Enclosure – BMTIII

Shree Manibhai Virani and Smt. Navalben Virani Science College, Rajkot (Autonomous)
Affiliated to Saurashtra University, Rajkot

DSE Course (Theory) For the students admitted from A.Y. 2021-22 & onwards		
Offering Department: **Mathematics**	Offered to: **B.Sc. (All Programs)**	
Semester – IV		
Course Code	Course Title	Course Credit and Hours
21UMTDC403	**DSE-2: Advanced Mathematics**	**3 Theory and 3 Credits**

Course Description:

This course focuses on advanced concepts of mathematics, set theory, vector differentiation, integration, and matrix theory. This course also introduces the advanced concepts of matrix theory.

Course Purpose:

This course aims to provide students with an understanding of set theory, integration, and vector differentiation. This is designed in such a way that students will be able to understand matrix theory. Students will be able to calculate the eigenvalue, eigenvector, and inverse of the matrix.

Course Outcomes: Upon completion of this course, the learner will be able to

CO No.	**CO Statement**	**Blooms taxonomy Level (K1 to K6)**
CO1	Understand the concept of set theory, operation on set, Venn diagram, and application of it.	K_2, K_3
CO2	Understand vector algebra, scalar product, and vector product.	K_2
CO3	Understand the concept of definite and indefinite integration.	K_2, K_3
CO4	Understand and utilize the fundamental concepts of a matrix with the application.	K_2, K_3
CO5	Calculate the characteristic root, eigenvalue, eigenvector, and inverse of the matrix.	K_3

Course Contents	Hours
Unit-I: Set theory	**9**
• Basic definition of sets and its examples. • Various operations on set. • Venn diagram. • Applications of set theory.	
Unit-II: Vector Differentiation	**9**
• Vector algebra • The scalar (dot) product • The vector (cross) product • Curl, gradient, divergence	
Unit- III: Integration	**9**
• Concept of integration • The indefinite integral • The definite integral	
Unit- IV: Concept of a matrix	**9**
• Introduction to matrices • Different types of matrices. • Algebraic operations on matrices including inverse. • Row operations of matrices. • The rank of a matrix by row echelon form.	
Unit- V: Eigenvalues and eigenvectors of a matrix	**9**
• The characteristic equation of a matrix. • Eigenvalues and eigenvectors. • The inverse of matrices.	

Pedagogic Tools:

- Chalk and board
- PowerPoint presentation
- Seminars

Text Books:

- Prof. H. K. Dass, (2010), Applied Mathematics, CBS Publishers & Distributors, New Delhi.
- Shanti Narayana and P.K. Mittal, (2010), Textbook of Matrices, S. Chand and Company Ltd, 11th Edition.

Reference Books:

- Erich Steiner, (2008), The Chemistry Maths Book, OXFORD University Press, Second Edition.

Suggested reading / E-resources:

- maths.ox.ac.uk/members/library/electronic-resources/

Suggested MOOCs:

- https://www.my-mooc.com/en/mooc/matrix-algebra-for-engineers/
- https://www.my-mooc.com/en/mooc/calculus-single-variable-part-3-integration/

Methods of Assessment & Tools:

Components of CIA: 30 marks

Sr. No.	Component	Content	Duration	Marks	Sub Total
A	Test 1	1st 2 units	$1\frac{1}{2}$ hours	5 (Set for 30)	20
	Test 2	All 5 units	3 hours	15 (Set for 70)	
B	Assignment			04	10
C	Class activity			06	
				Grand Total	**30**

Assignment	• Problem formulation and its analysis. • Notes are written by the learner on the different topics in the syllabus.
Class activity	• Surprise Quiz • Quiz • Seminar • Situation-based questions etc. • Attendance.

Note: Any other assessment tools or methods can be adopted as per the requirement of the course.

