to apply Bayes' theorem to practical problems and also obtain, mean, Variance, and higher-order moments of random variables

CO-PO Mapping: (BL – Blooms Taxonomy, C – Competency, PI – Performance Indicator)

CO	BL	C	PI	PO	Mapping
CSC301.1. Obtain the Laplace Transform of given functions and evaluate the integral (in standard form) using Laplace Transform	3	1.1 1.3	1.1.1 1.3.1	PO1	3
CSC301.2. Obtain inverse Laplace Transform of given functions	3	1.1 1.3	1.1.1 1.3.1	PO1	3
CSC301.3. Expand the given periodic function in terms of sine and cosine terms in the given interval	3	1.1 1.3	1.1.1 1.3.1	PO1	3
CSC301.4. Construct the analytic function and also determine the orthogonal trajectories of the given family of curves	3	1.1 1.3	1.1.1 1.3.1	PO1	3

CSC301.5. Obtain the best estimate for the dependent variable using regression lines and determining the trend between the given aspects	3	1.1 1.3	1.1.1 1.3.1	PO1	3
CSC301.6. Able to apply Bayes' theorem to practical problems and also obtain, mean, variance, and higher-order moments of random variables	3	1.1 1.3	1.1.1 1.3.1	PO1	3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CSC301.1	3											
CSC301.2	3											
CSC301.3	3											
CSC301.4	3											
CSC301.5	3											
CSC301.6	3											

Justification: PO1: Engineering Mathematics II provides the essential mathematical knowledge required for identifying and analyzing problems related to Data Mining, Machine Learning, Computer Networks & Optimization Techniques.

CO Measurement Weightages for Tools:

	Test	Lab	Assignment	SEE (O)	SEE (T)	Course Exit Survey
CSC301.1	30%	---	10%	---	60%	100%
CSC301.2	30%	---	10%	---	60%	100%
CSC301.3	30%	---	10%	---	60%	100%
CSC301.4	30%	---	10%	---	60%	100%
CSC301.5	---	---	40%	---	60%	100%
CSC301.6	---	---	40%	---	60%	100%

Attainment:

CO CSC301.1:

Direct Method

$$A_{CSC301.1D} = 0.3 * Test + 0.1 * Tutorial + 0.6 * SEE\_Theory$$

Final Attainment:

$$A_{CSC301.1} = 0.8 * A_{CSC301.1D} + 0.2 * A_{CSC301.1I}$$

CO CSC301.2:

Direct Method

$$A_{CSC301.2D} = 0.3 * Test + 0.1 * Tutorial + 0.6 * SEE\_Theory$$

Final Attainment:

$$A_{CSC301.2} = 0.8 * A_{CSC301.2D} + 0.2 * A_{CSC301.2I}$$

CO CSC301.3:

Direct Method

$$A_{CSC301.3D} = 0.3 * Test + 0.1 * Tutorial + 0.6 * SEE\_Theory$$

Final Attainment:

$$A_{CSC301.3} = 0.8 * A_{CSC301.3D} + 0.2 * A_{CSC301.3I}$$

CO CSC301.4:

Direct Method

$$A_{CSC301.4D} = 0.3 * Test + 0.1 * Tutorial + 0.6 * SEE\_Theory$$

Final Attainment:

$$A_{CSC301.4} = 0.8 * A_{CSC301.4D} + 0.2 * A_{CSC301.4I}$$

CO CSC301.5:

Direct Method

$$A_{CSC301.5D} = 0.4 * Tutorial + 0.6 * SEE\_Theory$$

Final Attainment:

$$A_{CSC301.5} = 0.8 * A_{CSC301.5D} + 0.2 * A_{CSC301.5I}$$

CO CSC301.6:

Direct Method

$$A_{CSC301.6D} = 0.4 * Tutorial + 0.6 * SEE\_Theory$$

Final Attainment:

$$A_{CSC301.6} = 0.8 * A_{CSC301.6D} + 0.2 * A_{CSC301.6I}$$

Course Level Gap (if any): No
Content beyond Syllabus: No

Lecture Plan (Theory):

Module No.	Contents	Hours	Planned Date	Executed Date	Content Delivery Method	Remark
1	Module 1: Laplace Transform – Introduction	5	25/07/2022	25/07/2022	Traditional	
	Examples based on formulas		26/07/2022	26/07/2022	Traditional	
	Properties of Laplace transform		28/07/2022	28/07/2022	Traditional	
	Examples based on properties		02/08/2022	02/08/2022	Traditional	

	Examples based on properties		03/08/2022	03/08/2022	Traditional	
2	Inverse Laplace transform	5	04/08/2022	04/08/2022	Traditional	
	Seminar in Samvaad		05/08/2022	----	Traditional	
	Examples based on the partial fraction method		06/08/2022	06/08/2022	Traditional	
	Examples based on convolution		10/08/2022	10/08/2022	Traditional	
	Examples involving log, tan, cot, and their inverse functions		11/08/2022	11/08/2022	Traditional	
3	Introduction to Fourier Series (F.S.)	9	12/08/2022	12/08/2022	Traditional	
	Examples on F.S.		17/08/2022	----	Traditional	16/08/2022 Holiday 17/08/2022 Engaged as Tutorial 1
	F.S. Examples		18/08/2022	18/08/2022	Traditional	
	F.S. of Even / Odd functions		23/08/2022	23/08/2022	Traditional	
	F.S. of general interval		24/08/2022	24/08/2022	Traditional	
	F.S. of general interval		25/08/2022	25/08/2022	Traditional	
	Half-range series		26/08/2022	26/08/2022	Traditional	
	Half-range series		30/08/2022	30/08/2022	Traditional	

