FR. Conceicao Rodrigues College of Engineering

Father Agnel Ashram, Bandstand, Bandra-west, Mumbai-50

Department of Humanities & Sciences

S.E. (Computer A) (Semester III) (2020-2021)

Lesson Plan

Subject: Engineering Mathematics III (CSC301)

Credits-4

CONTENTS :

Syllabus

Course Code	Course Name	Credits
CSC301	Engineering Mathematics-III	4

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 $e^{at}, sin(at), cos(at), sinh(at), cosh(at)andt^n, n \geq 0$.	
	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	

		problems involving ordinary differential equations.	
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.

Course Outcomes:

Upon completion of this course students will be able to:

CSC301.1	Obtain Laplace Transform of given functions and also 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 determine 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

Course	PO1
CSC301.1	**2**
CSC301.2	**2**
CSC301.3	**2**
CSC301.4	**2**
CSC301.5	**2**
CSC301.6	**3**
TOTAL	13
Direct Attainment	2.17 (M)

Justification:

Above CO's are mapped to the following PO's as explained below:

PO1: provide the complete basic mathematical knowledge required for

- evaluating Laplace transform of the standard functions.
- evaluating inverse Laplace transform of the standard functions.
- expressing periodic functions as Fourier and half-range series.
- studying fundamentals of analytic functions
- fitting the Lines of Best Fit to the given data using Regression Analysis.
- probability theory, random variables and theoretical distributions (Poisson and Normal).

CO Assessment Tools:

CSC301.1: **Direct Methods (80%):** Test 1+Tutorial 1+ End Exam

CO1 dm = 0.4xtest1+0.2xtutorial1+0.4x end exam

Indirect Methods (20%): Course Exit Survey(CES)

CO1 idm =1xCES

CSC301.1 = (0.8 x CO1 dm) + (0.2 x CO1 idm)

CSC301.2: **Direct Methods (80%):** Test 1+Tutorial 2+ End Exam

CO2 dm = 0.4xtest1+0.2xtutorial2+0.4x end exam

Indirect Methods (20%): Course Exit Survey(CES)

CO2 idm =1xCES

CSC301.2 = (0.8 x CO2 dm) + (0.2 x CO2 idm)

CSC301.3: **Direct Methods (80%):** Test 2+Tutorial 3+ End Exam

CO3 dm = 0.4xtest2+0.2xtutorial3+0.4x end exam

Indirect Methods (20%): Course Exit Survey(CES)

CO3 idm =1xCES

CSC301.3 = (0.8 x CO3 dm) + (0.2 x CO3 idm)

CSC301.4: **Direct Methods (80%):** Test 2+Tutorial 4+ End Exam

CO4 dm = 0.4xtest2+0.2xtutorial4+0.4x end exam

Indirect Methods (20%): Course Exit Survey(CES)

CO4 idm =1xCES

CSC301.4 = (0.8 x CO4 dm) + (0.2 x CO4 idm)

CSC301.5: **Direct Methods (80%):** Tutorial 5+ End Exam

CO5dm = 0.4xtutorial5+0.6xend exam

Indirect Methods (20%): Course Exit Survey(CES)

CO5 idm =1xCES

CSC301.5 = (0.8 XCO5 dm) + (0.2*x CO5 idm)

CSC301.6: **Direct Methods (80%):** Tutorial 6+ End Exam

CO6dm = 0.4xtutorial6+0.6xend exam

Indirect Methods (20%): Course Exit Survey(CES)

CO6 idm =1xCES

CSC301.6 = (0.8 XCO6 dm) + (0.2*x CO6 idm)

LESSON PLAN

Sr. No.	Planned Date	Executed Date	Timing	Topic Covered	Remarks (If any)
1	20/07/2020	20/07/2020	9:00 AM	Module 02: Inverse Laplace Transform	

