MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

COURSE PLAN

Department :	**MATHEMATICS**			
Course Name & code :	**Engineering Mathematics IV**			**MAT2227**
Semester & branch :	**IV**	**EC/EE**		
Name of the faculty :	**Dr. Rakshith B R**			
No of contact hours/week:	**L**	**T**	**P**	**C**
	2	**1**	**0**	**3**

COURSE OUTCOMES (COS)

At the end of this course, the student should be able to:		No. of Contact Hours	Marks	Program Outcomes (POs)	BL (Recommended)
CO1	Apply the fundamental concepts of probability theory to engineering problems.	5	14	1,2,12	3,4
CO2	Apply appropriate probability distributions to the problems of one dimensional random variables and to measure the relationship and the dependency between two random variables variables.	7	20	1,2,12	3,4
CO3	Apply Markov chain to model random processes and to construct probalility density functions for functions of one or two dimensional random variables.	8	22	1,2,12	3,4
CO4	Apply optimization techniques to find solutions that maximize or minimize some study parameters.	8	24	1,2,12	3,4
CO5	To apply the concept of vector gradient in physical phenomenon.	8	20	1,2,12	3,4
	Total	**36**	**100**		

*** COURSE LEARNING OUTCOMES (CLOS)

At the end of this course, the student should be able to:	No. of Contact Hours	Marks	Program Outcomes(POs)	Learning Outcomes (LOs)	BL (Recommended)

CLO1	Apply the fundamental concepts of probability theory to engineering problems.	5	14	1,2,12	**1,2,3**	**3,4**
CLO2	Apply appropriate probability distributions to the problems of one dimensional random variables and to measure the relationship and the dependency between two random variables variables.	7	20	1,2,12	**1,2,3**	**3,4**
CLO3	Apply Markov chain to model random processes and to construct probalility density functions for functions of one or two dimensional random variables.	8	22	1,2,12	**1,2,3**	**3,4**
CLO4	Apply optimization techniques to find solutions that maximize or minimize some study parameters.	8	24	1,2,12	**1,2,3**	**3,4**
CLO5	To apply the concept of vector gradient in physical phenomenon.	8	20	1,2,12	**1,2,3**	**3,4**
	Total	**36**	**100**			

***** Applicable to programs applied for IET accreditation only.**

Assessment Plan

IN – SEMESTER ASSESSMENTS

S. No.	Assessment Mode		Assessment Method	Time Duration	Marks	Weightage	Typology of Questions (Recommended)	Schedule	**Topics Covered
1	**MISAC**	**1**	**Quiz**	**15 Mins**	**05**	10 MCQs × ½ = 5	Bloom's taxonomy (B) level of the question should be L2 and L3.		L1-09
		2	**Mid-Term**	**120 Mins**	**30**	**Objective:** ….M …. MCQs × ½ = … marks **Descriptive:** … M (.. Questions of … marks +… Questions of … marks)	Bloom's taxonomy (BT) level of the question should be L3 and above.		L1-L20
		3	**Quiz**	**15 Mins**	**5**	10 MCQs × ½ = 5	Bloom's taxonomy (BT) level of the question should be L3 and above.		L21-L28
2	**FISAC**	**1**	**Take home assignment**	**One month**	**10**	**10 questions ×1=5**	Bloom's taxonomy (BT) level of the question should be L3 and above.		L0-L36 (SDL) L29-L36

END – SEMESTER ASSESSMENT							
1	**Regular/Make–Up Exam**	180 Mins	50	Answer all 5 full questions of 10 marks each. Each question can have 3 parts of 2/3/4/5/6 marks.	Bloom's taxonomy (BT) level of the question should be L3 and above.	18th week of the semester	Comprehensive examination covering full syllabus.

******* ***Individual faculty will be entering the topics***

****** Individual faculty must identify the assessment method from table 3 and fill in the details.***

NOTE: ***Information provided in the table is as per the In-semester assessment plan and schedule of V and VII semester B. Tech provided from Academic Section.***

Flexible In-semester Assessment Component (FISAC):

i) The FISAC 1 & FISAC 2 may be any of the types given in Table 1. However, tne two components should be of different type.

ii) The type of assessment should be informed to the students well in advance.

iii) Syllabus for the last component of In-semester Assessment (ISAC) i.e. FISAC 2 should cover the topics mentioned for self-study if any / topics which are not covered till MISAC 4: In-Semester Exam 2.

