FR. Conceicao Rodrigues College Of Engineering

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

Department of Humanities & Sciences

S.E. (PRODUCTION) (semester IV) (2018-2019)

Lesson Plan

Subject: Applied Mathematics IV (MEC401)

Credits-4

Syllabus:

Course Code	Course Name	Credits
MEC401	Applied Mathematics IV**	04

Objectives:

1 To inculcate an ability to relate engineering problems to mathematical context
2 To provide a solid foundation in mathematical fundamentals required to solve engineering problem
3 To study the basic principles of Vector analyses, complex integration, probability, test of hypothesis and correlation between data.
4 To prepare students for competitive exams

Outcomes: Learner will be able to…

1 Solve the system of linear equations using matrix algebra with its specific rules
2 Demonstrate basics of vector calculus
3 Apply the concept of probability distribution and sampling theory to engineering problems
4 Apply principles of vector calculus to the analysis of engineering problems
5 Identify, formulate and solve engineering problems
6 Illustrate basic theory of correlations and regression

Module	Details	Hrs
1	**Matrices:** 1.1 Brief revision of vectors over a real field, inner product, norm of a vector 1.2 Eigen values and Eigen vectors: Characteristic polynomial, characteristic equation, characteristic roots and characteristic vectors of a square matrix, properties of characteristic roots and vectors of different types of matrices such as orthogonal matrix, Hermitian matrix, Skew-Hermitian matrix, Cayley Hamilton theorem (without proof) . Similarity of matrices. Functions of a square matrix	08
2	**Matrices:** 2.1 Minimal polynomial and Derogatory matrix 2.2 Quadratic forms: Linear transformations of a quadratic form, congruence of a square matrix, reduction to Canonical form under congruent transformations, orthogonal transformations, determining the nature of a quadratic form, Applications of Eigen Values and Eigen Vectors **Vector calculus** 2.3 Brief revision of Scalar and vector point functions. Gradient of a scalar function, Divergence and curl of a vector function 2.4 Line integrals, circulation of a vector, condition for independence of the path in the line integral	09
3	**Vector calculus:** 1.1 Green's theorem(without proof) for plane regions and properties of line integrals, Stokes theorem (without proof), Gauss divergence theorem (without proof) related identities and deductions.(No verification problems on Stoke's Theorem and Gauss Divergence Theorem) **Linear Programming problems** 1.2 Types of solutions to linear programming problems, standard form of L.P.P. Simplex method to solve L.P.P	09
4	**Linear Programming problems Probability Distributions:** 4.1 Big M method (Penalty method) to solve L.P.P, Duality, Dual simplex method and Revised simplex method to solve L.P.P.	09

	Probability Distributions 4.2 Discrete and Continuous random variables, Probability mass and density function, Probability distribution for random variables, Expected value, Variance. 4.3 Probability Distributions: Binomial, Poisson and Normal Distributions	
5	**Sampling theory:** 5.1. Sampling theory: Sampling distribution. Test of Hypothesis. Level of significance, critical 5.2. region. One tailed and two tailed tests. Interval Estimation of population parameters. Large and small samples 5.3. Test of significance for Large samples: Test for significance of the difference between sample mean and population means, Test for significance of the difference between the means of two samples. **5.4.** Student's t-distribution and its properties. Test of significance of small samples: Test for significance of the difference between sample mean and population means, Test for significance of the difference between the means of two Samples, paired t-test	**09**
6	**Sampling theory and ANOVA** 6.1. Chi-square test, Test for the Goodness of fit , Association of attributes and Yate's correction 6.2. Analysis of Variance(F-Test): One way classification, Two-way classification(short-cut method)	**08**

Assessment:

Internal Assessment for 20 marks:
Consisting **Two Compulsory Class Tests**
First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:
Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions, each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved.**

References:

1. Advanced Engineering Mathematics, E Kreyszing, Wiley Eastern Limited
2. Higher Engineering Mathematics, B. S. Grewal, Khanna Publication
3. Advanced Engineering Mathematics, H. K. Dass, S. Chand & co
4. Vector Analysis by Murray R. Spiegel, Shaum Series
5. Operations Research, S.D. Sharma, S. Chand & CO.
6. Fundamentals of Mathematical Statistics, S C Gupta & V K Kapoor, S. Chand & Co
7. Elements of Applied mathematics, P N & J N Wartikar, Pune Vidyarthi Gruha Prakashan
8. Advanced Engineering Mathematics, E Kreyszing, Wiley Eastern Limited
9. Operations Research, Kantiswearup, Manmohan, P K Gupta, S. Chand & CO

Course Outcomes:

Upon completion of this course students will be able to:

1. MEC401.1)SOLVE practical problems using Binomial, Poisson & Normal distributions
2. MEC401.2)TEST the given hypothesis using Chi Square, Students' t, Normal& F tests
3. MEC401.3)DIAGONALISE the given matrix using Eigen values and Eigen vectors
4. MEC401.4)APPLY optimization technique to solve linear and nonlinear programming problem
5. MEC401.5)EVALUATE the given line, surface integrals using Green's ,Divergence & Stoke's theorems

CO- PO mapping

Course	PO1	PO2	PO4	PO6	PO11
MEC401.1	3	3	2	2	3
MEC401.2	3	3	3	3	3
MEC401.3	2	2	2	0	0
MEC401.4	2	2	2	2	3
MEC401.5	3	0	0	0	0
TOTAL	13	10	9	7	9
Direct Attainment	2.94 (H)	2.0(M)	1.8(M)	1.4(L)	1.8(M)

Justification:

PO1: provides the complete basic mathematical knowledge required for identifying and analyzing problems related to production engineering

PO2: Basic knowledge in probability and statistics , operation research and matrices is used in analyzing engineering problems related to statistical quality control , CAD-CAM , Design of experiments

PO4: Above topics are used in research problems based on testing of hypothesis

PO6: The above topics are used in making reasonable decisions on problems related to health ,safety and social issues

PO11: The topics are used in solving problems in financial engineering and management

CO Assessment Tools:

MEC401.**1:** **Direct Methods(80%):** Test1+End Exam

CO1 dm = 0.4xtest1+0.6x end exam

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

CO1 idm =1xCES

MEC401.1 = (0.8 x CO1 dm) + (0.2 x CO1 idm)

MEC401.**2:** **Direct Methods(80%):** End Exam

CO2dm = 1xend exam

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

CO2 idm=1xCES

MEC401.2 = (0.8 x CO2 dm) + (0.2x CO2 idm)

MEC401.**3:** **Direct Methods(80%): Test 2+** End Exam

CO3 dm=(0.4xtest 2)+(0.6xend exam)

Indirect Methods(20%): Course exit survey(CES)

CO3 idm=1xCES

MEC401.3 = (0.8 x CO3 dm) + (0.2 x CO3 idm)

MEC401.**4:** **Direct Methods(80%):** End Exam

CO4 dm = 1x end exam

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

CO4 idm =1xCES

MEC401.4 = (0.8 x CO4 dm)+ (0.2x CO4 idm)

MEC401.**5:** **Direct Methods(80%):** End Exam

CO5 dm = 1xend exam

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

CO5 idm =1xCES

MEC401.5 = (0.8 XCO5 dm) + (0.2x CO5 idm)