2	21/07/2020	21/07/2020	10:00 AM	Module 02: Inverse Laplace Transform (continued)	
3	23/07/2020	23/07/2020	10:00 AM	Module 02: Inverse Laplace Transform - Open Book Test	
4	24/07/2020	24/07/2020	10:00 AM	Module 03: Fourier Series	
5	27/07/2020	27/07/2020	9:00 AM	Module 03: Fourier Series (continued...)	
6	28/07/2020	28/07/2020	10:00 AM	Module 03: Fourier Series - Even/Odd Functions, Parseval's Identity	
7	30/07/2020	30/07/2020	10:00 AM	Module 03: Half-range Fourier Series	
8	31/07/2020	31/07/2020	10:00 AM	Module 03: Fourier Series - Problem Solving	Connectivity issue in between
9	03/08/2020	03/08/2020	9:00 AM	Module 03: Fourier Series - Problem Solving (continued)	
10	04/08/2020	04/08/2020	10:00 AM	Module 04: Complex Variable - Introduction	
11	06/08/2020	06/08/2020	10:00 AM	Module 04: Complex Variable - Analytic Functions	
12	07/08/2020	07/08/2020	10:00 AM	Module 04: Complex Variable - Analytic Functions (continued...)	
13	10/08/2020	10/08/2020	9:00 AM	Module 04: Complex Variable - Milne-Thomson Method	
14	11/08/2020	11/08/2020	10:00 AM	Module 04: Harmonic and Orthogonal families + Practise Problems on Complex Variable	
15	13/08/2020	13/08/2020	10:00 AM	Module 04: Practise Problems on Complex Variable (continued...)	

16	14/08/2020	14/08/2020	10:00 AM	Module 04: Practise Problems on Complex Variable (continued...)	
17	17/08/2020	17/08/2020	9:00 AM	Module 01: Laplace Transform - Revision	
18	18/08/2020	18/08/2020	10:00 AM	Module 01: Laplace Transform - Revision (continued...)	
19	20/08/2020	20/08/2020	10:00 AM	Module 02: Inverse Laplace Transform – Revision	
20	21/08/2020	21/08/2020	10:00 AM	Module 03: Fourier Series - Revision	
21	24/08/2020	24/08/2020	9:00 AM	Module 03: Fourier Series - Revision (continued...)	
22	25/08/2020	25/08/2020	10:00 AM	Module 03: Fourier Series - Revision (continued...)	
23	27/08/2020	27/08/2020	10:00 AM	Module 03: Fourier Series - Revision (continued...)	
24	28/08/2020	28/08/2020	10:00 AM	Module 03: Fourier Series - Revision (continued...)	
25	31/08/2020	31/08/2020	9:00 AM	Module 03: Fourier Series - Revision (continued...)	
26	01/09/2020	01/09/2020	10:00 AM	Modules 03 and 04: Fourier Series - Revision (completed) and Complex Variable – Revision	
27	03/09/2020	03/09/2020	10:00 AM	Modules 04: Complex Variable - Revision (continued...)	
28	04/09/2020	04/09/2020	10:00 AM	Modules 04: Complex Variable - Revision (continued...)	
29	07/09/2020	07/09/2020	9:00 AM	Problem Set 01	

30	08/09/2020	08/09/2020	10:00 AM	Problem Set 02	
31	10/09/2020	10/09/2020	10:00 AM	Problem Set 03	
32	11/09/2020	11/09/2020	10:00 AM	Problem Set 04	
33	12/09/2020	12/09/2020	9:00 AM	Problem Set 05	
34	15/09/2020	15/09/2020	10:00 AM	Problem Set 06	Unit Test 1
35	17/09/2020	17/09/2020	10:00 AM		
36	18/09/2020	18/09/2020	10:00 AM		
37	21/09/2020	21/09/2020	9:00 AM		
38	22/09/2020	22/09/2020	10:00 AM	Module 05: Statistical Techniques: Topic - Karl Spearman's correlation coefficient	
39	24/09/2020	24/09/2020	10:00 AM	Module 05: Statistical Techniques: Topic - Spearman's rank correlation	
40	25/09/2020	25/09/2020	10:00 AM	Module 05: Statistical Techniques: Topic - Examples on correlation	
41	28/09/2020	28/09/2020	9:00 AM	Module 05: Statistical Techniques: Topic - Examples on correlation (continued...)	
42	29/09/2020	29/09/2020	10:00 AM	Module 05: Statistical Techniques: Topic - Examples on correlation (continued...) and Introduction to Regression	
43	01/10/2020	01/10/2020	10:00 AM	Module 05: Statistical Techniques: Topic - Examples on Regression	
44	02/10/2020	02/10/2020	10:00 AM	Module 05: Statistical Techniques: Topic - Examples on Regression (continued...)	
45	05/10/2020	05/10/2020	9:00 AM	Module 05: Statistical Techniques: Topic - Examples on Regression (continued...)	

