FR. Conceicao Rodrigues College of Engineering

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

Department of Humanities & Sciences

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

Lesson Plan

Subject: Engineering Mathematics IV (CSC401)

Credits-4

CONTENTS :

Syllabus

Course Code	Course Name	Credits
CSC401	Engineering Mathematics-IV	4

Pre-requisite: Engineering Mathematics-I, Engineering Mathematics-II, Engineering Mathematics-III, Binomial Distribution.	
Course Objectives: The course aims to learn:	
1	Matrix algebra to understand engineering problems.
2	Line and Contour integrals and expansion of a complex valued function in a power series.
3	Z-Transforms and Inverse Z-Transforms with its properties.
4	The concepts of probability distributions and sampling theory for small samples.
5	Linear and Non-linear programming problems of optimization.
Course Outcomes: On successful completion, of course, learner/student will be able to:	
1	Apply the concepts of eigenvalues and eigenvectors in engineering problems.
2	Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals.
3	Apply the concept of Z- transformation and inverse in engineering problems.
4	Use the concept of probability distribution and sampling theory to engineering problems.
5	Apply the concept of Linear Programming Problems to optimization.
6	Solve Non-Linear Programming Problems for optimization of engineering problems.

Module		Detailed Contents	Hours
1	**Linear Algebra (Theory of Matrices)**		7
	1.1	Characteristic Equation, Eigenvalues and Eigenvectors, and properties (without proof)	
	1.2	Cayley-Hamilton Theorem (without proof), verification and reduction of higher degree polynomials	
	1.3	Similarity of matrices, diagonalizable and non-diagonalizable matrices	
	1.4	**Self-learning Topics:** Derogatory and non-derogatory matrices, Functions of Square Matrix, Linear Transformations, Quadratic forms.	
2	**Complex Integration**		7
	2.1	Line Integral, Cauchy's Integral theorem for simple connected and multiply connected regions (without proof), Cauchy's Integral formula (without proof).	
	2.2	Taylor's and Laurent's series (without proof).	
	2.3	Definition of Singularity, Zeroes, poles of *f(z)*, Residues, Cauchy's Residue Theorem (without proof)	
	2.4	**Self-learning Topics:** Application of Residue Theorem to evaluate real integrations.	
3	**Z Transform**		5
	3.1	Definition and Region of Convergence, Transform of Standard Functions: $\{k^n a^k\}, \{a^{\lvert k \rvert}\}, \{{}^{k+n}_{n}C.\, a^k\}, \{c^k \sin(\alpha k + \beta)\}, \{c^k \sinh \alpha k\}, \{c^k \cosh \alpha k\}$.	
	3.2	Properties of Z Transform: Change of Scale, Shifting Property, Multiplication, and Division by k, Convolution theorem.	
	3.3	Inverse Z transform: Partial Fraction Method, Convolution Method.	
	3.4	**Self-learning Topics:** Initial value theorem, Final value theorem, Inverse of Z Transform by Binomial Expansion	
4	**Probability Distribution and Sampling Theory**		7
	4.1	Probability Distribution: Poisson and Normal distribution	

	4.2	Sampling distribution, Test of Hypothesis, Level of Significance, Critical region, One-tailed, and two-tailed test, Degree of freedom.	
	4.3	Students' t-distribution (Small sample). Test the significance of mean and Difference between the means of two samples. Chi-Square Test: Test of goodness of fit and independence of attributes, Contingency table.	
	4.4	**Self-learning Topics:** Test significance for Large samples, Estimate parameters of a population, Yate's Correction.	
5	**Linear Programming Problems**		6
	5.1	Types of solutions, Standard and Canonical of LPP, Basic and Feasible solutions, slack variables, surplus variables, Simplex method.	
	5.2	Artificial variables, Big-M method (Method of penalty)	
	5.3	Duality, Dual of LPP and Dual Simplex Method	
	5.4	**Self-learning Topics:** Sensitivity Analysis, Two-Phase Simplex Method, Revised Simplex Method.	
6	**Nonlinear Programming Problems**		7
	6.1	NLPP with one equality constraint (two or three variables) using the method of Lagrange's multipliers	
	6.2	NLPP with two equality constraints	
	6.3	NLPP with inequality constraint: Kuhn-Tucker conditions	
	6.4	**Self-learning Topics:** Problems with two inequality constraints, Unconstrained optimization: One-dimensional search method (Golden Search method, Newton's method). Gradient Search method	

References:	
1	Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons.
2	R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Narosa.
3	Brown and Churchill, "Complex Variables and Applications", McGraw-Hill Education.
4	T. Veerarajan, "Probability, Statistics and Random Processes", McGraw-Hill Education.
5	Hamdy A Taha, "Operations Research: An Introduction", Pearson.
6	S.S. Rao, "Engineering Optimization: Theory and Practice", Wiley-Blackwell.
7	Hira and Gupta, "Operations Research", S. Chand Publication.

Term Work:		
General Instructions:		
1	Batch wise tutorial shave 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 2nd class test has to be conducted (Internal Assessment II) when an additional 35% syllabus is

Course Outcomes:

Upon completion of this course students will be able to:

CSC401.1	Able to diagonalize the given matrix using eigen values and eigen vector.