	Half-range series		08/09/2022	08/09/2022	Traditional	05, 06, 07 September 2022 UT 1
4	Complex variable: Introduction	6	13/09/2022	13/09/2022	Traditional	Holiday on 09/09/2022
	Analytic functions		14/09/2022	14/09/2022	Traditional	
	Properties of analytic function		15/09/2022	15/09/2022	Traditional	
	Examples of analytic functions		20/09/2022	20/09/2022	Traditional	
	Mile-Thomson method		21/09/2022	21/09/2022	Traditional	
	Mile-Thomson method		22/09/2022	22/09/2022	Traditional	
5	Correlation coefficient	3	27/09/2022	27/09/2022	Traditional	
	Correlation coefficient		28/09/2022	28/09/2022	Traditional	
	Rank Correlation		29/09/2022	29/09/2022	Traditional	
6	Expectation and Variance of a Random Variable	4	16/11/2021	22/11/2021	Traditional	
	Expectation and Variance of a Random Variable		18/11/2021	---	Traditional	On leave, lecture engaged by Prof Parshvi Shah
	Moments and Moment Generating Function		19/11/2021	---	Traditional	Holiday
	Moments and Moment Generating Function		22/11/2021	23/11/2021	Traditional	

Lecture Plan (Tutorial):

The entire class will be divided into two batches. The common tutorial slot for all the bathes is scheduled on Wednesday from 12.00 noon to 1.00 pm.

Sr. No.	Contents	Planned Date	Actual Date
01	Tutorial 1: Laplace Transform	12/08/2022	17/08/2022
02	Tutorial 2: Inverse Laplace Transform	26/08/2022	16/09/2022
03	Tutorial 3: Fourier Series	23/09/2022	23/09/2022
04	Tutorial 4: Complex Variable	30/09/2022	30/09/2022
05	Tutorial 5: Correlation, Regression, and Curve Fitting	07/10/2022	07/10/2022
06	Tutorial 6: Probability Theory	14/10/2022	14/10/2022

Rubrics for Tutorial

Indicator	Excellent	Good	Poor
Formulation of the problem (2)	Writing all formulae correctly (2)	One or two mistakes in the formulae (1)	Wrong formulae (0)
Stepwise explanation (3)	Explained all steps clearly (3)	One or two steps are left out (2)	Important steps are skipped (1)
Accuracy in solving (3)	Final answer obtained accurately (3)	Minor error in calculation (2)	Major error in calculations (1)
Overall presentation (2)	Introduce new methods of solving (2)	Systematic presentation (2)	Moderate presentation (1)

Rubrics for Mini Project

Each mini-project will be graded out of 10 with the following rubrics:

Indicator	Excellent	Good	Poor
Objectives of the project (2)	Well-defined objectives and steps to follow them (2)	Justifying objective without detailing (1)	Incomplete/unclear justification for the objective (0)
Analysis / Description of the project (3)	A Complete explanation of the key concepts with strong justification (3)	A Complete explanation of the key concepts with insufficient justification (2)	Incomplete justification (1)
Result Analysis (3)	A Complete explanation of the key concepts with strong justification (3)	A Complete explanation of the key concepts with insufficient justification (2)	Incomplete justification (1)
Conclusions (2)	Extensive knowledge and awareness of the project (2)	Sufficient knowledge and awareness of the project (1)	Insufficient knowledge and awareness of the project (0)

Text Books:

1. Engineering Mathematics-III by G.V. Kumbhojkar, J. Jamnadas Publication

Reference Books:

1. Advance Engineering Mathematics by H.K. Dass, S. Chand & Company Limited
2. Advance Engineering Mathematics by Peter O' Neil, Cengage Learning

Evaluation Scheme

CIE Scheme

Internal Assessment: 20 (Average of two tests)

Internal Assessment Scheme

Module		Lecture Hours	No. of questions in			No. of questions in SEE
			Test 1	Test 2	Test 3*	
1	Laplace transform	05	02 (10 Marks)	---	---	03 (19 Marks)
2	Inverse Laplace transform	05	03 (10 Marks)	---	---	04 (23 Marks)
3	Fourier series	09	---	02 (10 Marks)	---	03 (22 Marks)
4	Complex variable	06	---	02 (10 Marks)	---	03 (17 Marks)
5	Correlation, regression, and curve fitting	03	---	---	---	03 (21 Marks)
6	Probability theory	04	---	---	---	03 (18 Marks)

Note: Four to six questions will be set in the Test paper

Verified by:

Program Coordinator

Subject Expert: Prasad Lalit