Table 1: Flexible In-semester Assessment Component (FISAC)

No	Type	Description
A.	Quiz/MCQs	Same as MISAC 2: Quiz/MCQs
B.	Surprise Assignment	Same as MISAC 3: Surprise assignment.
C.	Take Home Assignment	*10 questions are to be given to each student. *Questions must be of Blooms Taxonomy Level 3 for first year and Level 4 for higher semesters. *Questions are to be given TWO weeks in advance. *Students have to write the answers to all the questions.
D.	Group Assignment	*The students are to be grouped in such a way that there are 3 – 4 students in each group. *Each group is to be given one question. *The questions should be of Blooms Taxonomy Level 4 for first year and Level 5 for higher semesters. *Questions are to be given TWO weeks in advance. *The questions may be in the form of case studies, design, report writing, etc.
E.	Seminar	*Students may be given the topics for seminar relevant to the course of study. *Topics are to be given TWO weeks in advance. *Should be of Blooms Taxonomy Level 4 for first year and Level 5 for higher semesters. *Topics should be related to the courses of study. *Topics should be in the field of recent developments in the courses of study. *Students have to collect the data regarding the seminar topic and submit a report. *Students should make a presentation for about TEN minutes using Power Point.
F.	Quiz / Assignment based on invited talks	*Faculty have to arrange for the invited talk in the emerging areas in the courses of study. *Quiz / Assignment is to be conducted on the topic of the invited talk. *Questions should be at Blooms Taxonomy Level 4 for first year and Level 5 for higher semesters.
G.	Development of Software / Apps	*Faculty has to define the problem statement. *Problem Statements are to be given TWO weeks in advance. *Should be at Blooms Taxonomy Level 4 for first year and Level 5 for higher semesters. *Students have to develop the software / mobile apps using the appropriate software language / platform.
H.	Mini Project	*Faculty has to define the problem statement. *Problem Statements are to be given TWO weeks in advance. *Should be at Blooms Taxonomy Level 4 for first year and Level 5 for higher semesters. *Students have to develop prototypes.

LESSON PLAN

L No	TOPICS	Course Outcome Addressed
1	Introduction to the course.	
2	Axiomatic approach to probability, addition theorem and basic problems.	CO1
3	Conditional probability, independent events and Bayes Theorem	CO1
4	Problems on Bayes Theorem (SDL)	CO1
5	One dimensional discrete / continuous random variables.	CO1
6	Expectations and moment generating functions.	CO1
7	Two dimensional random variables, mean and variance.	CO2
8	Covariance and correlation coefficients of two dimensional random variable.	CO2
9	Tutorial/Problems	CO2
10	Binomial distribution and related problems.	CO2
11	Exponential distribution and related problems.	CO2
12	Uniform distribution and Chi-square distribution (**SDL**).	CO2
13	Normal distribution.	CO2
14	Functions of one dimensional random variables.	CO3
15	Tutorial/Problems	CO3
16	Functions of two dimensional random variables.	CO3
17	Probability generating functions (**SDL**).	CO3
18	Static and dynamic probability.	CO3
19	Markov chains.	CO3
20	Tutorial/Problems	CO3
21	Transition probabilities.	CO3
22	Optimization: Basic solution, Convex sets and function.	CO4
23	Tutorial/Problems	CO4
23	Graphical method	CO4
24	Simplex method.	CO4
25	Tutorial/Problems.	CO4
26	Optimization Using Gradient Descent.	CO4
27	Constrained Optimization and Lagrange Multipliers. (**SDL**)	CO4
28	Tutorial/Problems	CO4
29	Basic concepts on vectors & their products. Ordinary / partial derivatives of a vector function and related formula. Scalar/Vector point functions.	CO5
30	Gradient of vector valued functions, Gradients of Matrices.	CO5
31	Divergence and Curl of a vector point function.	CO5
32	Identities involving the Gradients	CO5
33	Solenoid / Irrotational fields and related problems.	CO5
34	Scalar potential of vector field.	CO5
35	Backpropagation and automatic differentiation **(SDL)**	CO5
36	Linearization and Multivariate Taylor Series.	CO5

Text Books:

1. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Mathematics for Machine Learning, Cambridge University Press, 2020.
2. P L Meyer, Introductory Probability and Statistical Applications, Addison Wiley.
3. Medhi. J. Stochastic Processes, Wiley Eastern.

Reference Books:

1. Murray R. Spiegel, Vector Analysis Theory and Problems, Schaum's Outline Series, 2019.
2. Hamdy A. Taha, "Operations Research: An Introduction", 8th Edn., Pearson Education (2008).
3. Sheldon M. Ross, Introduction to Probability Models Eleventh Edition Elsevier.
4. E. S. Page, L. B. Wilson, An Introduction to Computational Combinatorics, Cambridge University Press.
5. Bhat U R, Elements of Applied Stochastic Processes, John Wiley.
6. https://youtu.be/CgP-3HctGe4

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2										1			
CO2	2	2										1			
CO3	2	2										1			
CO4	2	2										1			
CO5	2	2										1			
Articulation Level	2	2										1			

FACULTY MEMBERS TEACHING THE COURSE :

FACULTY	SECTION
Dr. Rakshith B R	EC-C
Dr. Sabitha D'souza	EC-D
Dr. Gowtham H. J.	EE-C
Dr. Swathi S. Nayak	EC-A
Dr. Santhosh Kumar C.	EE-B/EC-B
Dr. Balachandra Hadimani S.	VLSI
Dr. Sandhya S. P.	EE-A

Submitted by: Dr. Rakshith B R

(Signature of the faculty)

Approved by: Dr. Kuncham Syam Prasad

(Signature of HOD)