CSC401.2	Evaluate complex integrals using Cauchy's theorem.
CSC401.3	Evaluate Z −transform and the inverse Z −transform.
CSC401.4	Apply theoretical distributions (Poisson and Normal) to practical problems, test the goodness of fit, differences between means and variances, and analyse the independency of attributes.
CSC401.5	Able to optimize the given function using linear programming problem (LPP).
CSC401.6	Able to optimize the given function using non-linear programming problem (NLPP).

CO- PO mapping

Course	PO1
CSC401.1	**2**
CSC401.2	**1**
CSC401.3	**1**
CSC401.4	**2**
CSC401.5	**2**
CSC401.6	**2**
TOTAL	10
Direct Attainment	1.67 (M)

Justification:

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

PO1: provide the complete basic mathematical knowledge required for

- diagonalization of a matrix.
- evaluating complex integral
- evaluate Z and inverse Z transform.
- probability theory and testing of hypothesis.
- solving linear programming problem (LPP).
- solving non-linear programming problem (NLPP).

CO Assessment Tools:

CSC401.1: **Direct Methods (80%):** Test 2+Tutorial 6+ End Exam

CO1 dm = 0.4xtest2+0.2xtutorial6+0.4x end exam

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

CO1 idm =1xCES

CSC401.1 = (0.8 x CO1 dm) + (0.2 x CO1 idm)

CSC401.2: **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

CSC401.2 = (0.8 x CO2 dm) + (0.2 x CO2 idm)

CSC401.3: **Direct Methods (80%):** Tutorial 5 + End Exam

CO3 dm = 0.4xtutorial5+0.6x end exam

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

CO3 idm =1xCES

CSC401.3 = (0.8 x CO3 dm) + (0.2 x CO3 idm)

CSC401.4: **Direct Methods (80%):** Tutorial 4+ End Exam

CO4 dm = 0.4xtutorial4+0.6x end exam

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

CO4 idm =1xCES

CSC401.4 = (0.8 x CO4 dm) + (0.2 x CO4 idm)

CSC401.5: **Direct Methods (80%):** Test 1 + Tutorial 1+ End Exam

CO5dm = 0.4xtest1+0.2xtutorial1+0.4xend exam

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

CO5 idm =1xCES

CSC401.5 = (0.8 XCO5 dm) + (0.2*x CO5 idm)

CSC401.6: **Direct Methods (80%):** Test 2 + Tutorial 3 + End Exam

CO6dm = 0.4xtest2+0.2xtutorial3+0.4xend exam

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

CO6 idm =1xCES

CSC401.6 = (0.8 XCO6 dm) + (0.2*x CO6 idm)

LESSON PLAN

Sr. No.	Planned Date	Executed Date	Topic Covered	Remarks (If any)
1	27/01/2021	27/01/2021	Module 05: Linear Programming Problems - Types of Solutions	
2	02/02/2021	02/02/2021	Module 05: Linear Programming Problems – Forms	
3	03/02/2021	03/02/2021	Module 05: Linear Programming Problem - Trial and Error Method	
4	09/02/2021	09/02/2021	Module 05: Linear Programming Problem - Simplex Method	

5	10/02/2021	10/02/2021	Module 05: Linear Programming Problem - Simplex Method Example	
6	16/02/2021	16/02/2021	Module 05: Linear Programming Problem - Big M Method	
7	17/02/2021	17/02/2021	Module 05: Linear Programming Problem - Big M Method	
8	02/03/2021	02/03/2021	Module 05: Linear Programming Problem – Duality	Network problem
9	03/03/2021	03/03/2021	Module 05: Linear Programming Problem – Duality	
10	09/03/2021		Unit Test 1	
11	10/03/2021		Unit Test 1	
12	16/03/2021	16/03/2021	Module 05: Linear Programming Problem - Dual Simplex Method	
13	17/03/2021	17/03/2021	Module 06: Non-linear Programming Problems	
14	30/03/2021	30/03/2021	Module 06: Non-linear Programming Problems - Lagrange Method	
15	31/03/2021	31/03/2021	Module 06: Non-linear Programming Problems - Lagrange Method	Network issue
16	06/04/2021	06/04/2021	Module 06: Non-linear Programming Kuhn-Tucker Method	
17	07/04/2021	07/04/2021	Module 03: Z-transforms - Introduction	
18	20/04/2021	20/04/2021	Module 03: Z-transforms - Examples	
19	04/05/2021	04/05/2021	Module 03: Z-transforms - Properties	
20	05/05/2021	05/05/2021	Module 03: Z-transforms - Inverse Z-transform	

Tutorial Plan:

Sr. No.	Planned Date	Executed Date	Topic Covered (sharing with SSP)	Remarks (If any)
1	25/02/2021	25/02/2021	Tutorial 1: - Linear Programming Problem (LPP)	
2	15/04/2021	15/04/2021	Tutorial 3: - Non-linear Programming Problem (NLPP)	
3	26/05/2021	26/05/2021	Tutorial 5: - Z-transform	

Course Outcomes Target:

CSC401.1
TARGET RANGE: 2.5

CSC401.2
TARGET RANGE: 2.5

CSC 401.3.
TARGET RANGE: 2.5

CSC401.4
TARGET RANGE: 2

CSC401.5
TARGET RANGE: 2.5

CSC401.6
TARGET RANGE: 2.5