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DSE Course (Practical) For the students admitted from A.Y. 2021-2022 & onwards		
Offering Department: **Mathematics**	Offered to: **B.Sc. (All Programs)**	
Semester – IV		
Course Code	Course Title	Course Credit and Hours
21UMTDC404	**Core Practical 4:** **Advanced Mathematics Practical**.	**3 Credits- 6 hrs/wk**

Course Description:
This course focuses on advanced concepts of mathematics, set theory, vector differentiation, integration, and matrix theory. This course also introduces the advanced concepts of matrix theory.

Course Purpose:
This course aims to provide students with an understanding of set theory, integration, and vector differentiation. This is designed in such a way that students will be able to understand matrix theory. Students will be able to calculate the eigenvalue, eigenvector, and inverse of the matrix.

Course Outcomes: Upon completion of this course, the learner will be able to

CO No.	**CO Statement**	**Blooms taxonomy Level (K_1 to K_6)**
CO_1	Define and explain the concept of set theory, operations on set, Venn diagram, and application of it.	K_2,K_3
CO_2	Understand vector algebra, scalar product, and vector product.	K_2
CO_3	Calculate problems of definite and indefinite integration.	K_2,K_3
CO_4	Utilize the fundamental concepts of a matrix with the application.	K_2,K_3
CO_5	Calculate the characteristic root, eigenvalue, eigenvector, and inverse of the matrix.	K_3

List of Practical		
Sr.	**Experiments**	**Hrs**
1	Problem-based on various operations on the set.	6
2	Problem-based on the application of the Venn diagram.	6
3	Problem-based on scalar product and vector product.	6
4	Problem-based on curl divergent and gradient.	6
5	Problem-based on finite integration.	6
6	Problem-based on indefinite integration.	6
7	Problem-based on the operation of matrices.	6
8	Problem-based on the rank of matrices.	6
9	Problem-based on eigenvalue and eigenvector.	6
10	Problem-based on the inverse of matrices.	6

Pedagogic Tools:

- Chalk and Board
- PowerPoint presentation
- Handouts
- Computer
- Video

Textbooks:

- Prof. H. K. Dass, (2010), Applied Mathematics, CBS Publishers & Distributors, New Delhi.
- Shanti Narayana and P.K. Mittal, (2010), Textbook of Matrices, S. Chand and Company Ltd, 11th Edition.

Reference books:

- Erich Steiner, (2008), The Chemistry Maths Book, OXFORD University Press, Second Edition.

Suggested reading / E-resources:

- maths.ox.ac.uk/members/library/electronic-resources/

Suggested MOOCs:

- https://www.my-mooc.com/en/mooc/matrix-algebra-for-engineers/
- https://www.my-mooc.com/en/mooc/calculus-single-variable-part-3-integration/

Methods of Assessment & Tools:

Components of CIA: 40 marks

Sr. No.	Component	Content	Duration	Marks	Sub Total
A	Test 1	1-5 Experiments	$1\frac{1}{2}$ hours	15	30
	Test 2	6-10 Experiments	$1\frac{1}{2}$ hours	15	
B	Attendance and Regularity			5	10
C	Class Activities			5	
				Grand Total	**40**
Class activity	• Quiz • Situation based question • Handbook				

Note: Any other assessment tools or methods can be adopted as per requirement of the course.

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DSE Course (Theory) For the students admitted from A.Y. 2021-2022 & onwards		
Offering Department: **Mathematics**	Offered to: **B.Sc. (All Programs)**	
Semester – IV		
Course Code	Course Title	Course Credit and Hours
21UMTDC401	**DSE-2:** **Mathematics for Scientific Calculation and Analysis**	3 Credits - 3 hrs/wk (3 Theory)

Course Description:
This course focuses on elementary linear algebra and some topics from the calculus. The course also deals with ordinary differential equations and numerical methods, basics of statistics such as probability, measures of central tendency and measures of dispersion. The course gives alight on collection of data and presentation and analysis of data.