Subject:Applied Mathematics IV(MEC401) | **Academic Year: 2018-19**

Branch:Production | **Semester: IV(even sem)**

Sr. No.	*Name of the Topic*	*Planned Date*	*Executed Date*	*Rema*
1)	Introduction to Random Variables	2-1-2019	2-1-2019	
2)	Definitions & derivations	3-1-2019	3-1-2019	
3)	Expectation, Variance, Co-Variance ,MGF	4-1-2019	4-1-2019	
4)	Problems on Discrete R.V's	9-1-2019	7-1-2019	Extra lecture or
5)	Problems on Continuous R.V	10-1-2019	10-1-2019	
6)	Problems using properties of exp'n&Variance	11-1-2019	11-1-2019	Extra lecture or
7)	Binomial Distribution(theory)	14-1-2019	11-1-2019	On leave on 1
8)	Poisson Distribution(theory	15-1-2019	15-1-2019	
9)	Problems on B.D	17-1-2019	16-1-2019	Lecture ex
10)	Problems on P.D	18-1-2019	18-1-2019	
11)	Normal Distribution(theory)	21-1-2019	18-1-2019	Extra lecture or
12)	Derivations on N.D	22-1-2019	21-1-2019	
13)	Problems on N.D(Type 1)	24-1-2019	24-1-2019	
14)	Problems on N.D(Type 2)	25-1-2019	25-1-2019	
15)	Additional Practice problems on N.D	28-1-2019	28-1-2019	
16)	Combined problems on B.D,P.D&N.D	29-1-2019	29-1-2019	
17)	Revision of Q.B .for U.T 1 on R.V's	1-2-2019	1-2-2019	04,05,06 Fe
18)	Testing of Hypothesis(introduction)	7-2-2019	7-2-2019	
19)	Chi Square Test(application 1)	8-2-2019	8-2-2019	
20)	Chi Square Test(application 2&3)	18-02-2019	18-02-2019	11 to 15 Feb:E
21)	Students' t-test(application 1)	21-02-2019	21-02-2019	
22)	Students' t-test(application 2&3)	22-02-2019	22-02-2019	
23)	Normal test(large samples)	25-02=2019	25-02-2019	

24)	F-Test(two samples :variances)	26-02-2019	26-02-2019	
25)	F-Test(ANOVA: One way)	28-02-2019	28-02-2019	
26)	F-Test(ANOVA: Two way)	1-3-2019	1-3-2019	
27)	Matrices(introduction)	5-3-2019	5-3-2019	
28)	Eigen values	7-3-2019	7-3-2019	
29)	Derogatory& Non Derogatory Matrices	8-3-2019	8-3-2019	
30)	Functions of Square Matrices	11-3-2019	Nov-19	
31)	Cayley Hamilton Theorem(verification)	12-3-2019	12-3-2019	
32)	Cayley Hamilton Theorem(Application -1)	14-3-2019	14-3-2019	
33)	Cayley Hamilton Theorem(Application-2)	18-3-2019	18-3-2019	
34)	Eigen vectors(Non rep'd eigen values)	19-3-2019	19-3-2019	
35)	Eigen vectors(Rep'd eigen values)	22-3-2019	22-3-2019	
36)	Problems on Eigen vectors(extra)	25-3-2019	25-3-2019	
37)	Diagonalizaton of Matrices	26-3-2019	26-3-2019	
38)	Diag'n for non sym'c matrices(Modal matrix)	28-3-2019	28-3-2019	
39)	Diag'n for sym'c matrices(Uni-modal matrix)	29-3-2019	29-3-2019	
40)	Real Quadratic Forms(Cong't trans'n)	1-4-2019	1-4-2019	
41)	Real Quadratic form(Orthogonal trans'n)	2-4-2019	2-4-2019	
42)	Revision of Q.B for U.T 2 on matrices	4-4-2019	4-4-2019	
43)	Revision continued	5-4-2019	5-4-2019	
44)	Vector Integration(Line integrals)	N.D	N.D	N.D:Not I
45)	Green's Theorem	N.D	N.D	Lectures af
46)	Gauss Divergence theorem	N.D	N.D	8,9,10,Apr
46)	Stoke's Theorem	N.D	N.D	15,April

Course Outcomes Target:

Upon completion of this course students will be able to:

MEC401.1

TARGET RANGE : 2.5

MEC401.2

TARGET RANGE : 2.5

MEC 401.3.

TARGET RANGE : 2.5

MEC401.4
TARGET RANGE : 2.5

MEC401.5
TARGET RANGE : 2

MEC401.6

TARGET RANGE : 2.0