46	06/10/2020	06/10/2020	10:00 AM	Module 05: Statistical Techniques: Topic - Examples on Regression (continued...1)	
47	08/10/2020	08/10/2020	10:00 AM	Module 05: Statistical Techniques: Topic - Examples on Regression (continued...2)	
48	09/10/2020	09/10/2020	10:00 AM	Module 05: Statistical Techniques: Topic - Examples on Regression (continued...3)	
49	12/10/2020	12/10/2020	9:00 AM	Module 05: Statistical Techniques: Topic - Examples on Regression (continued...4) and Probability Theory Introduction	Attendance is given to all due to power supply failure
50	13/10/2020	13/10/2020	10:00 AM	Module 06: Probability : Topic - Probability Theory - Introduction	
51	15/10/2020	15/10/2020	10:00 AM	Module 06: Probability : Topic - Examples on Probability Theory	
52	16/10/2020	16/10/2020	10:00 AM	Module 06: Probability : Topic - Bayes' Theorem	
53	19/10/2020	19/10/2020	9:00 AM	Module 06: Probability : Topic - Examples on Bayes' Theorem	Technical problem
54	19/10/2020	19/10/2020	9:00 AM	Module 06: Probability : Topic - Examples on Bayes' Theorem	
55	20/10/2020	20/10/2020	10:00 AM	Module 06: Probability : Random Variable	
56	22/10/2020	22/10/2020	10:00 AM	Module 06: Probability : Topic - Properties of Expectation, Variance and Covariance	System attendance is not available. Attendance taken manually.
57	23/10/2020	23/10/2020	10:00 AM	Module 06: Probability : Topic - Examples on Expectation and Variance	

58	26/10/2020	26/10/2020	9:00 AM	Module 06: Probability : Topic - Examples on Expectation and Variance (continued...1)	
59	27/10/2020	27/10/2020	10:00 AM	Tutorial 1: Topic - Laplace Transform	
60	29/10/2020	29/10/2020	10:00 AM	Module 06: Probability : Topic - Examples on Expectation and Variance (continued...2)	
61	01/11/2020	01/11/2020	9:00 AM	Module 06: Probability : Topic - Moments and Moment Generating Function (MGF)	
62	03/11/2020	03/11/2020	10:00 AM	Tutorial 2: Topic: - Inverse Laplace Transform	
63	05/11/2020	05/11/2020	10:00 AM	Module 06: Probability : Topic - Examples on Moments and Moment Generating Function (MGF)	
64	06/11/2020	06/11/2020	10:00 AM	Module 06: Probability : Topic - Examples on Moments and Moment Generating Function (MGF)	
65	09/11/2020	09/11/2020	9:00 AM		Syllabus over (Theory): Lecture engaged by Prof. Prachi
66	10/11/2020	10/11/2020	10:00 AM	Tutorial 3: Topic: - Fourier Series	
67	12/11/2020	12/11/2020	10:00 AM		
68	13/11/2020	13/11/2020	10:00 AM		
69	16/11/2020	16/11/2020	9:00 AM		
70	17/11/2020	17/11/2020	10:00 AM		
71	19/11/2020	19/11/2020	10:00 AM	Tutorial 4: Topic: - Complex variable	
72	20/11/2020	20/11/2020	10:00 AM	Compensatory Tutorial : Topic: - Fourier Series and Complex variable	Only for those who missed one of the tutorials 1,2,3,4
73	22/11/2020	22/11/2020		Tutorial 5: Topic: - Correlation and Regression Tutorial 6: Topic: - Probability and Random Variables (Home assignment)	Home assignment Home assignment
74	23/11/2020	23/11/2020	9:00 AM		
75	24/11/2020	24/11/2020	10:00 AM		

76	26/11/2020	26/11/2020	10:00 AM		
77	27/11/2020	27/11/2020	10:00 AM		

Course Outcomes Target:

CSC301.1
TARGET RANGE: 2.5

CSC301.2
TARGET RANGE: 2.5

CSC 301.3.
TARGET RANGE: 2.5

CSC301.4
TARGET RANGE: 2

CSC301.5
TARGET RANGE: 2.5

CSC301.6
TARGET RANGE: 2.5