Course Purpose:
The main purpose of this course is to provide knowledge of matrix theory and calculus. This is designed in such a way that learners will be able to calculate determinant, limit, continuity and differentiability. This course helps the leaner to compute and interpret various measures of central tendency, dispersion and probabilities by using definition and probability rules. Students will be able to learn inferential statistics with the help of probability distributions: Binomial and Poisson distribution.

Course Outcomes: Upon completion of this course, the learner will be able to

CO No.	**CO Statement**	**Blooms taxonomy Level (K_1 to K_6)**
CO_1	Understand the Venn diagram of various set operations and utilize the formulae to evaluate the area and volume of different geometrical shapes.	K1, K3
CO_2	Produce and interpret numerical summary statistics using mean, median, mode, range, standard deviation and variance, and understand and construct the probability distribution and find mean	K2, K3

	and variance of the given Binomial Distribution and Poisson Distribution.	
CO_3	Understand the basic concepts of differential and integral calculus and apply to find maxima and minima.	K1, K2
CO_4	Understand the basic concept of linear algebra.	K1, K3
CO_5	Understand numerical integration and apply numerical solution	K3, K4

Course Contents	**Hours**
Unit-I: Set Theory, Area and Volume	**9**
• Basic definition of sets and its examples • Various operations on set • Venn diagram • Applications of set theory • Area of sphere, cone, cylinder • Volume of sphere, cone, cylinder	
Unit-II: Probability and Statistics	**10**
• Graphical presentation of data • Mean, median and mode • Measures of dispersion-Range, mean deviation, standard deviation, variance • Concept of probability • Laws of probability • Poisson distribution • Binomial distribution	
Unit- III: Calculus	**10**
• Limits • Continuity • Differentiation of some standard functions • Differentiation by rule. • Integration of some standard functions • Definite integral (Basic rules). • Partial Derivatives • Maxima and minima	

Unit- IV: Linear Algebra	**10**
• Matrices and determinants. • System of linear equations • Eigen values and Eigen Vectors	
Unit- V: Numerical Methods	**8**
• Solution of linear and nonlinear algebraic equations • Integration by trapezoidal and Simpson's rule	

Pedagogic Tools:

- Chalk and board
- Power point presentation
- Seminars
- Online resources

Text Books:

- D. Patri and D. N. Patri, (2011), Statistical Methods, Kalyani Publications.
- G. F. Simmons, (2017), Differential Equations with Applications and Historical Notes, 2nd edition, McGraw-Hill International Editions.
- S. C. Malik and Savita Arora, (2017), Mathematical Analysis, New Age International (P) Ltd, Publishers, 2nd Edition.
- M.K. Jain, S.R.K. Iyengar and R.K. Jain, (2007), Numerical Methods for Scientific and Engineering Computation, 5th Edition, New age International Publisher, India.
- David C. Lay, (2017), Linear Algebra and its Applications, 4th Edition, Pearson Education Asia, Indian Reprint.

Reference Books:

- Prof. H. Vyas, (2017), Business Statistics, B.S. Shah Prakashan, 13th Edition.
- M. D. Raisinghania, (2018), Advanced Differential Equations, (9th Edition), S. Chand & Co.
- Shantinarayan, (2013), A course of Mathematical Analysis, S. Chand & Sons.
- S. S. Sastry, (2012), Introductory method for Numerical Analysis, PHI New Delhi.

Suggested reading / E-resources:

- https://www.coursera.org/learn/stanford-statistics
- http://www.analysiswebnotes.com/contents.htmld/chapters.html

Suggested MOOCs:

- https://onlinecourses.nptel.ac.in/noc21_ma74/preview
- https://nptel.ac.in/courses/110107114
- http://www.analysiswebnotes.com/contents.htmld/chapters.html
- https://nptel.ac.in/courses/111/107/111107105/

Methods of Assessment & Tools:

Components of CIA: 30 marks

Sr. No.	Component	Content	Duration	Marks	Sub Total
A	Test 1	1st 2 units	$1\frac{1}{2}$ hours	5 (Set for 30)	20
	Test 2	All 5 units	3 hours	15 (Set for 70)	
B	Assignment			04	10
C	Class activity			06	
				Grand Total	**30**

Assignment	• Notes written by the learner on the different topics in the syllabus. • Problem Solving.
Class activity	• Quiz / Surprise Quiz • Seminar • Situation based question etc.

Note: Any other assessment tools or methods can be adopted as per requirement of the course

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Semester – IV		
Course Code	Course Title	Course Credit and Hours
21UMTDC402	**DSE 2 Practical: Practical on Mathematics for Scientific Calculation and Analysis**	**3 Credits- 6 hrs/wk**

Course Description:
This course focuses problems based on elementary linear algebra and some topics from the calculus. The course also deals with basics statistics and numerical methods.

Course Purpose:
The main purpose of this course is to provide some knowledge on applications of matrix theory and calculus. This is designed in such a way that learners will be able to calculate determinant, limit, continuity and differentiability. This course helps the leaner to compute and interpret various measures of central tendency, dispersion and probabilities by using definition and probability rules. Students will be able to learn inferential statistics with the help of probability distributions: Binomial and Poisson distribution.

Course Outcomes: Upon completion of this course, the learner will be able to

CO No.	**CO Statement**	**Blooms taxonomy Level (K_1 to K_6)**
CO_1	Understand the Venn diagram of various set operations and utilize the formulae to evaluate the area and volume of different geometrical shapes.	K1, K3
CO_2	Produce and interpret numerical summary statistics using mean, median, mode, range, standard deviation and variance, and understand and construct the probability distribution and find mean and variance of the given Binomial Distribution and Poisson Distribution.	K2, K3

CO_3	Understand the basic concepts of differential and integral calculus and apply to find maxima and minima.	K1, K2
CO_4	Understand the basic concept of linear algebra.	K1, K3
CO_5	Understand numerical integration and apply numerical solution	K3, K4

List of Practical		
Sr.	**Experiments**	**Hrs**
1	Problems based on area and volume of sphere, cone, cylinder.	6
2	Problems based on set theory and Venn diagram.	6
3	Problems based on Mean, Median, Mode.	6
4	Problems based on Variance and Standard Deviation.	6
5	Problems based on Probability.	6
6	Problems based on Poisson distribution and Binomial distribution.	6
7	Problems based on eigen value and eigen vector of a matrix.	6
8	Problems based on differentiation and integration.	6
9	Problems based on solution of linear and nonlinear algebraic equations.	6
10	Problems based on Trapezoidal and Simpson's rule.	6

Pedagogic Tools:

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- G. F. Simmons, (2017), Differential Equations with Applications and Historical Notes, 2nd edition, McGraw-Hill International Editions.
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- N. Pal, S. Sarkar, (2005), Statistics concepts and Applications, Prentice Hall of India.
- J. Kapur, H. Saxena, (2010), Mathematical Statistics, S. Chand & Company Ltd.
- P.S.S. Sundar Rao, J. Richard, (2012), Introduction to Biostatistics and Research Method, PHI Learning Private Ltd, 5th Edition.
- R. Agarwal, (2017), Quantitative Aptitude, S. Chand and Company, New Delhi.

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- https://www.coursera.org/learn/stanford-statistics
- http://www.analysiswebnotes.com/contents.htmld/chapters.html

Suggested MOOCs:

- https://onlinecourses.nptel.ac.in/noc21_ma74/preview
- https://nptel.ac.in/courses/110107114
- http://www.analysiswebnotes.com/contents.htmld/chapters.html
- https://nptel.ac.in/courses/111/107/111107105/

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				Grand Total	**40**
Class activity	• Quiz • Situation based question • Handbook				

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